

IPCC AR6 WGIII Final Government Distribution Government Review Comments (Summary for Policymakers)						
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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13488	0	0			The Government of Saint Lucia, would like to sincerely thank the authors, WGIII Co-Chairs and TSU staff for their efforts in preparing this FGD and the SPM Final Draft, which we consider to be a substantial improvement with regards to the SOD and previous SPM draft. Some key issues still remain for us, which we are looking forward to engaging on constructively in this review round as well as in the Approval Plenary. Thank you!	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13490	0	0			While we appreciate the policy-relevant information given throughout the SPM and especially in sections B and C regarding 1.5°C and 2°C, about two thirds of these statements then bundle together "limit warming to 1.5°C with no or limited overshoot, or likely to 2°C". This makes it impossible to derive much-needed separate information on both 1.5° and 2°C, and makes problematic statements by averaging findings. This becomes evident for example with regards to fossil fuel phaseout needs in C.3.2, where surely the reduction needs would be much higher in scenarios that limit warming to 1.5°C as opposed to 2°C, and not be the same for 1.5°C and 2°C scenarios as the current statement seems to suggest? Please provide differentiated statements for all sections of the SPM concerned, or add footnotes in those cases where the literature would not allow this. The bullets in question are: B.2.3, B.7.2, C.1, C.2, C.2.3, C.2.4, C.3, C.3.1, C.3.2, C.3.3, C.4, C.4.3, C.12, E.1, E.1.3, E.2, E.5.1. Some bullets even provide information only on 2°C, in which cases information on 1.5°C needs to be added. These are: B.3.3, Figure SPM.2 top-level statement, C.9.3, C.12, C.12.3(2x)	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13492	0	0			We understand that the IPCC authors tried to be very careful not to be policy prescriptive in their pathway classification. The claim that the authors take a 'neutral stance' on those is questionable as all such classifications represent a value judgement that needs to be justified and presented to policy makers. That is not done here. We find that the way the categories are presented here is highly prescriptive in several ways that need to be addressed. 1) The outline of Chapter 3 explicitly asked for modelled pathways that are compatible with the PA. The Paris Agreement also includes the mitigation goal in Article 4.1, that clearly expresses the objective to achieve net zero greenhouse gases. Whether or not pathways achieve net zero GHGs thereby is not an "outcome" of a pathway analysis in the context of the Paris Agreement. Rather it should be seen, as a characteristic of pathways that could be considered Paris Agreement compatible. Such a criterion is more justifiable for the pathway classification in light of the Paris Agreement than criteria that the authors have set out themselves, such as i.e. the temperature outcome in 2100, that are not directly referenced in the Paris Agreement. Net zero greenhouse gases is also central to the policy discourse. Countries representing more than 90% of global emissions have set themselves net zero goals, several big emitters, like the EU or the United States expressed in net zero greenhouse gases. Omitting this key policy relevant criterion is highly policy prescriptive. Therefore, the authors should include achieving net zero GHGs as an explicit criterion for their pathway classification. 2) It is unclear, to what extent the pathways in the database are reflecting existing net zero commitments made by countries. C1-C3 Pathways should be vetted against how well they represent national targets. The policy relevance of a stringent mitigation pathway that does not meet what parties set out to do under the Paris Agreement (including net zero GHG targets) is questionable. This should be made explicit and only pathways that closely reflect existing policy objectives should be presented in the SPM. 3) The Paris Agreement established 1.5°C as the long-term temperature limit. This has been reaffirmed by parties at COP26 and the outcome of COP26 should be reflected in the presentation of the pathway categories. In decision 3.CMA paragraph 21, parties have renewed their commitment to the 1.5°C limit and "resolved to pursue efforts to limit the temperature increase to 1.5°C". This makes it ever more clear, that pathways that do not pursue such efforts should not be considered Paris Agreement compatible. This is in particular the case for the categories C2, that is unlikely to limit peak warming to 1.5°C and even more so for the category C3, where no effort at all is being made to limit warming to 2°C.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13494	0	0			We would like to see much more information in the SPM on the IMPs as a way of illustrating different potential ways in which mitigation targets can be achieved. The C1-C8 pathway categories and Table SPM.1 provide important information and insights but do not provide policymakers with potential mitigation strategies towards net zero. Figure SPM.6 panel D does show important information in this regard, but timeseries plots, as in Chapter 3, Figure 3.8 would be more informative. Please consider placing more emphasis on the IMPs throughout the SPM, as this is what policy makers are going to expect from WGIII.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development

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13496	0	0			As small island states with unique circumstances and challenges, information provided at the regional level is critical. However, the current SPM is lacking information at the regional level, for example in section C. We understand and support the need for the SPM to be concise, but this should not come at the expense of providing policy makers with information that is particularly relevant to them, meaning information for their regions. The WGI report including the Interactive Atlas has shown how important and well-received the regional-level information is. In this regard, we would also like to request for Figures SPM.2, SPM.3, and SPM.11 to be made fully comparable (i.e. by employing the same intermediate level categories as described in Annex II), and for a category "small island developing states" to be added, which we understand is a UNSD grouping.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13498	0	0			Statements regarding financial flows must be strengthened and quantified throughout the SPM. Information on this is readily available in Chapter 15. This concerns, first, statements on international climate finance, where more information on the USD 100 billion goal and progress towards achieving it, as well as on finance for mitigation and adaptation must be added. Second, information on the levels of fossil fuel finance including subsidies and particularly how they compare to levels of international climate finance must be added. This type of information is of highest policy relevance and will surely be demanded by policy makers.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13500	0	0			We would like to see more specific information in the SPM on the co-benefits of mitigation and on the "Economic Benefits of Avoided Climate Impacts" - this topic even has a dedicated Cross-WG Box as described in the Introduction section, but is then barely covered in the subsequent SPM. The specific bullet C.12 is welcome but much too descriptive. Quantitative statements are available e.g. in Chapter 6 regarding energy or in Chapter 3 regarding health. Please add this important information and ensure that it is available for both 2°C and 1.5°C.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
34	0	0	0	0	The assessment in the entire SPM is skewed towards 1.5 and 2 degrees and do not cover all GWLs. From risk management perspective the SPM have to provide decision makers with all possible warming levels to be scientifically credible. Table SPM.1 shows eight categories but the assessment is only focused on C1 and C2. Therefore, assessment of all the 8 possibilities will provide comprehensive and more credible scientific presentation. The authors are urged to provide assessment to all 8 categories in the writeup as shown in Table SPM.1.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
36	0	0	0	0	Indicate projected/predicted outcomes rather than stating them as facts. e.g., line 7 on page 16: fall need to be replaced by projected to fall. There is contradiction for example in page 16 starting in line 7 as predictions are presented as if facts. Please reflect that the numbers are predictions along with reference to their statistical tests and confidence intervals if available.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
38	0	0	0	0	Medium confidence is repeated 60 times in the SPM and it is recommended to avoid the use of such term in the SPM.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
40	0	0	0	0	The SPM is largely deemed to be policy-prescriptive language and not scientific-like document. Discussions seem to focus on sectors rather than emissions and more so on the energy sectors and CO2. Ignoring emissions, regardless of sources raise major concerns about the coverage of all GHGs on scientific basis. It is recommended to be more inclusive and to focus on scientific aspects and findings and avoid policy perspective, to be more in line with conventional IPCC principles.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
42	0	0	0	0	The use of the confidence levels and level of agreements is deemed as not clear throughout the entirety of the SPM. In the underlying chapters, statements are supported with evidence in the following way: "medium evidence, low agreement" OR "medium evidence, high agreement" However, the statement reported in the SPM, depicts only "medium confidence level". This is concerning in a high-impact panel as it can reflect inaccuracy in the reported evidence of the scientific information shared as well as ethical implications. The authors are urged to revisit the presentation pertaining to confidence level so that they are comparable to those presented in the underlying report.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
44	0	0	0	0	There should be a caption at the beginning of each section and before the first headlines statement summarizing the literature findings on facts and differences among nations/regions as well as cross literatures.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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46	0	0	0	0	Using different years as a base of comparison for changes in GHG tends to bring more confusions than clarification/understanding of the case in question. In addition, presented changes in GHG during different segments are done in isolation of associated economic growth presentations and lifecycle analysis. For clarity, it is recommended to use pre-industrial period 1850 as the base for comparison to 2019 in association with economic growth, changes in lifestyle and lifecycle-based emissions analysis.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2490	0	0	0	0	<p>Development pathways are largely driven by the availability of adequate energy resources.</p> <p>In its present form, the AR6WG3 report fails to account for the quantity (resources and reserves) and quality (EROI estimates) of remaining fossil fuels in general - and of oil in particular - while this subject is extensively documented in the scientific literature (see references below).</p> <p>It therefore lacks robustness in the evaluation of the envisaged development pathways and, more importantly, does not allow a precise assessment of their concrete operability.</p> <p>More precisely:</p> <ul style="list-style-type: none"> <li>- C1 to C4 operability could be locally or globally seriously hampered (either directly or indirectly, by an increase in the cost of access to a massive development of technical devices alternative to fossil energies) for lack of effectively accessible resources and effectively extractable reserves of fossil energies ;</li> <li>- C5 to C8 operability could be locally or globally out of reach due to a lack of effectively accessible resources and effectively extractable reserves of fossil energies.</li> </ul>	Government of France, Ministère de la Transition écologique et solidaire
2492	0	0	0	0	The use of grey colour in figures makes them difficult to read. Plain black should be used for legends.	Government of France, Ministère de la Transition écologique et solidaire
2494	0	0	0	0	This new version of the SPM WG3 is a real improvement of the previous version, and tackles the challenges of succinctly and effectively summarizing the AR6-WGIII report. The quality and number of figures support a better understanding of technical information in the SPM while <u>remaining accessible</u> .	Government of France, Ministère de la Transition écologique et solidaire
2496	0	0	0	0	While the figures are accessible and successful in highlighting key points from the main text, dividing sentences which are particularly layered and complex would ease the SPM reading experience. This can be particularly helpful in section descriptions for example. (B.2 or B.7)	Government of France, Ministère de la Transition écologique et solidaire

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2498	0	0	0	0	<p>The line between policy-relevant and policy-prescriptive is a delicate one that needs to be respected. However, we find that the SPM is overly cautious in places, with the result that it will be harder for decision-makers to make direct use of the information providing in developing their strategies for enhanced action. There is therefore scope to make the information provided more useful and as clear as possible. Many of our specific comments address such points throughout the draft. We suggest however that the authors also undertake a cross-cutting examination to ensure that the final text is as clear and as directly useful as possible. We suggest that this might look in particular at the following issues:</p> <p>+120 Many paragraphs qualify information with verbs such as “may” which leave uncertainties on what the conditions might need to be to ensure that results could be reached. The nature of the SPM means it can obviously not be comprehensive, but each paragraph should provide sufficient information to be fully understood as a stand-alone.</p> <p>Another example is that many options provide only limited insight on the potential negative effects – just as decisions-makers need to understand the conditions to implement actions, so they also need to be alerted to the possible down-sides. The very few part on social dimensions are to be preserved, especially in section B on the link between inequalities and emissions, one of the main advances in recent years.</p> <p>Very few pages are devoted to the issue of demand and consumption, and they do not include some of the most interesting messages from chapter 5:</p> <ul style="list-style-type: none"> <li>several messages on the fact that equality would improve mitigation (on page 6 on chapter 5);</li> <li>the health crisis has shown that profound changes can be implemented in a short time;</li> <li>unequal societies organise changes less quickly (page 32 in chapter 5);</li> <li>the fact that we need other indicators than GDP (page 105 point 5.7 in chapter 5);</li> </ul> <p>The very few part on social dimensions are to be preserved, especially in section B on the link between inequalities and emissions, one of the main advances in recent years.</p> <p>These key points are not taken up in the SPM, indeed the information provided can sometimes go in different directions, for example: C. 6: increasing urban concentration makes it easier to reduce GHGs ;C8: the electric vehicle offers the greatest opportunities for GHG reduction, while there are many criticisms of electric vehicles; C10.1: individual efforts are of little use.</p>	Government of France, Ministère de la Transition écologique et solidaire
2500	0	0	0	0	<p>We have a serious concern with the fact that the important difference between the 2019 global emissions used in B.6 (assumed emissions) and C.1 (modelled emissions) and the actual 2019 emissions (as presented in B1.1) is not discussed in depth. As an example, who would understand how current policies can be projected to result in global GHG emissions of 57 (52–60) GtCO<sub>2</sub>-eq in 2030 (B6.1) which are significantly lower than the actual 2019 emissions provided in B1.1 (59 GT CO<sub>2</sub> eq)? These differences must have important implications on the “projected” 2030 emissions resulting from NDC or current policies, especially when numbers are given for the percentage of emissions to be reduced by 2030 for achieving the Paris agreement warming levels. Historical emissions must be displayed until 2019 on Fig SPM.5 and SPM.6 to highlight these significant differences. Table SPM,1 should be updated, too. Such a discussion is required since, inter alia, the WG3 report is expected to be a major source of policy-relevant scientific knowledge for the 1st global stocktake of the Paris Agreement.</p>	Government of France, Ministère de la Transition écologique et solidaire
2502	0	0	0	0	<p>The SPM does not mention the role of population growth in the current trends except with regards to the CO<sub>2</sub> emissions from residential buildings in C7.2. The role of population growth in current emission trends was mentioned in the SOD version of the SPM (headline of B.2 and B2.1) and we do not understand why it has been removed from the current version. Indeed, it is an important driver of past emissions (about 1/3 of increased FFI CO<sub>2</sub> emissions between 2010 and 2018). It would be very policy-relevant to find in the SPM findings on the role of population growth on future emissions, which is one of the main assumptions of the socio-economic scenarios used throughout the report.</p>	Government of France, Ministère de la Transition écologique et solidaire
2504	0	0	0	0	<p>The ocean remains very limitedly mentioned in this SPM and will only be so in a technological context of ocean fertilization. While the volume mentions Blue Carbon in Chapter 7 on land uses, so could the SPM in order to give the protection of ocean areas some importance, in the context of the co-benefits derived from their sustainable management for example.</p>	Government of France, Ministère de la Transition écologique et solidaire
2506	0	0	0	0	<p>A warning should be added to SPM.C.4.1 (p22 - I28) that ammonia as an energy carrier is not without risks to air quality.</p>	Government of France, Ministère de la Transition écologique et solidaire
2508	0	0	0	0	<p>The theme ‘system transformations’ is mainly technology based. It may be of value to introduce overall strategies and the complexity between different sectors by a scheme like in Figure 1.7 (wrongly labelled 1.6) of the introduction chapter.</p>	Government of France, Ministère de la Transition écologique et solidaire

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2510	0	0	0	0	The term « livestock » appears just one time in the SPM. this is surprising in the context of the current debates regarding this sector and its importance within agriculture. (yet this sector is widely discussed in chapter 7 (Agriculture-Forestry-and-Other-Land-Uses-AFOLU). The complex relationship between livestock grazing systems and climate change could be mentioned in the § D. Mitigation, adaptation, 1 and sustainable development : interactions between grazing and climate change are crucial to contribute to the new challenges that face livestock production in a context of both climate change and the need for food security. The sector is still the subject of controversy. It's an important GHG emitter, and at the same time offer a high mitigation potential (CH4, soil C sequestration) and a low level of non-renewable energy consumption Strategies to support sustainable grazing activities are therefore a major stake for boosting their significant mitigation potentials while also strengthening their real ability to adapt to climate change. At the same time, the need and obvious contribution to food security of large populations and the response to future demand for animal products requires considering animals as contributors when designing climate-smart farming systems . There is an evidence that the ruminant population must be reduced at a global scale, but how can we maintain grasslands and pastoral lands –which represent half of the agricultural area in the world - with less animals as they represent a source of biodiversity to maintain and a carbon sink? And how could we transfer fertility from grasslands to crop areas without ruminants? As well, reducing quality nutrient from animals can result in a change of land use, with the cultivation of grasslands (and the corresponding GHG emissions). {7.3.2.1}	Government of France, Ministère de la Transition écologique et solidaire
2512	0	0	0	0	The introduction and framing are well presented, with the main innovations of this report clearly stated, including the increased consideration of social and political dimensions and a strengthened integration with the development scenarios. These elements should be preserved, even if a lighter/easier to digest presentation might be desirable.	Government of France, Ministère de la Transition écologique et solidaire
2514	0	0	0	0	One main concern is the highly compact, technical, and therefore sometimes challenging content of this Summary-for-Policymakers. While the glossary in Annex 1 has proved most helpful in defining terminology used across the SPM, we would recommend adding to it compound expressions such as "conditional/unconditional NDCs" or the term "package" used in different contexts, which are not yet defined in the SPM itself.	Government of France, Ministère de la Transition écologique et solidaire
2516	0	0	0	0	We do not understand why the reference to « sufficiency » (C7.2 of the SOD SPM) has been removed from the SOD version. The concept of "sufficiency" and the SER (Sufficiency, Efficiency, Renewable) framework are largely used in Chapter 9. "Sufficiency" is a critical concept to address some of the potential reduction in GHGs emissions linked to behaviour changes. We strongly recommend to reintroduce this concept in the SPM, for example by reflecting some parts of the Chapter 9 Executive Summary (e.g. Ch 9 pp 4 lines 15-30 and lines 31-41). Chapters 5 and 12 largely refer to "sufficiency" too.	Government of France, Ministère de la Transition écologique et solidaire
2518	0	0	0	0	The use of abbreviation for expressions such as "IMP-Ren" for example, should be limited to main and frequently used one (such as GHG). They are too many and make the summary hard to read as the reader has to go back to full spelling of abbreviations.	Government of France, Ministère de la Transition écologique et solidaire
2520	0	0	0	0	The SPM of WGIII uses its own scenario sets, whose categories are different from the SSPx-y used in WGI and WGII. Therefore, it is difficult for the reader to establish links between the different working groups. Moreover, the methodology and models used for WGIII scenarios are not explained. We suggest to add a methodological box, similar to Box SPM.1 of WGI to explain what kind of models are used in WGIII, what are their main hypotheses, how models are calibrated, and how results compare with SSP scenarios and projections from WGI.	Government of France, Ministère de la Transition écologique et solidaire
2522	0	0	0	0	According to table SPM.1, only 3 climate emulators are used. How do they compare with the full range of CMIP6 models, and how is the new estimate of climate sensitivity assessed in WGI taken into account ?	Government of France, Ministère de la Transition écologique et solidaire
2524	0	0	0	0	The fact remains that there is very little question of biodiversity here, which is very surprising. The impact of mitigation actions (including renewable energies) on biodiversity is mentioned too briefly, which is clearly not a major concern here. There is a risk of misinterpretation of IPCC reports because it breaks a dynamic that tended to link the two issues of climate and biodiversity. The role of protected areas in preserving both biodiversity and facilitating carbon storage is not even mentioned, although there has been major work on this subject.	Government of France, Ministère de la Transition écologique et solidaire
2526	0	0	0	0	The individual human dimension is a little lacking, which is clearly seen as not being a source of major "progress" in terms of mitigation. We are in a "top-down" strategy here, but we may not be totally in agreement and consider that the pedagogy must target both the decision-makers and the citizens (especially if we want the solutions chosen by the decision-makers to be accepted by the base).	Government of France, Ministère de la Transition écologique et solidaire

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2528	0	0	0	0	Being from a research institute focused on marine and maritime questions, we though notice that very little is said about mitigation in the marine world, although there is increasing knowledge and awareness about the huge importance of a healthy ocean for climate regulation, and that protecting and restoring marine ecosystems is part of the solution. Nature-based solutions do not appear in this SPM beyond few mentioning of coastal wetlands.	Government of France, Ministère de la Transition écologique et solidaire
2530	0	0	0	0	The document is in general well written. Each headline, in bold, is followed by paragraphs which give quantitative information and links to chapters and figures of the report. The headlines themselves do not include any quantification. In some cases it may be worthwhile to include already numbers in the headline.	Government of France, Ministère de la Transition écologique et solidaire
2532	0	0	0	0	The introduction chapter includes a very well formulated, constructive 2. headline in the executive summary ('While there are some trade-offs, effective and equitable climate policies are largely compatible with the broader goal of sustainable development and efforts to eradicate poverty as enshrined in the 17 Sustainable Development Goals'). In the document points B3 and D1 seem to touch this issue, but somehow the headlines sound less constructive.	Government of France, Ministère de la Transition écologique et solidaire
2534	0	0	0	0	Figures are key to bring this complex information to the public. The figures in this draft provide essential, quantitative information, but often several sub-figures of very different form are merged into one figure. Also the legends are very long with some of the explications directly found in the figure. On peut supprimer car on a décidé de garder des subpanels	Government of France, Ministère de la Transition écologique et solidaire
2536	0	0	0	0	AFOLU sector : there is not enough attention paid to the uncertainty associated with the estimation of mitigation potentials and costs in the AFOLU sector, although this uncertainty is explicitly mentioned in chapter 7. Concerning AFOLU sector, it could be mentionned that livestock, represent a large part of the AFOLU sector's emissions, in particular in the South.	Government of France, Ministère de la Transition écologique et solidaire
2538	0	0	0	0	There is nothing in the SPM about the lack of knowledge on the potential of agroecology, apart from agroforestry, organic farming, conservation agriculture, etc., to reduce emissions from the AFOLU sector. These practices are not included in the "carbon sequestration in agriculture" category, whose title may be misleading.	Government of France, Ministère de la Transition écologique et solidaire
2540	0	0	0	0	The potential trade offs of biochars with some SDG as SDG2 when deployed at large scale, or when made from biomass contaminated with pollutants, and the energy consumed to produce it should be taken more into account and proposes some additions in D1.6 and D2.2. Consistency with SPM of SRCCL : - To be consistent with panel B of figure SPM 3 of the SRCCL, the potential impact on food security when deployed at large scale should be mentioned. To be consistent with B3.1 of SRCCL SPM the "increase demand for land conversion" when deployed at scale should also be mentioned. To be consistent with B5.2 SPM SRCCL ("The application of certain biochars can sequester carbon (high confidence),and improve soil conditions in some soil types/climates"), the addition of "certain" before biochar would be appropriate. Or the sentence "mitigation and agronomic co-benefits depend strongly on biochar properties and the soil to which biochar is applied" from 7.4.3.2. could be used.	Government of France, Ministère de la Transition écologique et solidaire
2542	0	0	0	0	For the introduction of the Global Warming Potential, it would be desirable to specify more precisely how the calculation works because this potential is at the heart of the calculation of carbon credits and there are many attempts, notably in the UK (presentation at the CDR forum in December) to introduce alternatives to this GWP specifically for certain actions, notably the elimination of CO2. These elements of the debate on metrics are not new, but it is nevertheless essential to introduce in more detail the basic principles of accounting comparison between gases.	Government of France, Ministère de la Transition écologique et solidaire
2544	0	0	0	0	Footnote 7 should be preserved or even moved to the main text, as it is particularly relevant to issues related to Article 6 of the Paris Agreement, for which important discussions took place at COP26 regarding the definition of what was considered anthropogenic CO2 removal.	Government of France, Ministère de la Transition écologique et solidaire
2546	0	0	0	0	We strongly recommand to add a reminder in Section A, that the use of "global warming" throughout the SPM implies "anthropogenic" global warming consistently with the main result of WG1	Government of France, Ministère de la Transition écologique et solidaire

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3402	0	0	0	0	<p>The treatment of Carbon Dioxide Removal issues in this version of the SPM suffered from a serious degradation and loss of information compared to the underlying chapters as well as previous special reports (SR1.5, SRCCL, SROCC), in particular with regards to societal, demand-related dimensions, involved risks and impacts, sustainability and feasibility constraints. The outcome depicts CDR in an overly optimistic manner, which could be misinterpreted by readers as a signal that there are no constraints to CDR deployment and no particular lesson to draw in terms of sustainability depending on its role in mitigation scenarios. Given their policy relevance, the absence of details on this matter is in itself policy prescriptive.</p> <p>More specifically, there is a first clear imbalance between the treatment of technological CDR options, on which a strong and optimistic emphasis is made, and the treatment of "natural" options related to protection, sustainable management and restoration of natural sinks, as well as societal and demand related options, the stakes of which are barely covered. This is the case in particular for solutions related to the AFOLU sector, which lack detail throughout the SPM (not all AFOLU options are equivalent, and neither are all land-based CDR options – the report emphasizes mostly on BECCS and barely details existing soil carbon sequestration options) as well as nature based solutions and ecosystem based approaches. The underlying chapters indicate clearly that without a protection of natural sinks efforts will have to be compensated by additional mitigation action. This seems self-explanatory but it is not covered in the SPM and there is a risk of misunderstanding, in particular from the biodiversity community, if this is not addressed. On demand management options, as a reminder, SR1.5 SPM indicated that "Significant near-term emissions reductions and measures to lower energy and land demand can limit CDR deployment to a few hundred GtCO2 without reliance on bioenergy with carbon capture and storage (BECCS) (high confidence)."</p> <p>Regarding specific description and representation of land-based CDR options in the AFOLU sector, these options are most of the time reduced to biochar (which are partly technology based). It would be more balanced and reflective of the diversity of options outlined in the chapters to refer to these options as soil carbon sequestration techniques – as these techniques refer not only to biochar, but also to soil carbon sequestration through agroecology, non-tillage, agroforestry, among others.</p> <p>Furthermore the potential trade offs of biochars with some SDG as SDG2 when deployed at large scale, or when made from biomass contaminated with pollutants, and the energy consumed to produce it should be taken more into account – we propose some additions in D1.6 and D2.2.</p>	Government of France, Ministère de la Transition écologique et solidaire
3404	0	0	0	0	<p>The below suggestions can also be highlighted for consistency with the SPM of SRCCL :</p> <p>To be consistent with panel B of figure SPM 3 of the SRCCL, the potential impact on food security when deployed at large scale should be mentioned.</p> <p>To be consistent with B3.1 of SRCCL SPM the "increase demand for land conversion" when deployed at scale should also be mentioned.</p> <p>To be consistent with B5.2 SPM SRCCL ("The application of certain biochars can sequester carbon (high confidence),and improve soil conditions in some soil types/climates"), the addition of "certain" before biochar would be appropriate. Or the sentence "mitigation and agronomic co-benefits depend strongly on biochar properties and the soil to which biochar is applied" from 7.4.3.2. could be used.</p> <p>There is a second imbalance, between the treatment of the potential of CDR and that of its feasibility and sustainability constraints, which was clearly summarized in the SPM of SR1.5 and in the underlying chapters : (SR1.5) "CDR deployment of several hundreds of GtCO2 is subject to multiple feasibility and sustainability constraints (high confidence)." This is all the more problematic since the contribution from WG1 to the AR6 report introduced in its SPM the notion of risks, impacts, and sustainability implications on biogeochemical cycles and biodiversity without exploring them with the understanding that volume 2 and 3 would address it : (WG1 SPM) Potential negative and positive effects of CDR for biodiversity, water and food production are methods-specific and are often highly dependent on local context, management, prior land use, and scale. IPCC Working Groups II and III assess the CDR potential and ecological and socio-economic effects of CDR methods in their AR6 contributions. Not providing more details would fail on delivering on this point and provide an incomplete picture of this critical subject throughout the AR6.</p>	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3406	0	0	0	0	<p>The current SPM of volume 3 does not provide sufficient detail and in most instances restricts itself in listing the fact that CDR methods vary in terms of impacts, risks, constraints, without indicating the direction of these impacts and risks and proposing an actionable conclusions which can be understood by policymakers – such a listing is not policy relevant. In other instances, the listing is also lacking references to crucial impacts, such as on biodiversity – for example the notion of pressure on land is mentioned several times when referring to impacts of some CDR options such as BECCS, but the pressure and impact on biodiversity is not mentioned (although it was in chapters) – a similar statement can be made on socio-economic impacts.</p> <p>Thirdly, there is also an imbalance in the treatment of scenarios compatible with 1,5°C regarding the priority and benefits of a reduction in emissions compared to a massive use of CDR – this is the case for example in section C.3. The role of CDR in scenarios in particular in terms of timing of deployment relative to the timing of emission reductions is also not explored enough. This has critical implications with relation to overshoot and related impacts : in terms of adaptation, depending on the delay of emissions reductions and thus on the extent of the overshoot, the capacity of natural carbon sinks to adapt to climate change impacts may be constrained and this will have an impact in term on their capacity to act as a carbon sink – this is in addition to the other constraints already explored in WG1 regarding their reduced marginal storage capacity in higher emissions scenarios.</p>	Government of France, Ministère de la Transition écologique et solidaire
3408	0	0	0	0	<p>The role of CDR in scenarios, in addition to the above mentioned constraints, are also explored in chapters and previous reports in terms of moral bias, an overemphasis on early implementation of CDR being likely to delay emissions reduction which are critical to avoid being on a high-overshoot track (which would in term pose new constraints as detailed above). These policy-relevant details are essential to inform the upcoming global stocktake, in particular on the credibility of net zero strategies from a science perspective.</p> <p>Finally, on the difference between CCS and CDR, the technical summary recalls (p94 line 40 to p95 line 3) that “Carbon Capture and Storage (CCS) and Carbon Capture and Utilisation (CCU) applied to fossil CO2 do not count 1 as removal technologies. CCS and CCU can only be part of CDR methods if the CO2 is biogenic or directly captured from ambient air, and stored durably in geological reservoirs or products”. However, there are occurrences in the SPM where the words are used interchangeably when CCS actually refers and applies to specific situations. This is the case for example regarding application of CCS to industrial processes and energy production in mitigation strategies. In such instances, it would be relevant to specify the term CCS in complement to CDR (and maybe refer in a footnote to the distinction between the two, referring to the glossary &amp; TS) – there are sufficient references in the chapters to base it from, for example Chapter 12, page 8, lines 8 to 10 regarding application to industry sectors and energy production, or throughout chapter 3, 4 and the technical summary.</p>	Government of France, Ministère de la Transition écologique et solidaire



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3460	0	0	0	0	<p>CCS is not sufficiently well explained in the SPM document considering the stakes it represents and the confusion it can generate with CDR. (See references in chapter 3, 4, 12 and TS)</p> <p>Therefore, we suggest to distinguish CCS a bit more clearly in some parts of the SPM where it adds some clarity and we suggest as well a dedicated subparagraph to introduce it.</p> <p>First, on the difference between CCS and CDR, there are occurrences in the SPM where the words are used interchangeably when CCS actually refers and applies to specific situations. This is the case for example regarding application of CCS to industrial processes and energy production in mitigation strategies. In such instances, it would be relevant to specify the term CCS in complement to CDR (and maybe refer in a footnote to the distinction between the two, referring to the glossary &amp; TS) – there are sufficient references in the chapters to base it from, for example Chapter 12, page 8, lines 8 to 10 regarding application to industry sectors and energy production, or throughout chapter 3, 4 and the technical summary.</p> <p>Second, we suggest to add a specific subparagraph to introduce CCS, its role with regard to mitigation and its relation to CDR, for example around C.1.2). Below is an idea, based on references from chapters, of information which could feed into such a subparagraph :</p> <p>The level of CCS and CDR is expected to change depending on the extent of mitigation. CCS can mitigate hard-to-abate residual CO2 emissions from industry (steel, cement, refineries, pulp and paper, ...) and fossil fuel electricity sector (see Chapter 12, p. 8, line 8-10).</p> <p>Carbon Capture and Storage (CCS) and Carbon Capture and Utilisation (CCU) applied to fossil CO2 do not count as removal technologies. CCS and CCU can only be part of CDR methods if the CO2 is biogenic or directly captured from ambient air, and stored durably in geological reservoirs or products (See TS, p94 line 40 to p95 line 3)</p> <p>CCS can help to provide CO2 removal from the atmosphere when coupled with energy recovery from biomass (BECCS) or with direct air capture (DACCS) (see Chapter 12, p. 8, line 10-11, and Chapter 3 p. 47 lines 9-10). {3.3, 6.4, 12.1}"</p>	Government of France, Ministère de la Transition écologique et solidaire
5088	0	0	0	0	<p>Many thanks to the authors for providing such a clear and comprehensive SPM. The substance of this SPM is extremely useful, with the appropriate level of detail provided in most instances. The key sentences above the figures are particularly helpful, and together will form the narrative of this SPM. In some places, the most policy-relevant messages are buried in the sub-paragraphs; we have indicated where we believe these could be elevated to strengthen the overall narrative arc and enhance accessibility for policymakers.</p>	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6210	0	0	0	0	<p>The German IPCC Focal Point would like to express its deep gratitude to the WG III authors, review editors, co-chairs, vice-chairs and TSU for their commitment to the IPCC and for all their hard work and time dedicated, especially in these difficult times of COVID-19. We congratulate the WG III team on an excellent draft and look forward to working with the authors and other governments during the approval meeting to further improve this SPM.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6212	0	0	0	0	<p><u>BIOCHAR</u>: Throughout the SPM, soil amendment with biochar is positively highlighted as a mitigation strategy (SPM-29-18; SPM-32-33, SPM-35-16), while environmental side effects and negative implications (e.g., associated with particulate matter (TS-96, Table TS-7)) are not well represented. Land competition from bioenergy, biochar and afforestation are only briefly mentioned on SPM-35-25, but side effects are not further discussed. In our view, this strongly overemphasises the potential of biochar application as a climate mitigation strategy, while it neglects "occasional adverse impacts" (AR6 WG III, 7-64-10). The application of biochar cannot not be easily equated to sustainable land management practices such as cover cropping or the restoration of natural vegetation and does not provide the same level of synergies, as given in section D. As mentioned in the underlying Chapter 7.4.3.2, the biophysical effects of biochar application are highly variable and depend on the types and properties of biochar as well as on local climatic characteristics and soil types (7-64-11 to 7-64-13 and 7-64-28 to 7-64-29). These yet to be determined uncertainties should be represented in the SPM and do not justify the strong positive emphasis throughout the SPM. Additionally, in Chapter 7.4.3.2, biochar is not shown to have any positive effects on biodiversity and should, therefore, not be treated as such in the SPM. We urge the authors to provide a more balanced representation of the potentials and side effects of biochar application throughout the SPM.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6214	0	0	0	0	<p>_CDR IN CONTEXT: The SPM is clear about the need for CDR/net negative emissions to a certain extent in order to limit global warming to 1.5°C or well below 2°C. However, the SPM lacks information on the influence of socio-economic developments on mitigation pathways, and in particular the need for CDR. What are socio-economic developments that efficiently and cost-effectively help to reduce the CDR demand, for instance by reducing emissions that would need to be compensated (e.g. methane from the food sector or aviation)? On the other hand, which socio-economic developments would increase the demand for CDR? Are there mitigation options and developments that could free land, which would in turn help to respond to the need for CDR? E.g. (demand-side) mitigation in the food sector would specifically addresses both the need for CDR and the potential for CDR (freeing land). How important are education and other socio-economic factors that have a direct influence on the population growth and how important are such developments to reach the Paris temperature goals? We urge the authors to include information from the underlying report on these topics and for example discuss diet shifts/reduction of food waste/loss and overconsumption and the importance of education more comprehensively.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6216	0	0	0	0	<p>_CURRENT EMISSIONS: The SPM provides contrasting information on current GHG emissions in paragraph B.1.1 (59 GtCO<sub>2</sub>eq/yr) versus B.6.1 (54 GtCO<sub>2</sub>eq/yr). It is essential that the SPM clearly explains the reasons for this discrepancy (e.g. the use of different versions of emission data sets for LULUCF and other GHG, see chapter 2.) and its influence on quantitative statements of this report in the context of other uncertainties for statements on milestones of emission pathways, including updates of historical emissions, of scenarios/pathways, of GWP-values, and of calibrations of climate model emulators from one report to the next. At the same time please clarify that these uncertainties are insignificant for the key messages of the AR6. At the same time, please clarify that despite these uncertainties the key messages (rapid reduction to net-zero CO<sub>2</sub> and as little non-CO<sub>2</sub> as possible) remain valid.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6218	0	0	0	0	<p>_FOOD: As highlighted in the SRCCL and as discussed in Ch. 5 and 7 as well as in the technical summary TS.5.6.2, there are various co-benefits of shifting to plant-based diets and reducing food waste, and food overconsumption. These co-benefits relate for example to health, freeing land, adaptation, water, animal welfare, reduced mortality, reduced CH<sub>4</sub> and N<sub>2</sub>O emissions, and biodiversity. Also, measures to achieve a shift in diets are mostly of low cost (c.f. Table TS.6) and are so-called no-regret options. However, these demand-side options take time which in turn has implications for their deployment. Most of this very policy-relevant information is not stated clearly in the SPM, some pieces are spread out over a few sections. We, therefore, urge the authors to emphasize the importance and relevance of demand-side measures in the food sector and provide a corresponding paragraph in section C.9, C.10 or D.1, as they have a very high mitigation potential while featuring many co-benefits.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6220	0	0	0	0	<p>_MERGING 1.5 and 2C: The SR1.5 and AR6 WG II have shown significant differences in the impacts of warming at 2 and 1.5°C. We, therefore, do not agree with WG III's approach to frequently merge pathways for 1.5 and 2°C in this SPM to deduce information on climate action, e.g. a composition of a 2050 energy mix with significant fossil energy sources (C.3.2), and its implications for the timing of a phase out of coal, oil and gas. Separate information is needed for 1.5 and 2°C and we strongly urge the authors to amend the SPM. Please also specify whether the figures provided are for fossil fuels with CCS or for unabated emissions. In addition, the narrow and prescriptive definition of the "well below 2°C" limit to only 66% probability instead of also for 90% again weakens the need for action (please see also our general comment on this issue). Furthermore, please clarify how emission milestones of the AR6 WG III report are different from those of the SR1.5 that are used as benchmarks of climate policy by many countries and in international climate policy, e.g. in the Glasgow Climate Pact for the 2030 emissions. If possible, provide comparisons of the SR1.5 and WG III benchmarks (e.g. for 2030 emission reductions) with the same reference time.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6222	0	0	0	0	<p>_MITIGATION CONCRETE: A relevant message of this report would be to give clarity on which mitigation options have the largest potential, have the most co-benefits with adaptation and sustainable development, are least costly or should be started right now, as they might take a lot time to become effective. We strongly encourage the authors to identify such options as well as difficult but critical ones, and those that are assessed have been assessed as less useful. Information about the context (region, sector, socio-economic) and the scale of deployment would be much appreciated.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6224	0	0	0	0	<p>_SCALE: The SPM notes in various places that co-benefits, trade-offs, risks and potentials of many mitigation options depend on the scale they are deployed at. Therefore, we regret that comparisons of mitigation options regarding their prices (C.12, Figure SPM.8), their sustainability (D.1, Figure SPM.9) and their feasibility (E.1, Figure SPM.10) lack clarity and transparency about the scale the individual options had been assessed at. Since comparing mitigation options at different scales does not seem reasonable, we urge the authors to either add information about the scales considered and how much a given result is influenced by the scale of the assessment, or assure that all assessments were done at the same scale, like for example at 1 Gt as a proxy for a "large-scale" implementation as referred to in D.2.3.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6226	0	0	0	0	<p>_SCENARIO NAMES: The wording of the two ambitious pathways, "Pathways that limit warming to 1.5°C with no or limited overshoot" and "Pathways LIKELY to limit warming to 2°C" is misleading, because one term includes a probability statement, the other one does not. There is also up to 50% probability that 1.5°C pathways will exceed 1.5°C in 2100 - hence there is also a possibility that they will not limit warming to 1.5°C even with an overshoot. This is not conveyed by the pathway's name.</p> <p>It reads like there is a very high probability for limiting warming to 1.5°C in these pathways (no probability stated = statement of fact), which gives a wrong impression especially when it is mostly used in the text next to the 2°C pathways with a probability statement ("pathway LIKELY to limit warming to 2°C"). Please note also our comment on the C1 category being relevant for 2°C with 90% probability. We request to find a wording that contain probability statements for these scenario categories.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6230	0	0	0	0	<p>_SCENARIOS IN CONTEXT: We appreciate the clarity how scenarios are categorized into C1 to C8 and the transparency of emission pathways' milestones and temperature goals. However, it is unclear what socio-economic development underpins the various scenarios. As it is not mentioned in the SPM, one would expect that the various scenarios are based on similar assumptions of main socio-economic drivers such as population growth or technological trends. However, as explained in Box TS.5 this is by far not the case as "most of the scenarios in the AR6 database are SSP-based". E.g. C1 scenarios are based on SSP1-1.9 scenarios (i.e. population of about 7 billion in 2100), whereas C3 are based on SSP2-2.6 (about 9 billion in 2100) and C7 are based on SSP3-7.0 (about 13 billion in 2100). As we know from various other IPCC reports, population growth is one of the two main drivers for increasing emissions (this was also stated in the SOD SPM as well as it is stated in the TS on page 63). Still, the three most important scenario categories differ in about 6 billion people and a lot of more very important socio-economic assumptions such as technological change, material-intensive consumption, level of inequalities, land-use regulation, lifestyle, food production and diets, international partnership, urbanisation, GDP trends, etc. They also come with different grades of transformative challenges, which would be also a very policy-relevant information. Some shared socio-economic development pathways are actually not able to stay below 1.5°C or 2°C (e.g. SSP3) because the narrative does not allow for a sufficiently low RCP. So, it is by far not enough to merely state information on the different CO2 emission levels at certain timings and the associated warming levels (Table SPM.1) and illustrating the CO2 emission pathway and the emission of each sector (Figures SPM.5 and SPM.6) in order to comprehensively and transparently discuss the various scenarios.</p> <p>We, therefore, very strongly urge the authors to provide information on these very important differences between the various sets of pathways. Otherwise the SPM lacks comprehensive and transparent information on the scenarios and the socio-economic developments they base on. This could be preferably done in C.1.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6232	0	0	0	0	<p>If CH4 reductions is key to lower the peak warming as mentioned in C2.3 (SPM-19:30-31), it would be of great relevance for policymakers to understand which sectors are the most CH4 intensive ones and what response options exist to particular address CH4 emissions. What are the three response options with the biggest potential and cost-efficiency to reduce CH4 emissions?</p> <p>We, therefore, urge the authors to include</p> <p>1) a figure in B.2 that depicts the CO2, CH4 and NO2 emissions sector-wise. This would be already helpful to give an overview on the different sectors and their major emission drivers. It would also make clear the biggest drivers for CH4 emissions which are of particular relevance for the near-term warming and overshoot warming. We strongly suggest to include Figure TS.6 and add some more information on the main gases per sector driver (as it is done for the AFOLU sector).</p> <p>2) the most relevant mitigations options addressing CH4 emissions in C.3.4 or anywhere in D. As we learned in the SRCCL and found in chapter 5 and 7, diet shifts/reduction of food waste/reduction of overconsumption would in particular help to reduce CH4 emissions and free land as found in TS-86:14-17 ("Sustainable intensification in agriculture, shifting diets, and reducing food waste could enhance efficiencies and reduce agricultural land needs, and are Therefore, critical for enabling supply-side measures such as reforestation, restoration, as well as decreasing CH4 and N2O emissions from agricultural production."). These options also involve a lot of co-benefits (health, water, adaptation, food security... see TS-89:12-15) and they come at almost no costs. Maybe there are other no-regret mitigations options that are in particular able to reduce CH4 emissions.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6234	0	0	0	0	<p>The term "Finance" is mentioned or addressed in several headline statements and bullet points. For the purpose of this SPM, it might be helpful if the exact meaning of "finance" in the various contexts could be explained a little more. Many readers might link the word to the Paris Agreement and related international governance processes (e.g., Article 9). In addition, the introduction (3-23) states that finance (as an enabler for climate action) would be addressed in section D, but information can be found in B.5.4, D.3.4, E.2, E.2.3, E.4.4, E.5.2, E.5.3, E.5.4, E.6.2 and E.6.3 instead, with the most relevant statements in the E.5 bullet points. We suggest to either amend the introduction. Information from the E2 and E6 paragraphs could be merged with the E5 paragraphs. The narrative of E could possibly become: feasibility - development pathways, broader context - governance - instruments - finance. Only E.5.3 would provide some input for processes related to the Paris Agreement if we understand correctly.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6236	0	0	0	0	<p>We appreciate that the SPM is concise, well-structured and most of the paragraphs are comprehensible for an interested readership from various backgrounds. We recognize the difference of compressing many hundreds of pages into a few ones, but urge the authors to ensure that the SPM can be understood, using the glossary, without having to search the references and underlying report for additional information.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6238	0	0	0	0	<p>We very much appreciate a lot of clear statements within the SPM clarify the urgency of action in order to limit global warming consistent with the Paris Agreement, as assessed in the underlying report. E.g. last sentence of B.2.3, B.6, B.7. We strongly encourage the authors to maintain this clear and concise language as it helps policy makers to understand the urgency of action.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9848	0	0	0	0	<p>Suggestion to insert a Box that explains the use of the different temperature scenarios en illustrative mitigation pathways. The explanations are now scattered throughout the SPM: in footnote 8, table 1 and figure SPM.6 and a clear link with how these scenarios relate to the SSPs used in WGI is missing. Also, sometimes the scenarios and pathways are being referred to before they are properly introduced. for example in Figure SPM.2 scenarios C3a and C1 are introduced, without a reference to table 1, where these are explained in the context of all the other global emissions pathways.</p>	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
13428	0	0	0	0	<p>We would like to thank the authors for providing this Final Draft SPM despite the extremely difficult circumstances we all face due to the COVID pandemic. Your efforts are much appreciated and thank you for your great work! Below are some comments that we hope can further improve the SPM and its relevance for policy making.</p>	Government of Estonia, Estonian Meteorological & Hydrological Institute
13430	0	0	0	0	<p>We would much appreciate if the current section B was section A. So the content and headline messages flow from A-D. The introduction could be also shortened to one page. The entire SPM could be further shortened to max 30 pages.</p>	Government of Estonia, Estonian Meteorological & Hydrological Institute
13432	0	0	0	0	<p>We much appreciate that many of the headline messages are clear and concise and urge the authors to maintain this also in the next draft of the report, so that these meessages can create a self-standing narrative.</p>	Government of Estonia, Estonian Meteorological & Hydrological Institute

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13486	0	0	0	0	Socioeconomic impacts (including issues around just transition) are not sufficiently covered in the SPM. Please make the current information more precise and quantified. Also synergies between adaptation and mitigation could be highlighted better including related socioeconomic impacts. Many of the general statements could be shortened or combined and quantified.	Government of Estonia, Estonian Meteorological & Hydrological Institute
14190	0	0	0	0	We appreciate that compared to earlier IPCC reports, this SPM and the AR6 WG 3 as a whole provides more information based on a consumption based emissions (CBE) approach. This is valuable, as a supplement to earlier analyses based on territorial emissions (TA). It widens the scope, and highlights the potential role of stakeholders at sub-national levels, such as cities.	Government of Norway, Norwegian Environment Agency
14192	0	0	0	0	We noticed that several terms are used interchangeably in the different parts in the SPM, e.g. co-benefits and synergies, trade-offs and adverse side effects, and very low or zero carbon energy (C.3), low carbon energy (C.4) and no or low carbon fuels (C.3.2). Please check for consistent usage of these terms and notions, and make sure that the different usages are intentional.	Government of Norway, Norwegian Environment Agency
14194	0	0	0	0	WGIII outlines the variations in who is responsible for most emissions – the summary explains the contribution distributed by geographical location (With N America as the greatest contributor) and income (the richest contributing to most emissions). However, there is a lack of the same outline of how actions on mitigation could be addressed using the same variables on geographic location and income levels. Under the sub-chapter on AFOLU (ch 7) there are some suggestions on different actions for different sources of emitters (Location and income levels) – we would recommend that the summary for policymakers would reflect these variations in suggested mitigation as this would also impact on the suggestions for international cooperation.	Government of Norway, Norwegian Environment Agency
14196	0	0	0	0	Please consider to add a table of contents on page 1.	Government of Norway, Norwegian Environment Agency
14198	0	0	0	0	We find the use of categories and IMPs in the SPM a bit confusing. In WG1 only SSPs were used, in WGII a mix of SSPs and RCPs and now in WG III, categories and IMPs. Please consider how the link between the scenarios, categories and pathways could be made clearer to the reader.	Government of Norway, Norwegian Environment Agency
14200	0	0	0	0	We think the SPM lacks a figure about how the energy mix will look like in the different mitigation pathways. This figure should show the total energy consumption and the distribution on different sources in Twh. It should preferably also include estimates of how much area the different sources of energy would occupy. A quantification of this information is crucial for policymakers when making decisions about the future energy system.	Government of Norway, Norwegian Environment Agency
14202	0	0	0	0	In general the figures in the document are very complex with a lot of information included, e.g with different figures a,b,c etc. associated with each other. Please consider to keep many of the figures much simpler, and making sure that the most important information needed to understand the figure is on the figure, without the need to read captions or other explanations. This will greatly enhance the propability of re-use of the figures.	Government of Norway, Norwegian Environment Agency
14204	0	0	0	0	This is a highly relevant and important summary, however, we would appreciate some concretisations, especially related to what the authorities/governments can do. In our view, the parts that mentions different mitigation options are somewhat vague and could be more concrete in connection to what policymakers can do to implement mitigation options in the future.	Government of Norway, Norwegian Environment Agency
14206	0	0	0	0	In our view, ecosystems could be better covered in this summary. E.g, it would be useful to have a sentence or two about the importance of sustainability and conservation of forests and nature, and preferably something that clarifies the connection between climate and nature (not to forget the ocean and blue forests). We appreciate if this could be included to a greater extent, so that policymakers see the big picture when they read about different aspect of mitigation of climate change.	Government of Norway, Norwegian Environment Agency
14208	0	0	0	0	Important information emerges in this summary, and much is linked to the 2030s, which is 8 years away. We must act quickly to reach the goals. To help the policymakers understand and emphasize this dilemma, it could be useful to add something about the sense of urgency (e.g in B.7 or in section E).	Government of Norway, Norwegian Environment Agency
14210	0	0	0	0	Please consider to add more descriptive quantification on the different sectors metioned in this SPM, e.g more information on what the emissions are today, and the development paths.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14212	0	0	0	0	One important part of the mitigation strategies described in the SPM are transition to renewable energy and electrification, which by nature are variable and also more challenging to store and to a large extent are transported in electricity lines. When most of the energy system are transformed to renewable sources this may lead to a need for enhanced investment in the electricity grid, both with regards to increased connectivity for households that are not connected to the grid, and to increased capacity and enhanced efficiency (smart grids) in order to secure stable energy supply and reduce energy loss of variable energy production. This may also involve balancing between relying on local and domestic production vs. international electricity trade. Currently, in our view, the draft SPM focus mostly on the production and consumption of energy, and it would benefit from addressing better the perspectives related to energy distribution and transmission, such as electricity grids at different geographical levels.	Government of Norway, Norwegian Environment Agency
14214	0	0	0	0	Throughout the SPM text it now mentions "current policies" and "current NDCs", please avoid the term "current", and rather refer to the explicit time and date in order to clarify.	Government of Norway, Norwegian Environment Agency
14216	0	0	0	0	Different formulation of "low-carbon" are used throughout the SPM, e.g. related to sources, energy, technology, energy carriers etc. This is fine as long as it is intentional and consistent, but please check. Please also consider to define the different version of this term in the glossary.	Government of Norway, Norwegian Environment Agency
14218	0	0	0	0	The WGI report highlights the importance of reducing of methane in addition to CO2 in particular for near term mitigations. In our view, this is not sufficiently followed up in WG III by informing policymakers on mitigation options for methane. Please consider to add information about mitigation options of individual climate drivers, and methane in particular in e.g. in section C and E both in the text and the figures. Regional specific best solutions according to the literature assessed, including the UNEP/CCAC, 2021 Global methane assessment ( <a href="https://www.unep.org/resources/report/global-methane-assessment-benefits-and-costs-mitigating-methane-emissions">https://www.unep.org/resources/report/global-methane-assessment-benefits-and-costs-mitigating-methane-emissions</a> ) are appreciated as this is highly relevant for policymakers. Please add the reference to GMA, UNEP/CCAC, 2021, as we could not find it in the references in the WGIII report.	Government of Norway, Norwegian Environment Agency
14220	0	0	0	0	Please consider to add information about socio-economic aspects by e.e. describing the SSPs in this SPM as we believe it is important for the conclusions drawn.	Government of Norway, Norwegian Environment Agency
14222	0	0	0	0	Please contribute to fulfil the expectation that SPMs from WGI, WGII and WGIII can be read in context and are as consistent as possible when it comes to e.g. scenarios, common terms etc.	Government of Norway, Norwegian Environment Agency
14224	0	0	0	0	There is a lack of information in the SPM on how the degree of efficiency and sustainability in the food system interacts with deforestation. Please elaborate if possible.	Government of Norway, Norwegian Environment Agency
14226	0	0	0	0	Please consider if it is possible to elaborate on the differences in the potential related to the most relevant mitigation options in different regions. As an illustration you could look at how it is described for methane in page 10 of <a href="https://www.unep.org/resources/report/global-methane-assessment-benefits-and-costs-mitigating-methane-emissions">https://www.unep.org/resources/report/global-methane-assessment-benefits-and-costs-mitigating-methane-emissions</a> .	Government of Norway, Norwegian Environment Agency
14228	0	0	0	0	There is a lack of information in the SPM on the role of oceans and coastal ecosystems in the transition to a low emissions world. Oceans are only mentioned in the text in connection with ocean fertilization and alkalisation, in our view information about Blue carbon and the role of protecting natural carbon stored in oceans are more interesting and relevant in the context of mitigation. Please consider if this could be elaborated in the SPM.	Government of Norway, Norwegian Environment Agency
14230	0	0	0	0	It would be helpful to add when individual sectors including the AFOLU sector reach net zero CO2 emissions in different pathways. In C.3.3 it is stated that AFOLU and Industry reach net zero CO2 emissions earlier than the demand sectors, and it is referred to Figure SPM.6. We do not manage to read out this information from figure SPM.6.	Government of Norway, Norwegian Environment Agency
15616	0	0	0	0	Our sincere appreciation to the authors, Working Group III Co-Chairs and technical staff. The underlying report and the SPM are comprehensive and clearly structured, communicating a multitude of relevant findings. These robust scientific assessments will continue to be needed to inform discussions and decisions in the policy sphere. The SPM in particular must pay close attention to being as clear and relevant for policymakers as possible, and in that sense supply findings that are relevant to the UNFCCC, the Paris Agreement and 1.5°C, in particular, as well as important policy developments, above all the revisions of NDCs and long-term (net zero) targets.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15618	0	0	0	0	The Working Group I report has shown the value of providing regional-level information, especially with its Interactive Atlas. It is understood that the same can maybe not be done for WGIII as well but the SPM should nonetheless try to include as much regional-level information as possible. Many of the general global-level statements in this SPM are already well known, while especially regional-level information would provide additional value, especially when it can be compared across the different regions of the world (preferably in greater detail than the three regional SPM figures provided). This is especially the case when the different sectors are presented in section C. There, it is often not clear which regions of the world the findings apply to, and especially developing country regions would need to be better represented. Especially for regions such as small islands, as detailed information as possible would find great appreciation.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
15620	0	0	0	0	The scenarios featured in this report and SPM and the global emissions pathways as well as the IMPs need to be introduced and explained more clearly so that they can easily be understood by policymakers. Some of this information is now featured in footnote 8 where it does not make the most sense in our view. The IMPs are not very well introduced at the start of C.3. The Working Group I SPM had a very useful Box SPM.1 on scenarios, climate models and projections, and we would therefore suggest that something in this form should also be used for this SPM and placed prominently at the start of the document.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
6228	0	0	0	0	<p><u>SCENARIOS - COMPATIBLE WITH THE PA:</u> There is no explicit reference to the Paris Agreement's (PA) temperature goals in the SPM in the context of emission pathways, but obviously policy makers will associate the C1 and possibly the C2 category with 1.5°C and C3 and possibly C4 with 2°C. The choice of categories has strong implications on the characteristics of the emission pathways and associated policy options, hence key policy relevant statements of this report.</p> <p>1.5°C warming: During the SR1.5 approval it has been clarified that the C2 category is inconsistent with the PA's 1.5°C limit which strictly spoken excludes any overshoot. Therefore, while we appreciate the additional information on C2 in Table SPM.1, we strongly support that the text only refers to C1 when referring to 1.5°C warming, which was also decided for the SR1.5's SPM during its approval session.</p> <p>Well below 2°C warming: Footnote 8 identifies the C3 and C4 categories as consistent with limiting warming to 2°C. In our view, particularly after COP26 that reinforced the need for ambitious mitigation targets, it is not appropriate for the IPCC to imply that these categories are consistent with the "well below 2°C" target of the PA. In particular, C4 only has a 50:50 probability of staying below 2°C and is hence not relevant with the PA's target of "well below 2°C", please amend. In addition, in order to avoid policy prescriptiveness and a bias towards weak mitigation targets, please explain in a clear manner that the C1 category is also consistent with a "very likely" (&gt;90%) chance to limit warming to 2°C (Table SPM.1, first line of far-right column) and hence is relevant in the context of the PA's "well below 2°C" target. We urge the authors to amend the descriptions of the C1 category at each occasion including in footnote 8 as well as in the captions of Figure SPM.5, Table SPM.1 and add that the C1 category is also referred to as scenarios "Very Likely below 2 °C throughout the century with a probability of 90% or greater. Furthermore, please indicate the remaining budgets for 2°C also for reaching this limit with a 90% probability in including in B.1.3 and B.7.1"</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13468	0	0	0	0	How do the scenarios used in this section compare to the ones used in WGI? Also the feasibility and risks of having several hundreds of Gt negative emissions are not discussed in the chapter. Some of the risks were highlighted already in SRCLL.	Government of Estonia, Estonian Meteorological & Hydrological Institute
524	0	0	0	0	Another key message that needs to be highlighted in the SPM document is that "mitigation at the pace and depth required to achieve Paris Agreement goals may imply deep economic structural changes and shifts in development pathways, raising multiple types of distributional concerns across regions, income classes and sectors" (TS-4-31 L7-10). More details about this statement are given in Chapter 3 (3.6.1.2. Regional mitigation costs and effort-sharing regimes). Similarly, "globally cost-optimal pathways include more emissions from developed countries, while if equality criteria determine the burden sharing approach used, then more emissions from developing countries are allowed" (TS-4-31 L16-18).	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
6858	0				We applaud and thank Co-Chairs, authors and the TSU members involved for their ongoing efforts! The FGD and its SPM successfully presents relevant findings in a convincing way. In general, the SPM has to be considered too technical for the policy audience still. In the following, we are presenting concrete suggestions on how we believe the SPM could be improved further.	Government of Jamaica, Meteorological Service Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6860	0				An overall issue with the SPM is how parts of its most central information cannot be related to the Paris Agreement. Acknowledging the challenge of ensuring policy-relevance while avoiding policy-prescriptiveness, it must still be clear that providing information that is relevant to the Paris Agreement temperature as well as mitigation goal does not constitute an interpretation of these goals. That being said, while the presentation of consistent information on "limiting warming to 1.5°C with no or limited overshoot, or likely to 2°C" throughout the SPM is welcome, those statements that average the information over the corresponding pathway classes are misleading. They suggest, for example, that mitigation needs would be the same for limiting warming to 1.5°C and to 2°C. The statements in question must instead always separate out the findings on 1.5°C and 2°C. It is evident from UNFCCC COP26 that specific information on 1.5°C will be sought after by policymakers. It is also unclear how the categorisation of "1.5°C with no or limited overshoot" and "likely 2°C" relates to the Paris Agreement temperature goal. A statement clarifying this must be added, or the categorisation has to be adjusted accordingly. A similar issue relates to the categorisation of pathways. Also here, it is unclear how the categories, C1 through C4 in particular, can be related to the Paris Agreement temperature goal. Moreover, it would seem that the most ambitious category C1 would be in line with the Paris Agreement mitigation goal of achieving net zero greenhouse gas emissions. However, only a little more than half of pathways achieve this. In this context, we would like to seek further clarification from the authors regarding the pathways that make up this category, as it is unclear to us why not all pathways in this category achieve net zero greenhouse gas emissions. We will provide further comments with concrete suggestions on the table.	Government of Jamaica, Meteorological Service Division
6862	0				Unfortunately, it appears that the SPM does not provide the state of the science on emission reduction pathways in the most policy relevant way. Most major emitters have set themselves long-term net-zero targets, governments around the world have committed themselves to the 1.5°C limit. Their actions and (near-term) targets are wholly insufficient to achieve that, yet that is what they are set out to do. The question "where do we want to be" has been largely answered. The main policy question now is 'how to get there'. Averaging very different emission reduction pathways, even across very different categories does not provide this information. Much more, different policy choices and strategies, as they are e.g. outlined in the IMP pathways do. They help to illustrate the effect and potential of different options available to policy makers. It is therefore strongly encouraged to strengthen the role of the IMPs in how results are presented across the SPM, and include a figure and table similar to the very useful figure SPM3 in the SR1.5.	Government of Jamaica, Meteorological Service Division
6864	0				The SPM needs more information at the regional level which would greatly expand its policy relevance especially for developing regions for which this type of information may otherwise not be readily available. This concerns first the text itself, e.g. the sector-focussed bullet points in section C which often do not make clear whether they relate to a global average, or only certain (developed country?) contexts. This also concerns the figures, namely SPM.2, SPM.3, SPM.11, which should all be based on the same level of classification from the UNSD scheme, and furthermore reflect small island developing states in a separate category based on what is available in the underlying assessment.	Government of Jamaica, Meteorological Service Division
6866	0				Several important pieces of information in the SPM require precise quantitative statements instead of statements such as "most", "high levels", etc. This holds specifically but not exclusively for statements on climate finance levels, climate finance for adaptation and for mitigation, fossil fuel finance, fossil fuel subsidies. The ongoing discussions of these topics at the highest political level means that scientifically robust, concrete statements (which are available in the chapters) will be expected from this SPM. We will provide specific comments with concrete suggestions.	Government of Jamaica, Meteorological Service Division
6868	0				Our comment on the need for more quantitative statements throughout the SPM also concerns the topic of economic benefits of avoided climate impacts. We appreciate the dedicated CWGB on the topic. Yet, both the box itself and the SPM do not contain the necessary quantitative assessment information that would make such findings meaningful for policymakers. The SPM must be strengthened in this regard.	Government of Jamaica, Meteorological Service Division



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11828	0				<p>The SPM is not always reader-friendly. The consequence is that the text itself appears rather trivial, recalling facts, ideas and diagnosis which are of course true (and important) but can be expected well known by most people - especially in Section E. For example most readers will consider obvious that:</p> <p>- "C.2 Limiting warming to 1.5°C with no or limited overshoot, or making it likely that warming is limited to 2°C, requires reaching net zero CO2 emissions globally and deep reductions in other GHG emissions. The level of peak warming depends on the cumulative CO2 emissions until the time of net zero CO2 and the warming contribution of non-CO2 climate forcers at that time."</p> <p>- "C.3 Pathways that limit warming to 1.5°C with no or limited overshoot, or are likely to limit warming to 2°C, involve deep GHG emissions reductions in all sectors and regions. These are achieved through the substitution of fossil fuels by very low- or zero-carbon energy carriers, limiting energy intensity, reductions in non-CO2 emissions, and deploying carbon dioxide removal (CDR) measures to counterbalance remaining emissions. Illustrative Mitigation Pathways (IMPs) show different combinations of sectoral strategies that can be consistent with a given warming level."</p> <p>- "C.4 Limiting warming to 2°C or 1.5°C involves major energy system transformations: reductions in fossil fuel use, the deployment of low-carbon energy sources, switching to low-carbon energy carriers, and greater energy efficiency and conservation. The continued installation of fossil fuel based infrastructure risks 'locking-in' high emissions"</p> <p>-"E.1 The feasibility of deploying response options is shaped by barriers and enabling conditions across geophysical, environmental-ecological, technological, economic, socio-cultural, and institutional dimensions. The deployment of response options depends on reducing or removing barriers, and on establishing and strengthening enabling conditions. Immediate, strengthened action can spread out system-level feasibility challenges over time in scenarios likely to limit warming to 2°C, or limit warming to 1.5°C"</p> <p>Multiple other examples of that sort can be found. Besides, similar assertions are repeated in various parts of the document which renders the reading discouraging.</p> <p>Many paragraphs include caveats, list numerous items, display nuances which lead to a text unpleasant to read.</p> <p>A consequence of all this is that what is new, not obvious and maybe counterintuitive is not really flagged out. See for example: B.7.2, C 10.1, E 4.6, E 5.2, E5.3, E6.6 etc.</p>	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11830	0				Descriptions for figures are very long, can they be shortened or some information put in the text?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11832	0				General comment on emissions levels in figures & tables: The authors need to take a closer look at the collective impression given by Figures SPM.1, SPM.2, SPM.5, SPM.6 and Table SPM.1. Policymakers and other actors around the world will be using AR6 to inform discussion of mitigation goals and policies. They are likely to use summary statistics such as cumulative emissions, peaking dates and net zero emissions timing to inform such discussion. In particular, the authors should consider adding one or more footnotes to clarify whether the values presented in the figures and tables are comparable to national GHG inventories. It is also important to clarify whether present day emissions are closer to 55 GtCO2e (as in Figure SPM.5) or 60 GtCO2e (as in Figures SPM.1, 2 & 6). Similarly, the consistency of net zero timing between these figures should be made clearer. The WG1 report and Figure SPM.6 clearly associate 1.5°C pathways with net zero CO2 emissions around 2050, whereas Figure SPM.5 gives a different impression (admittedly due to aggregation and use of GWP-100, but this may not be understood by non-expert readers).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11834	0				<p>The SPM could make more effort to highlight the potential contribution of CH4 reduction to short-term and long-term temperature reductions. This is covered to some extent, but it would be useful to mention for example: what proportion of CH4 emissions are from the energy sector and what are from AFOLU.</p> <p>The Executive Summary of chapter 3 notes that rapid reductions in non-CO2 GHGs, particularly methane, would lower the level of peak warming. This finding is not included in the SPM, but would be relevant to highlight, especially given the outcomes of COP26 in Glasgow and the significant attention to non-COs GHGs, and methane in particular.</p>	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11836	0				The term "low-carbon" is used extensively but not defined (neither in the SPM nor in the glossary). Please define it in the glossary. Without a proper definition, many statements can be misleading. For instance, some readers might assume that unabated natural gas is included in low-carbon, while others would not do so.	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11838	0				The SPM would benefit from a consolidated paragraph on GDP & wellbeing that includes (but goes beyond) existing material on the GDP cost/benefit of climate action and demand-side mitigation. In particular, how does this interact with sufficiency concepts (either imposed by policy or changes in consumer attitudes) and 'alternative economic approaches' that scientists and stakeholders sometimes call for. For example, what can we about de-growth and green growth? Is de-growth required (at global level) to reach climate goals? Or is the opposite true? Is green growth both possible, and necessary, to drive zero carbon investments?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11840	0				General comment: further ocean related issues should be reflected in this SPM considering that they are underlined in the underlying chapters. It is difficult to understand the logic to limit the SPM to CDR issues. (eg: ocean energy mentioned in chap 6 and 16, blue carbon in chap 4, 12-13, fisheries in chap 7 and 12, blue infrastructures in chap8)	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11842	0				It would be powerful to make the link with WG1 (and possibly WGII) and in one graph remind the readers what the different degrees of warming entail.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11844	0				The demographic assumptions behind different mitigation scenarios/outcomes are often unclear. I.e., contrasting outcomes may relate to different population levels, not just different mitigation efforts.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11846	0				Nature-based solutions are not mentioned in the document, although they can play an important part in climate change mitigation (IPBES-IPCC report 2021).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11848	0				Overall, the role of the COVID pandemic receives insufficient attention. Not much (understatement) is said about the "green" as opposed to "grey" recovery, what we are seeing across countries, structural changes that it triggered by the pandemic as well as associated opportunities and risks for mitigation action.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11850	0				A reference to rebound effects and the Jevons paradox would seem necessary. The SPM deals extensively with the potential side-effects of policies and measures (i.e., unintended impacts on other factors than those targeted by them), but does not consider rebound, which can reduce/reverse the intended effect itself. E.g., in the absence of other measures, increased efficiency itself can drive and increase in energy demand.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11852	0				Consistency of terminology and framing should be checked here and throughout. Examples: * Scope of "energy sector" (e.g. whether or not it includes also demand side management, energy efficiency, etc). * CO2-AFOLU versus LULUCF * "net-zero" and whether or not it includes indirect/consumption-based emissions and offset (sometimes it seems to, sometimes not) * "anthropogenic" [emissions and removals]: it is often stipulated, but in other cases it is not. Sometimes it is unclear whether it is not mentioned because it is considered trivial, or because natural removals were also included. * Stipulation of the exclusion of certain emissions is inconsistent, e.g., aviation and maritime is mentioned both with and without "international", "biogenic CO2" may or may not be mentioned and its scope unclear. * "Advanced" biofuels are emphasized in some places, but not in others. It is unclear when it is considered important and also what these fuels would be, as they are interpreted very differently in different jurisdictions/contexts. * "electric vehicle" unclear whether it is only cars/trucks or also includes micromobility/rail, and whether hybrids are included. This makes it difficult to interpret some findings (like number of vehicles or capacities). * "economic benefits/costs" vs GDP: it is not always clear whether they are considered equivalent or, if not, how the former is different from the latter. * the potential of demand-side measures are sometimes generalised, but then conspicuously missing in certain places (like aviation). * Mitigation to date (earlier and existing policies and their impacts) is often mentioned, but in some places the language suggests that mitigation is considered only in the future, ignoring any effort/result to date.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11854	0				The SPM (even C.5) fails to reflect on emissions (and mitigation needs) associated with raw material extraction (primary sectors). All references to materials/industry seem to begin with processing (like steel and concrete), but not mining and other raw material extraction (and related processing and transport) activities.	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11856	0				<p>Somewhere in the SPM (either in C9 or C11) a clear reference to the potential for "blue carbon" or ocean-based mitigation is needed. In the SROCC, the potential mitigation contribution of restoring vegetated marine ecosystems is specified clearly. Nevertheless, the term "blue carbon" is often used in policy circles (intentionally or accidentally) in a way that conflates very different concepts (such as ecosystem restoration, natural CO2 absorption by the ocean, ocean-based CDR methods, and other phenomena such as the whale pump) and implies that they are all part of mitigation toolbox. Clarifying the potential mitigation contribution and key differences between some of these phenomena will be extremely helpful in avoiding the future misleading uses of terms such as "blue carbon".</p>	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11858	0				<p>The treatment of land use (in particular carbon sinks/sources, LULUCF) is overly general, often rather inconsistent and fails to address certain issues that are important for policy makers and for the understanding of interactions with other sectors. In particular:</p> <ul style="list-style-type: none"> <li>* AFOLU versus LULUCF: They are used variously throughout the SPM, and it would be essential to clarify their relationship and use them consistently, especially because of the critical role of LULUCF in attaining the balance between anthropogenic emissions and removals envisioned by the Paris Agreement. LULUCF is mentioned 10 times in the text, but not mentioned in C.9. It also appears in several figures (without AFOLU), whilst AFOLU appears in other figures (without LULUCF), and it is often unclear whether mitigation contributions mean removals, emission reductions or both.</li> <li>* The relationship between anthropogenic and natural emissions/removals. Whilst mitigation is concerned with only anthropogenic emissions/removals, natural (or indirect human-induced) land sinks have a decisive role in climate scenarios and human action can have an impact on these sinks and sources. It should be clarified how natural and anthropogenic removals are treated in this report and any policy-relevant considerations/assumptions for the future.</li> <li>* It would be important to clarify the interlinkages with other sectors, most specifically energy. The sections on the energy transition make little reference to bioenergy (apart from some biofuels) and almost no reference to its linkages to LULUCF, although scenarios rely very heavily on bioenergy, which is the biggest source of renewable energy.</li> <li>* More specifically, the relationship of "land-based CDR options" (mentioned in C.9) and "negative emissions" in the energy sector (like BECCS) should be clarified. C.3.3 makes reference to "net-zero CO2 emissions" in the "energy supply" sector. If that includes reliance on BECCS for negative emissions, it suggests that some of the removals on land are counted towards the energy sector. It would be important to understand how that relates to the mitigation potential considered under AFOLU. Similarly, C.11 includes some (but not all) forestry measures as "CDR" without once noting AFOLU (or LULUCF), whilst all such measures seem to be included in C.9 as AFOLU. It would be crucial to clarify the linkages, including how double-counting of mitigation potentials can be avoided.</li> </ul>	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11860	0				<p>There is only one reference to discount rates in the SPM (in C.12.3) and their impact on expected outcomes in economic models. It applies to one specific context (assessing long-term benefits of mitigation). I would be important to elaborate on this further and in other contexts. What would be "the range usually considered", mentioned in C.12.3? Are there other findings in the SPM that depend strongly on the discount rates applied (e.g., the relative cost of certain technologies, such as CDR options)? Are the implied discount rates consistent throughout?</p>	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11868	0				<p>We would like to thank the authors very much for the FGD draft. We believe that it is overall very informative, clearly written and well structured. The figure quality is excellent and complement the text well, with very helpful top-level statements that summarize the main message. Overall, the SPM could still be shortened where possible. In many instances, quantitative statements need to be added. We look forward to further engaging constructively during the Approval Plenary.</p>	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11870	0				<p>There is an overall issue with the current pathway classification and its value for policymakers. It is clear that the future SPM reader will look for clear information on whether the different pathway classes can be considered "compatible with the long-term goal", as Chapter 3 was explicitly tasked to assess this information (directly from approved chapter outline: "Modelled emission pathways compatible with the Paris Agreement, including the long-term temperature goal[1], and higher warming levels, .... [1] As set out in article 2 of the Paris Agreement"). Currently, it is not possible to clearly derive this kind of information. We understand that the mitigation pathways were not grouped using Paris Agreement language directly, but that they are classified by their probabilistic temperature outcomes, which we appreciate. This, however, also means that all features of the Paris Agreement Long-Term Temperature Goal (PA LTTG), i.e. adequate "limit warming to 1.5°C" and "well below 2°C" representation, must be captured by the probability based pathway categories. Only the no/limited overshoot 1.5°C category (C1) would be suitable to be considered fully PA compatible. As the PA LTTG is one goal and the impression should be avoided that the LTTG would allow for an "either below 1.5°C or well below 2°C" interpretation (which is somewhat implied by the current categories), the C1 category should be expanded to also capture the "very likely below 2°C" component to reflect the the PA LTTG "well below 2°C" language. As is, the C1 category is almost there, as 86% of pathways would be below 2°C, when looking at the 5th percentile shown in Table SPM.1. Please adapt the pathway selection criteria in a way that the 5th percentile would capture 90% of pathways. The C1 category should then be relabelled to read "Below 1.5°C with no or low overshoot and very likely below 2°C". If this approach is not feasible a new dedicated "very likely below 2°C" category has to be included. The full suite of temperature outcome probabilities has to be captured with the pathway classification to transparently communicate policy-relevant characteristics that can then be interpreted by the SPM reader. Leaving out this type of information would also represent a policy prescriptive pre-selection of pathways and has to be avoided. The table should then be simplified where possible as it can be considered too technical for a document for policymakers.</p>	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11872	0				<p>There are fundamental questions around the pathway characteristics for the C1-C3 categories, in particular, and these questions directly relate to a concerning net-zero GHG messaging of the current SPM draft. We would like to recall that the Paris Agreement established not only the Long-Term Temperature Goal in Art2 but also defined the Mitigation Goal in Art4.1 by adopting language to achieve net zero greenhouse gas emissions in the second half of the century. This criterion, which is clear and quantifiable, is not at all considered in the current pathway classification. In fact, it appears that even a large part of C1 pathways does not achieve net-zero GHGs in the 21st century, which implies that they could be seen as not fully Paris Agreement compatible. This is a clear departure from the SR1.5 assessment and raises fundamental questions on pathway design. When looking at the C1 pathway characteristics, it can be observed that a substantial cooling of 0.3°C is achieved (from 1.6°C at peak warming to 1.3°C in 2100) while only accumulating around 200 GtCO2 net-negative CO2 emissions out to 2100. The comparably small net-negative emission requirement results in the majority of C1 pathways not achieving net-zero GHG in the 21st century. We have tried to understand the reasons for this, including emulator behaviour (Zero Emissions Commitment), non-CO2/methane cooling (which however appears to be capped at 50% as per table 3.6 in chapter 3), and the characteristics of some of the pathway trajectories subsumed in the C1 category, but this issue remains opaque and problematic. We ask the authors to introduce a C1 subcategory C1a that pools the C1 pathways that meet the net-zero GHG criterion in order to clarify underlying pathway specifics. In addition, the strong cooling of C1 pathways in the SPM needs to be clarified and explained. Please consider the dangerous messaging resulting from the current C1 pathway specifics, i.e. that "there is no need to achieve net-zero GHGs", we would "have more time left to adequately mitigate", and in fact that "Art4.1 of the Paris Agreement is no longer required". A new category or sub-category to C1 should be added that contains all pathways reaching net zero GHGs. This issue has to be revisited with utmost care.</p>	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11874	0				It is our interpretation of Figure 3.5(a) in Chapter 3 that selecting scenarios from the AR6 scenario database and arriving at the pathway classification only included an initial vetting with the vetting criteria "coherence with historical trends", while the later IMP vetting with the additional vetting criteria "near-term plausibility" would not have applied to the overall pathway classification but only to the IMPs. If this is correct, we are concerned with regards to the pathways that make up particularly the C1 category, especially regarding the low percentage of net zero GHG pathways (only 52%) as well as the cooling of 0.3°C (from peak warming to 2100 levels), which we do not fully understand. We would therefore like to ask the authors to provide clear and transparent information with regards to the selection criteria for the pathways that make up category C1 and the vetting process for these pathways. While we fully appreciate that authors are bound by the scenarios available in the literature and have made great efforts to consider scenarios up to the cut-off date, it is critical for this authoritative WGIII SPM to provide policy-relevant information to policymakers that is relatable to the Paris Agreement Art.2 and Art.4. We therefore strongly urge the authors to take policy-relevance and plausibility into consideration especially for the crucial category C1 which will no doubt focus a lot of attention and scrutiny, and to possibly re-evaluate the pathways that currently make up this category. While Table SPM.1 provides a very technical overview, really helpful and illustrative assessment information on possible mitigation options gets lost. This type of information was captured in SR1.5 Figure SPM.3b and has proven extremely useful since. Please re-evaluate the balance between the overall classification and the IMPs.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11876	0				We have several fundamental questions with regard to the pathways included in the scenario database. Unlike for WG1, however, the information on those pathways is not openly available. We would therefore request confidential early access to the database to allow us to critically assess the information that is presented to us here.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11878	0				The pathway category "below 1.5°C with high overshoot" (C2) continues to be potentially misleading as it may be interpreted in a way that these pathways would keep warming below 1.5°C, while warming is in fact "likely" to exceed 1.5°C ("peak warming higher than 1.5°C with a probability of 67% or greater" as stated in the Table SPM.1 caption). There was a similar issue in the 1.5 Special Report process. Category C2 should therefore be renamed to avoid any potential misinterpretation, e.g. to "likely to overshoot 1.5°C and returning to below 1.5°C in 2100". As already highlighted, readers will expect the SPM to provide clear information on how the presented pathway categories can be applied in the context of the Paris Agreement, not least because WGIII was tasked to assess pathways compatible with the Paris Agreement based on the approved outline. It is therefore critical for the policy-relevance of this SPM to allow for a transparent, unambiguous and comprehensive pathway classification that is able to fully capture Paris Agreement language, while focussing on the probability of temperature outcomes.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11880	0				While we fully understand and appreciate the limitations in terms of peer-reviewed literature that can be considered to ensure the most robust assessment possible, we are convinced that current policymaker demands (resulting from COP26) have to inform the way the SPM authors are selecting and framing core findings from the underlying assessment. This is particularly true for information needs around pathways that limit warming to 1.5°C. Science on 1.5°C is reflected at the highest level in the Glasgow Climate Pact, in particular in Article 21: "[...] resolves to pursue efforts to limit the temperature increase to 1.5 °C". WGIII should be the most authoritative resource in this regard. However, the relevant assessment information provided in the current SPM draft is frequently aggregated in a very unhelpful and misleading manner, as relevant 1.5°C and 2°C statements are combined instead of spelling the information out for both 1.5°C and 2°C separately (see e.g. C.3.2). It is also not clear why only the 2°C statements include a statement on the probability ("likely") why the 1.5°C statements do not; this might be misleading. It is crucial to find 1.5°C specific information separated out and readily available in the SPM, directly elevating information from Table 3.6, for instance. Please revise all relevant SPM passages to provide dedicated 1.5°C pathway requirements. This also includes information needs in the SPM to inform the Glasgow Climate Pact CMA Article 22 on CO2 reduction needs of 45% by 2030 relative to 2010 levels.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11882	0				It is unfortunate that the current SPM does not make full use of the very helpful information provided with the IMPs in the underlying assessment, in particular when looking at implications for net-zero GHGs in the second half of the 21st century. The IMPs and their 21st century time series, as shown in Figures 3.7 and 3.8 in Chapter 3 (and similar to Figure SPM.3b in the SR1.5 SPM), would be very helpful to illustrate how the 'same' or a similar target can be achieved using very different scenario assumptions and mitigation strategies. More than 90% of global emissions are covered under some form net-zero target at the moment. While we understand that the WGIII SPM's focus on the classification along warming levels allows for comparability with WGI, providing information on available options to achieve these net zero targets is the kind of policy relevant information the world is looking for, especially as this was provided by SR1.5. Focusing the SPM more on the IMPs can achieve this. Currently, especially with Figure SPM.6(d), the authors choose to provide very broad averages across a range of different trajectories that do provide very general benchmarks instead of much more concrete illustrations of "solution" pathways. Please reconsider the way IMPs are used in the SPM and provide more information in this regard. This should then also contain an assessment of sustainable development implications of the IMPs.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11884	0				Throughout the SPM, "limiting warming to 2°C" is mentioned. It is not clear, which likelihood level is implicitly assumed here. Is this referring to the "likely below 2°C" category? If it is meant to reference the Paris Agreement LTTG of "holding the increase in the global average temperature to well below 2°C", the addition "well below" should be made throughout the SPM everytime the 2°C limit is mentioned. In this context, it is crucial to flag that the narrative needs to focus on limiting warming to 1.5°C, which is increasingly and explicitly emphasised in the climate policy sphere, in particular in the Glasgow Climate Pact. The authors have to ensure that the information presented in the SPM is as relevant for policymakers as it can be.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11886	0				We fully support the efforts to make the SPM as concise as possible. However, there is too little regional information given throughout the text. Wherever possible, assessment information that is substantially different when moving from global to regional scale should be highlighted. In this context, we would like to reiterate the very unique circumstances of Small Island Developing States. It is our understanding from the UNSD M49 Standard for country and region classification that is referred to in Annex II Part I Section 1 that there is a "SIDS" grouping ( <a href="https://unstats.un.org/unsd/methodology/m49/">https://unstats.un.org/unsd/methodology/m49/</a> ). If that is the case, we would like to ask for this category to be added to the figures concerned, i.e. Figures SPM.2, SPM.3, SPM.11 (possibly along with an additional "LDC" grouping that is also included on the UNSD M49 website). SIDS are currently subsumed under "Latin America and Caribbean" as well as "Asia and developing Pacific", which does not adequately capture the regional disparities. If this cannot be achieved, at the very least the three regional figures in question should make use of the same categories, i.e. all make use of the more detailed "intermediate level", which currently is only the case for Figures SPM.3 and SPM.11 but not for SPM.2 which makes use of the "high level". It is critical that information is comparable across the SPM.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11888	0				The issue of fossil fuel investments and financing including subsidies, the barriers these immense sums represent to mitigation and how they compare to climate finance is not adequately reflected in the SPM, in particular in sections B and E. This issue is of highest relevance, also looking at the political discussions under the UNFCCC. Please revise the relevant sections to provide more specific information on the current amount of investments and financing including subsidies and how they compare to investments in low-carbon/emission technologies, as well as on the benefits of accelerating the transition to clean energy. Scientific information on this is readily available.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11890	0				Section A of the SPM highlights the very important issue of economic benefits of avoided climate impacts, pointing to Cross-Working Group Box 1 of Chapter 3, in particular. Unfortunately, this issue and related cost-benefit analyses are not covered adequately in the subsequent SPM text, only touching on this topic in section C.12 and focussing only on 2°C (see C.12.3), sending a rather misleading "2°C is cost-efficient" message, while also assessment information on 1.5°C is needed. The figure that should be part of the Cross-WG box could provide very important quantitative information, while the box text itself unfortunately does not provide the required quantitative information (yet). The scale of climate impact damages and how they can change the overall picture has to be communicated in greater detail (while pointing to caveats in such assessments). This issue is one of the great challenges in IAM modelling. Also, other actors such as IRENA report net-positive economic gains from 1.5°C compatible stringent climate action. This is in stark contrast with some of the information presented here and the question is, if the current SPM content are the result of a certain economic paradigm dominant in the underlying chapter rather than anything else. Similarly, health co-benefits have to be covered more explicitly, as accounting for those would also change the overall narrative in this context. Other co-benefits, which may not be (so immediately) relatable to economic gains, should also be mentioned here, such as improved air quality. The reader has to understand the scale of the issue and what needs to be done to move forward in this scientific domain. There are fundamental questions in relation to the realism of such cost estimates in IAMs, and even more so in anything that relates to a cost-benefit type of approach. It might therefore be advisable to not include such statements in the SPM at all.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
844	1	1	37	5	Thanks to all authors who have contributed to this revised draft which addresses many comments and issues raised.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
846	1	1	37	5	Overall the report is well structured but links between sections could be improved and length reduced	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
848	1	1	37	5	Comments should aim to inform policy and avoid prescriptive, normative or pointed statements that transcend policy.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
850	1	1	37	5	Some headline statements are weak, more quantification in and precision in statements is required: e.g., terms such as "as rapidly" or "Decline gradually" should be framed and quantified.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
852	1	1	37	5	Key concepts need to be clearly explained e.g. what is meant by Carbon Budget and expanding the carbon budget, material from previous reports SR1.5C, Land and WGI can be used and elucidated to do this.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5090	1	1	43	30	We are concerned that the groupings of countries used throughout the report, be that regionally or along developed/developing-type lines, is not logical, consistent or transparent. It needs to be clear why specific groupings have been used (ideally showing that the groupings are representative of their members), that they can be compared with other analyses (particularly within the WGIII report but also across all the WG reports and aligned with the UNFCCC) and it must be obvious which countries are in groups when they are used. The definitions of 'least developed countries' and 'developed countries' are not stated in the report and should be explained. If 'least developed countries' corresponds to the Least Developed Countries, as recognised by the UN, then the phrase should be capitalised for clarity.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5092	1	1	43	30	The SPM is lacking in its discussion of counterfactuals, and this leads to some misleading messages that are open to misinterpretation. In particular, the discussions around mitigation costs and inequality compare effects to a baseline without climate change; this isn't possible, and the counterfactuals here are therefore unrealistic. The SPM should present a balanced approach to assessing mitigation costs and inequality, and should acknowledge that the counterfactual used isn't possible.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5094	1	1	43	36	We welcome the focus on solutions and areas where progress has been made to date. However, the SPM in some places is missing a balanced consideration of the challenges in some sectors. Could the authors please review the SPM, ensuring that both solutions and the positive efforts that have come so far are balanced with realistic assessments of where urgent action and further effort is needed.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14232	1	1	43	36	In general, the SPM is a very good summary of the robust findings within the report. However, there are few references to nuclear power in the SPM compared with the number of references to nuclear power in the underlying report.	Government of Romania, National Meteorological Administration
5096	1	1	1	1	The introduction and framing section as the first section is not that compelling and is quite long (much longer than the opening of the IPCC SR1.5 report and AR6 WG1 report for instance). If this could be made significantly shorter the SPM would be more effective at grabbing attention and creating a strong narrative by immediately getting into its substantive content.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12408	1	6	1	9	"The report reflect methodological development and new findings" More clarity is needed . Methodological development on what?, new findings regarding what?	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
5098	1	11	1	11	A justification for use of the 1990 base year here would be useful - particularly so as it isn't mentioned in the headline statement.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5100	1	12	1	12	The use of 'absolute' here can be confusing. For instance does this mean that CO2 removals are included or excluded in the CO2 emissions considered here? A better phrasing might be 'growth in the magnitude of CO2-equivalent emissions' . Similarly in the second part of the sentence 'growth rates' could be replaced with 'proportional growth rates' to make this more specific and accurate.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12410	1	14	1	14	Who are those emerging Actors?, how new are they?	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
5102	1	19	1	19	Temporarily' not needed here - it is clear from next sentence that this was temporary. 'Global average' is needed to accurately describe which emissions statistic is being presented here.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2558	2	0	2	0	Footnote 8 : It might be useful here or below to explain what is the approach to estimate GtCO2-eq in the various figure.It make sense for global estimates but is it still the case for regional estimates	Government of France, Ministère de la Transition écologique et solidaire
5104	2	1	2	28	The headline from section B6 should be highlighted in the introduction	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5106	2	1	2	28	Some of the opportunities for large scale decarbonisation could also be brought out more in section A, for example some of the most policy-relevant points in sections C6, C7 and C8	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13504	2	1	2	28	We recommend adding to the first bullet point which references the Paris agreement, a statement or reference that includes the need for accelerated action to mitigate climate change in line with the Paris Agreement's goals.This particularly important in the framing section.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
854	2	1	3	1	More information on the shared policy framework identified in the Paris Agreement can be provided including its temperature goal and mitigation pathways : this might also avoid statements in the text or report which rework the Paris Agreement text.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
856	2	1	3	1	There are major differences between policies and measure that address land/food based emissions and those from for energy related activities. These are recognised for carbon dioxide but not for methane. The report can better distinguish between land based methane emissions and those from fossil sources. This can be included in the framing and in the detail in later section.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division



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858	2	1	3	1	The term "expanding the carbon budget" and how this can be achieved and potential limits and risks should be included here.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
566	2	1	3	24	The summary of Section 1.4 "Drivers and Constraints of Climate Mitigation and System Transitions/Transformation" in the underlying report is missing in this part and it is suggested to make verification and additions.	Government of China, China Meteorological Administration
13502	2	1	3	24	Saint Lucia recommends that the WGIII, section A be shortened to fit in one page, this would align it with WGI SPM and WGII FDG SPM. This would also further shorten the WGIII SPM making it more concise.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13706	2	1	3	24	We think it would be good to include a statement about the close linkages between GHG emissions and status of development - to set the stage when it comes to later statements about the close linkages between mitigation efforts and development pathways. To put the "climate crisis" into a broader context, please consider to mention other relevant global assessments, such as IPBES Reports and UNEPs Making peace with nature, Emission GAP Report etc. in the introduction and framing section.	Government of Norway, Norwegian Environment Agency
14312	2	1	3	24	Clearly written and relevant. Good categorization. Includes material that the reader might very well not have encountered multiple times before. Anyone can understand this. Good take-aways.	Government of United States of America, U.S. Department of State
2466	2	1	3	25	Having developments and new findings in bullet points like this is helpful and gives good overview	Government of Denmark, Danish Meteorological Institute
860	2	1	4	3	In view of the information contained in WGI report inclusion of a short section/box that explains the key findings that will be considered. Specifically information on carbon dioxide budgets and their links to non-CO2 GHGs, including any assumptions made as a result of various scenario analyses.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6240	2	4	2	4	As not only levels of confidence, but also the assessed very likely range (90% interval) is given in () brackets in this draft, it may be helpful to use square brackets [x to y] to provide the 90% interval in order to clearly distinguish between the two. In this case, a corresponding sentence may be added in footnote 2: "In this Report, unless stated otherwise, square brackets [x to y] are used to provide the assessed very likely range, or 90% interval". Furthermore, ensuring consistency with the SPM of the WGI contribution to AR6 (see footnote 4, page 4 of WGI-SPM).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6242	2	4	2	4	Footnote 2: As the terms used to indicate the assessed likelihood is also typeset in italics, please clarify that "typeset in italics" does not only refer to the level of confidence.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6244	2	4	2	4	Footnote 2: Please add the description of "more likely than not" which is the probability of the C4 category, and hence key information for this report.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
8	2	5	2	5	It is unclear for someone not familiar with IPCC SPMs what the nature of those numbers in curly brackets are. It is suggested to add: The numbers included in curly brackets refer to the chapters/subchapters of the main report or to sections of the technical summary.	Government of Austria, Federal Ministry of Agriculture, Forestry
11100	2	6	2	8	Why is the AR6 WGI report not referenced here? It is mentioned in footnotes 5 and 6.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12394	2	9	2	13	Not clear what is the value of this paragraph. We suggest more clarification be given to highlight the key science message, otherwise better delete it	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
2548	2	9	2	13	A reference to TS.1 could be added (see page TS-3 lines 10-17)	Government of France, Ministère de la Transition écologique et solidaire
6246	2	9	2	13	Please include SDGs and rewrite the sentence as follows: "The literature reflects, among other factors, developments in the UN Framework Convention on Climate Change (UNFCCC) process, including the outcomes of the Kyoto Protocol and the goals of the Paris Agreement {13, 14, 15}, the UN 2030 Agenda for Sustainable Development including SDGs {1, 4, 17} and the evolving roles of international cooperation {14}, finance {15} and innovation {16}.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
7010	2	9	2	13	The text can be misinterpreted, because it seems that the UN 2030 Agenda for Sustainable Development is part of the UNFCCC process. Considering this comment, please, change the comma in line 11 by semicolon: "The literature reflects, among other factors, developments in the UN Framework Convention on Climate Change (UNFCCC) process, including the outcomes of the Kyoto Protocol and the goals of the Paris Agreement {13, 14, 15}; the UN 2030 Agenda for Sustainable Development {1, 4, 17} and the evolving roles of international cooperation {14}, finance {15} and innovation {16}. And, please, see comment below.	Government of Brazil, Ministry of Foreign Affairs
7012	2	9	2	13	In our point of view, there is a need to avoid classifying specific aspects of the Kyoto Protocol and the Paris Agreement. A general comment on those UNFCCC instruments is more appropriate. Considering this comment, please delete "the outcomes of" (in line 10) as well as "the goals of" (in line 11). And based in the comment provided above, please change the comma in line 11 by a semicolon. The text should be read as follows: "The literature reflects, among other factors, developments in the UN Framework Convention on Climate Change (UNFCCC) process, including the Kyoto Protocol and the Paris Agreement; the UN 2030 Agenda for Sustainable Development and the evolving roles of international cooperation, finance and innovation".	Government of Brazil, Ministry of Foreign Affairs
14314	2	9	2	28	Across all three initial bullets, the focus is on new, emerging, or recent literature, which may or may not be robust. What assessment is made of robustness? Confidence?	Government of United States of America, U.S. Department of State
3840	2	9	2	9	Based on the content of lines 9-13, we suggest the word 'governance' be added to the subject line (i.e., 'an evolving global governance landscape').	Government of Canada, Environment and Climate Change Canada
13090	2	9	2	9	It states that the "literature reflects, ... developments in .." UNFCCC, Kyoto, the Paris Agreement and the 2030 Agenda. When reviewing the entire SPM the underlying link to these international policy instruments as mentioned here are - apart from the chapter on the 2030 Agenda - not directly visible nor evident. The Paris Agreement is then only mentioned once throughout the document, and the other ones mentioned here are not referenced at all.	Government of Switzerland, Federal Office for the Environment FOEN
14316	2	9	2	9	These bullets need to be better introduced. They need a lead-in sentence such as "Highlights from this summary include:"	Government of United States of America, U.S. Department of State
11102	2	9	3	17	It would be useful to introduce the bullet points with an additional sentence or short paragraph. The listing does not seem to follow naturally E.g., the "evolving global landscape" is neither a "methodological development", nor a "new finding" (from the second paragraph of page 2).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11104	2	10	2	11	"outcomes of the Kyoto Protocol" could be explained. The final numbers for the second commitment period are not yet available and several parts of the SPM are written as if no mitigation had been taken place to date.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
1202	2	11	3	17	Please clarify that the references are to the Chapters of the report (e.g. the {13, 14, 15} on line 11).	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
13092	2	14	2	14	Harmonize terminology: "approaches" are mentioned here, later the language uses the terms "responses", "response options", "pathways", "scenarios", etc. Introduce the differences between the terms used and / or harmonize the language.	Government of Switzerland, Federal Office for the Environment FOEN
6248	2	14	2	16	Here, the movements of the youth are especially worth mentioning, as they really drive politics forward. References can be found in chapters 1, 5, 13, 14, 16, and 17.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6250	2	14	2	17	In Chapter 13, the role of subnational entities and their policies is discussed (e.g. Section 13.5). For this reason, please reconsider to (re-)include Chapter 13 in this listing of referenced chapters in line 17 (as in the SOD).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12954	2	14	2	28	It is also important to emphasize in this portion that development pathways are also determined by the development stage of a country, i.e., developed vs developing.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
14318	2	15	2	15	Add after "cities,": "indigenous and local communities,"	Government of United States of America, U.S. Department of State
13094	2	16	2	17	The sentence on the low emission technologies does already present a result/outcome/finding from the analysis of the literature. Here, in the neutral, adn framing section, we would not expect a sentenced that is already assessing the literature. Use a more neutral language instead, along the following lines: "the literature assess the costs of existing, new and emerging technologies ..."	Government of Switzerland, Federal Office for the Environment FOEN
13096	2	17	2	17	What is meant by "emerging literature"? Omit the word "emerging" as it is clear to the reader that AR6 assesses the literature in a defined window between X and Y year.	Government of Switzerland, Federal Office for the Environment FOEN

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13098	2	17	2	20	In this introductory section, the text should not weigh in and judge the approaches to mitigation: f.ex. what is the reason only the mitigation efforts of developing countries are strengthened? Remove the qualifiers , and make the sentence neutral, so it reads: "The literature examines climate policies, mitigation efforts, developments in greenhouse gas (GHG) emissions, and the new context ..."	Government of Switzerland, Federal Office for the Environment FOEN
6252	2	18	2	18	_COUNTRY GROUPINGS: Since this is the first reference to "developing countries", please explain the country groupings used in this SPM. Please insert a paragraph or a box with the definitions of the alternative country groupings and regions in the SPM. The issue is very important, in particular since the groups differ from those usually used in the context of the UNFCCC, the main audience of the IPCC, so that it is not sufficient to merely refer to the underlying report.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
768	2	19	2	19	Wording: 'some developed countries' requires clarification (may be in a footnote). In the UNFCCC 'developed' means Annex 1 Parties. Is it the same in the SPM or not?	Government of Russian Federation, Institute of Global Climate and Ecology
2550	2	19	2	19	The adjective "new" may not be the good one as the Covid-19 pandemic situation is continuously evolving.	Government of France, Ministère de la Transition écologique et solidaire
568	2	19	2	20	As stated in lines 14-15, Chapter 1 of the underlying report, "developed country emissions barely changed from 2010", the statement on "sustained reduction" in the SPM is not consistent with that in the underlying report. It is suggested to change it into "Emerging literature examines the global spread of climate policies, strengthened mitigation efforts in developing countries, sustained greenhouse gas (GHG) emissions in some developed countries, and the new context arising from the COVID-19 pandemic."	Government of China, China Meteorological Administration
22	2	20	2	20	The format of reference to Cross-Chapter Box with "in Chapter x" is redundant. Better is to change it to "Cross-Chapter Box x.y", where x is Chapter and y is Box. The same is valid for all SPM, TS and Report too.	Government of Czech Republic, Czech Hydrometeorological Institute
2552	2	21	2	22	Mitigation is not questioned in this report because economic development (not the type of development but development itself) as we know it today is not questioned. Basically, can we sustain at long run growth and mitigation from a technological and social point of view? The approach itself is questionable.	Government of France, Ministère de la Transition écologique et solidaire
3842	2	21	2	22	Hard to follow - more clarity is requested. Are we talking about the stage of economic development as in Polanyi's (1944) "The Great Transformation" or the choice made by the economies.	Government of Canada, Environment and Climate Change Canada
11106	2	21	2	22	It would be useful to provide an explanation to what is meant by "development pathways". The definition in the glossary is rather vague, but suggests that mitigation is part of the pathways, not independent of them. If development pathways "largely drive GHG emissions" and do not incorporate mitigation, then it is hard to conceptualise the parallel existence of development and mitigation pathways.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12470	2	21	2	27	Line 21-27 must be deleted and reframed. The underlying chapters provide information, analysis and overall assessment of mitigation across both developed and developing countries. In the manner in which development pathways is used here, it suggests that emissions are driven by developing countries. It cannot be argued that developed countries can be considered developing in an earlier period and that the term development pathways are hence justified. In lines 26 and 27 the association of poverty eradication and aspirations with this term shows that the reference is only to developing societies. All of South Asia, Sub-Saharan Africa are, both historically and in the present, well below the global average in both cumulative and annual terms. Hence the statement that development pathways drive GHG emissions is not justified. This para does not reflect the underlying literature in a correct manner. The glossary definition of "development pathways" must also be suitably rewritten.	Government of India, Ministry of Environment, Forests and Climate Change
13332	2	21	2	28	The focus is very much on developing countries. To also get the developed countries "on board", this paragraph might include a sentence that also for developed countries the framing of climate change mitigation as sustainable, effective paths is important.	Government of Switzerland, Federal Office for the Environment FOEN
14320	2	21	2	28	This bullet should also include "adaptation" in the boldface lead-in and in the summary that follows to be consistent with Section D.	Government of United States of America, U.S. Department of State
13102	2	22	2	22	"largely" here serves as a qualifier. We advice to not use a qualifier in this introductory chapter. It also lacks a quantification, as "largely" is not accompanied by a number or a confidence level.	Government of Switzerland, Federal Office for the Environment FOEN
11108	2	22	2	25	Since Chapter 16 is cited here, an inclusion of "innovation" in the list of enabling conditions of action might make the connection even clearer.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
570	2	24	2	24	The term "institutional capacity" is not objective and does not fully reflect the core content of Chapter 13, which is mainly about institutions and policies. The SPM cannot mention only one element of capacity. It is suggested to change "institutional capacity, policy" into "policy, institutions".	Government of China, China Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13618	2	24	2	24	It would be useful to add governance arrangements (including the role of legislation) into the list of enabling conditions for action. There is material in the underlying report that would support such an inclusion, for example the following from Chapter 1, page 6, lines 5-9: Therefore, the governance required to address climate change has to navigate power, political, economic, and social dynamics at all levels of decision making. Effective climate-governing institutions, and openness to experimentation on a variety of institutional arrangements, policies and programmes can play a vital role in engaging stakeholders and building momentum for effective climate action.	Government of New Zealand, Ministry of the Environment
14322	2	24	2	24	Shouldn't "economics" be among the list of enabling conditions, as much as anything else on that list?	Government of United States of America, U.S. Department of State
14324	2	24	2	24	Change "human behaviour and lifestyle" to "human preferences and behaviour." Arguably, it is preferences and the other conditions or factors on the list that lead to lifestyle, which is an outcome not an enabling condition. "Lifestyle" is an unclear word anyway, perhaps referring to employment or cultural practices or many other undefined concepts.	Government of United States of America, U.S. Department of State
14326	2	24	2	24	Shouldn't "resource availability" or "access to resources" be on the list of enabling conditions? It seems pretty fundamental to feasibility and cost (or economics).	Government of United States of America, U.S. Department of State
2554	2	25	2	28	This is absolutely relevant but nothing is presented on these questions in the following summary for policy makers. It is absolutely necessary to specify these challenges	Government of France, Ministère de la Transition écologique et solidaire
2556	2	25	2	28	The sentence seems to be redundant and unclear: "framed in the context of sustainable development"? Sustainable development is an expected result. Suggestion: This literature highlights that climate change mitigation that takes into account equity and poverty eradication, and that are rooted in the development aspirations of the society within which they take place, will be more acceptable, sustainable and effective, and thus lead to sustainable development (1, 3, 4).	Government of France, Ministère de la Transition écologique et solidaire
14328	2	25	2	28	Consider referencing Chapter 5 as well for the sentence "This literature highlights that climate change mitigation framed in the context of sustainable development, equity, and poverty eradication..." since this framing is also central to Chapter 5.	Government of United States of America, U.S. Department of State
5108	2	26	2	28	Is it mitigation framed in this context? Rather than carried out in this context?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13104	2	27	2	27	Omit "poverty eradication": Following the definition of "sustainable development" and the 2030 Agenda for Sustainable Development, "poverty eradication" is already PART of sustainable development. "Poverty eradication" is pertaining to the social dimension (next to the economic and environmental dimensions) of sustainable development. --> Here the sentence already talks to sustainable development and hence this subset can be omitted. SEE ALSO the overarching / general comment made to that end.	Government of Switzerland, Federal Office for the Environment FOEN
13106	2	27	2	27	"development aspirations of the society": Delete. It is already part of sustainable development. SEE ALSO the overarching / general comment made.	Government of Switzerland, Federal Office for the Environment FOEN
14330	2	27	2	27	Add "individuals and" before "the society" (which grammatically should be plural: "societies").	Government of United States of America, U.S. Department of State
14332	2	28	2	28	Add after "development aspirations of the society within which they take place": "and the needs and meaningful participation of indigenous, poor, and marginalized local communities."	Government of United States of America, U.S. Department of State
6036	2	28	3	1	Footnote 2: We suggest using the same text as in the WGI SPM footnote 4 (here some information is missing, in particular the fact that likelihood is also indicated in italics, not only confidence). All these qualifiers (for confidence and for likelihood) should also be typeset in italics in the footnote.	Government of Belgium, Belgian Science Policy Office - Belspo
	2		2		Footnote 2 : could the use of the probabilistic language when reporting ranges be also provided (WGI used square brackets for very likely ranges, for instance).	WGI Bureau,
2560	3	1	3	10	A reference to TS.1 could be added (see pages TS-3 line 28 to TS-4 line 4)	Government of France, Ministère de la Transition écologique et solidaire
13108	3	2	3	3	What is meant by "demand"? Demand of from who or what? If it is meant to talk to the demand by society, then it would correspond to the "social aspects" of mitigation as mentioned in line 3.	Government of Switzerland, Federal Office for the Environment FOEN
14334	3	4	3	4	Insert the following sentence after "... transfer {16}": "In comparison to AR5, AR6 involves a far greater use of social science perspectives and a much broader range of social science disciplines."	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12956	3	5	3	5	Perhaps clarify what near and medium term perspectives mean. Refer to the time periods or years, which define these and make it more clear for policy makers from the onset.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13370	3	5	3	5	It would be great for the authors to have the years for 'near-to medium-term perspectives' so that this is clear. Suggestion 'near (2020-2030), medium-term (2030-2050). This enhances clarity in time periods used for easy understanding by policymakers.	Government of Kenya, Kenya Meteorological Service
2562	3	9	3	9	Unable to find the box as indicated here. Furthermore, it seems that there is no "cross-WG box 1 in chapter 3". In the chapter 3, boxes are indicated such as: "Cross-Chapter Box" and within the Chapter 3, the only box is "Cross-Chapter Box 3" (see the table of contents)	Government of France, Ministère de la Transition écologique et solidaire
15622	3	9	3	9	Here the Cross-WG Box on Economic Benefits of Avoided Climate impacts is introduced, which is a great collaborative cross-discipline effort on a very important issue. We found that the Box itself falls short of the (quantitative) information needs on this issue, and furthermore that too little information is integrated in the SPM. Statements comparing the (economic) benefits of low-carbon- vs. carbon-intensive societies must also take the economic benefits of avoiding impacts into account, or make it clear in case such assessments did not do so. Such findings may have far-reaching consequences for decision making and should therefore be communicated with great care. Findings should also always be presented for 1.5°C.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
13110	3	11	3	11	"Bioeconomy": This term is not introduced, and most probably constitutes a new term for the policy maker reading this document. Either introduce or rephrase by avoiding this term all together.	Government of Switzerland, Federal Office for the Environment FOEN
12396	3	12	3	17	Not clear how "ethics" is explained and linked to drivers and barriers of Mitigation	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
2564	3	12	3	17	A reference to TS.1 could be added (see page TS-4 lines 3-8). Chapter 16 could also be referred to as in the Technical Summary	Government of France, Ministère de la Transition écologique et solidaire
13112	3	13	3	13	Omit "analytical frameworks": This combination of words does unnecessarily complicate the sentence by adding the concept "analytical framework" that could be easily omitted or replaced by a more accessible phrasing: "This report identifies multiple ways the literature assesses the drivers of, barriers to and options for, mitigation action."	Government of Switzerland, Federal Office for the Environment FOEN
6022	3	14	3	14	We welcome the identification of multiple analytic frameworks from the underlying literature to assess the drivers of, barriers to and options for mitigation action, including ethics. Despite being presented as a novel aspect by this report, the term "ethics" is not used again in the report. We would like to invite the authors to address this gap.	Government of Belgium, Belgian Science Policy Office - Belspo
11110	3	14	3	14	It is unclear how "efficiency" is interpreted in these contexts (also in other parts of the SPM). Perhaps it means effectiveness?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13114	3	14	3	14	What is meant by "economic and environmental efficiency"? While we could somewhat guess what ist meant by "economic efficiency" (cost saving, etc.) it is completely unclear what ist meant by environmental efficiency? Please rephrase.	Government of Switzerland, Federal Office for the Environment FOEN
3844	3	14	3	15	The term socio-technical may be explained in words within a bracket.	Government of Canada, Environment and Climate Change Canada
11112	3	14	3	17	Add "and governance structure; international cooperation." after "socio-political-institutional frameworks". Even if institutional frameworks can include governance structure in a broad sense, ch.13 deals with them in a separate manner.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14336	3	15	3	15	Strike "and" before, and add after "socio-political institutional frameworks": "indigenous and local knowledge"	Government of United States of America, U.S. Department of State
572	3	16	3	16	It is suggested to change "equitable transition" to "just transition" to ensure consistency with the statement of the underlying report.	Government of China, China Meteorological Administration
11114	3	16	3	16	Consider deleting "windows of" to read "risks and opportunities".	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2568	3	18	3	18	Gramatically incorrect: "assesses" suggests an affirmative phrase whereas "Where are we now and where are we headed" suggest a question (such as in the title of the Section B). If so change the verb "assess" and/or add a question mark.	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11116	3	18	3	18	Consider redrafting from 'assesses Where are we now and where are we headed' to 'assesses Where we are now and where we are headed;. Or include the title with '?'.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2566	3	18	3	24	Explanation for section titles are only given for Section C and E. A few words to outline B and D would give consistency to the paragraph.	Government of France, Ministère de la Transition écologique et solidaire
12958	3	18	3	24	Why was more or less the same headings not used as in SPM WGII and others, which would be more easily understood by policy makers than the current headings. For instance, for section B: Observed and Projected Impacts and Changes; Section D: Mitigation measures and enablers.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13116	3	18	3	24	Please assess if such a paragraph is still helping the reader? In fact, only few readers take merit from this descriptive way of introducing the contents of the document, as a table of context is more suitable as a visual guide. Also, the bullet points above should reflect and introduce the sections?	Government of Switzerland, Federal Office for the Environment FOEN
11118	3	20	3	21	"assesses specific mitigation options": it may sound too ambitious, as there are not many specific mitigation options assessed.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2570	3	21	3	21	General comment with regards to the term "mitigation options": To ensure the clarity and comprehension by a large audience, the authors should be more consistent throughout the SPM in their use of the terms 'options' (used 64 times – including 'response options' (9 times), 'mitigation options' (26 times)), 'measures' (12 times) and 'strategies' (3 times), 'mitigation actions' (7 times) which appear to be all used relatively interchangeably.  The SPM includes no evident justification for using interchangeable terms rather than one consistent term, or any clarification if differences exist between terms (and explanation of these differences), for instance between: 'demand-side measures' (1 time), 'demand-side options' (5 times), 'demand-side strategies' (2 times). This lack of consistency creates confusion for the lay reader on what the text exactly refers to each time	Government of France, Ministère de la Transition écologique et solidaire
12412	3	23	3	23	Replace "can deliver climate change mitigation" to "can contribute to climate change mitigation" or " can strengthen climate change mitigation"	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
62	4	0	15	0	The text in this section only specifies the sources of emissions of one gas i.e., CO2 and provides the other main GHG gases, i.e., CH4 and N2O individually without mentioning of sources of their emissions. The text should treat gases in a balanced manner reflecting IPCC's definition of all identified GHG gases. Required Action: addressing the IPCC 8 identified GHGs will provide more credibility for the numbers and the report.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
58	4	0	4	0	The text in footnote 4 only specifies the sources of emissions of one gas i.e., CO2 and provides the other main GHG gases, i.e., CH4 and N2O individually without mentioning of sources of their emissions. The text should treat gases in a balanced manner reflecting IPCC's definition of all identified GHG gases. Required Action: addressing the IPCC 8 identified GHGs will provide more credibility for the numbers and the report.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
60	4	0	4	0	The use of term " carbon budget" in footnote 6 needs to be clarified as "carbon equivalent" and stated as such. It is also important to use to cumulative GHG even prior to 1850 - 2021. the term "carbon" and "GHG" are used interchangeably and it's more clear to use the term "GHG" that includes all 8 emissions identified and agreed by IPCC as missing or incomplete data on one or more emissions sources will impacts the level of reported confidence and that need to be reflect throughout the report.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2596	4	0	4	0	Footnote 4: Fluorinated gases are not mentioned in the WG1 report, where CFC, HFC and HFC are labelled as "halogenated gases" (cf WG1 TS2.2). The sentence should be modified to be consistent with WG1, or this difference of vocabulary should be explained.	Government of France, Ministère de la Transition écologique et solidaire
2598	4	0	4	0	Footnote 4 : Please explain why CFC and HCFC, which are powerful GHG, are not considered here.	Government of France, Ministère de la Transition écologique et solidaire
2600	4	0	4	0	Footnote 5 : The notion of Global Warming Potential is introduced here and then used throughout the summary. However, it only mentions the time horizon dimension of the definition. In order to better understand it, in particular its usage in figure SPM1 (where emissions totals based on different GWP values are compared), it would be useful to introduce in slightly more details how it works, either here or in the description of figure SPM.1. We also strongly recommend to include a text message in the SPM for commenting the implications of the data shown in Panel b of Fig SPM1	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3392	4	0	4	0	Footnote 4 : consider to add "but are, with the emissions of aerosols and ozone precursors considered in the report."	Government of France, Ministère de la Transition écologique et solidaire
12398	4	1	4	1	We suggest the he subtitle be changes to " Current status and future projection of GHG Emission" to enhance clarity and synchronization with the underlying text	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
9386	4	1	10	24	There is no mentioning about aerosol emissions throughout the section B, although section C briefly touches upon aerosol in a qualitative manner. The balance between CH4 & aerosol emission reduction is one of the main messages from WG1 AR6. Showing some quantitative figures on aerosol emissions (maybe somewhere near or within B.1.2 or B.2.2) would help on this viewpoint from the perspective of inter-WG consistency.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
5110	4	1	4	1	Could the net in 'net anthropogenic GHG emissions' be defined?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6254	4	1	4	1	"where are we headed" is difficult to understand for non-native speakers. Please use another formulation, e.g. "what do the current pledges imply".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12414	4	1	4	1	The current subtitle does provide the readers with quick understanding about the contents. We suggest the title to be re-written to read " GHG emission Trends and Dynamics"	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
12960	4	1	4	1	Perhaps it would help to clarify to policy makers, which sections under B address the current and which address the future/projected impacts or changes.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
2602	4	1	4	4	Although this information is relevant and synthetic, there is a logical confusion in its wording, as the sentence is introduced with a focus on CO2 for fossil fuels and industry, and then lists as part of the drivers agriculture and land-use change, which is part of another category of CO2 emissions (LULUCF) in the categorization introduced in section B.1.Furthermore, some of the numbers outlined below could be reflected here.	Government of France, Ministère de la Transition écologique et solidaire
13708	4	1	7	23	The description of emissions from different sectors and sources would benefit from including the results presented in the IPCC special report on climate change and land. The land report has a representation of the global food system which includes agricultural emissions and land use change as well as outside farm gate emissions (A3.6 in the SPM of the land report). This is a useful concept to understand the drivers behind AFOLU emissions and to look at options for reducing emissions. A paragraph that includes this concept would be helpful.	Government of Norway, Norwegian Environment Agency
9888	4	2	4	10	The statement "highest absolute decadal increase" (II.8-9) seems at odds with the statements about the rate of growth that would be "lower" (I.4) and "have slowed" (II.9-10) from the previous period, illustrated by annual percentages of 1.3% versus 2.1%.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
6256	4	2	4	2	"Total global net anthropogenic GHG emissions have continued to rise": Please indicate the timeframe for this sentence to make it clearer.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6258	4	2	4	2	In footnote 4, last sentence, please replace "F-gas" by "Ozone-depleting substance (ODS)". Chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) are not termed F-gases. Besides fluorine, ODS also contain other halogens such as chlorine (CFCs and HCFCs) or bromine (halons) which are responsible for their ozone-depleting nature. The group of F-gases comprise all fluorinated gases, but not ODS.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6870	4	2	4	2	Could the footnote 4 explain why "F-gas emissions covered by the Montreal Protocol ... are not considered here"? This is also the case in the Figure SPM.1 caption.	Government of Jamaica, Meteorological Service Division
11120	4	2	4	2	The first sentence would benefit from an indication of the timeframe ("have continued to rise" since when?)	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11122	4	2	4	2	Footnote no 4 - If anthropogenic GHG emissions from marine ecosystems are not included, it would be good to mention that as well.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11124	4	2	4	2	Footnote 4: It would be helpful to provide some rationale for not considering Montreal CFCs and HCFCs - with the collective forcing quite substantial (0.338 Wm <sup>-2</sup> in 2019; Annex 2, wg1).	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12968	4	2	4	2	History did not start in 2019 or 2010. WGIII needs to clearly acknowledge historical emissions. WGI re-stated the near-linear relationship between historical CO <sub>2</sub> emissions and global warming – and reported that we are already at 1.1 °C DUE TO HISTORICAL EMISSIONS. Apart from avoiding responsibility politically, it would be UNSCIENTIFIC to focus only on future emissions, or emissions from the very recent past.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13124	4	2	4	2	"have continued to rise": for this phrase we need a starting and end point and a delta, i.e. the change over time	Government of Switzerland, Federal Office for the Environment FOEN
13710	4	2	4	2	In footnote 4, Please clarify if GHG emissions refer to anthropogenic emissions. Further it is stated that CO <sub>2</sub> -LULUCF is defined as NET CO <sub>2</sub> emissions from land use, land use change and forestry. We suggest to add anthropogenic in front of NET. Please also make sure that CO <sub>2</sub> -LULUCF refer to net anthropogenic CO <sub>2</sub> emissions throughout the SPM.	Government of Norway, Norwegian Environment Agency
3846	4	2	4	5	Since the global temperature is mainly concerned with the cumulative emissions and underlying global carbon budget, the emphasis in heading B1 should be given to Emissions level rather than the growth. It is evident that high emissions with relatively low growth can still be high in an absolute term.	Government of Canada, Environment and Climate Change Canada
14340	4	2	4	5	It is necessary to define terms and use consistent terminology. There are issues in several dimensions in this section. First, the use of the term "net" in B.1 does not persist in the other B subsections. Why not? Is "net" necessary? Second, the associated footnote (#4) does not specifically define what is meant by "total global net anthropogenic GHG emissions." Regarding "... have continued to rise", over what time frame is the reader supposed to interpret this statement, and are "total global net anthropogenic GHG emissions" cumulative or average annual or something else? It would be more correct if it read "Average annual GHG ..." Again, does the word "net" need to be here? It appears in B.1.1 where this summary statement is expanded upon.	Government of United States of America, U.S. Department of State
14338	4	2	5	2	Narrative states that average GHG emissions during 2010-2019 were higher than in any previous decade, but Figure SPM.1 only shows emissions from 1990. Figure would be more helpful for policymakers if it showed trends since 1900.	Government of United States of America, U.S. Department of State
1204	4	3	4	3	It is stated that the growth rate of emissions has been lower over the last decade, compared to the decade before. This would seem to clash with the line 9 (and 10), where the last decade is attributed the highest absolute decadal increase (relative rates of increase vs. absolute increase?). A clarification either in the B.1 or the B.1.1 would be useful.	Government of Sweden, Swedish Meteorological and Hydrological Institute
12962	4	3	4	3	2010-2019 is not 10 years and therefore not comparable to a decade.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
12964	4	3	4	3	"rate of growth"... what growth is referred to and at what level? Is it global economic growth?	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13126	4	3	4	4	"but the rate of growth between 2010 and 2019 was lower than that between 2000 and 2009.": Assess if this message you are putting in the lead paragraph, is the one you want to highlight from the literature? When reading the sentence, I understand the growth is slowing down (what percentage?), and with that everything one could judge that we are on the right path and the job is done?	Government of Switzerland, Federal Office for the Environment FOEN
14342	4	3	4	4	The last clause in boldface seems to get more space than it should given the supporting text below. The fact that the 2010-19 growth rate was lower is secondary; what really matters is that not only are GHGs increasing in the atmosphere, but more are emitted each year than the previous. It is also very challenging for a reader not already well-versed in this science to grasp that reducing the rate of growth does not mean producing less emissions from year to year. This sentence gives more weight than the supporting text merits and is also easily misinterpreted.	Government of United States of America, U.S. Department of State
2572	4	4	4	5	A reference to TS.2 could be added (see for example page TS-8 lines 7-8)	Government of France, Ministère de la Transition écologique et solidaire
2574	4	5	4	5	Isn't it rather Cross-Chapter Box 2 GHG emission metrics in chapter 2 ? CCB1 is about Covid-19 crisis	Government of France, Ministère de la Transition écologique et solidaire
2212	4	6	4	6	Here in the text or in the associated footnote, suggest including that 'net' anthropogenic emissions only refers to LULUCF. This would make the text here consistent with the Figure SPM.1 caption which notes 'CO <sub>2</sub> -LULUCF emissions include gross removals as well as emissions'. This would provide clarity on the distinction between estimated LULUCF emissions and other GHG emissions.	Government of Australia, Department of Industry, Science, Energy and Resources



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5112	4	6	4	10	"Global net anthropogenic GHG emissions were 59±6.6 GtCO <sub>2</sub> -eq <sub>5</sub> in 2019". Can text be added to state why this differs from the 54 Gt figure in section B.6.1 and the 56 Gt value implied by figures implied by the percentage reductions and 2030 values in the underlying chapter (rows 1-14, page 43 in chapter 3)?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6262	4	6	4	10	Please consider stating the global net anthropogenic GHG emissions for the year 2000 (around 42 Gt according to Figure SPM.1). This would complete the data given in this paragraph for the decades 2000-2009 and 2010-2019.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12966	4	6	4	10	Percentage and absolute values are not use consistently. This could be confusing.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13128	4	6	4	10	This paragraph does have a lot of numbers to digest in a SPM. Assess which numbers can be omitted? Also in terms of how to present the numbers and percentages, always use the same set-up: that is the % first and the GtCO <sub>2</sub> -eq in brackets, be consistent.	Government of Switzerland, Federal Office for the Environment FOEN
12474	4	6	4	18	Shift Section B.1.3 to the beginning and renumber as B.1.1 Reason: Cumulative emissions thus far are the most significant constraint in determining our current options vis a vis Climate Change Mitigation, and must be given primary importance over the current emissions.	Government of India, Ministry of Environment, Forests and Climate Change
68	4	6	4	6	It is important to include a statement on the limitations and uncertainties of the GHG metrics to explained the ranges given in the emissions versus exact numbers. The text in footnote 5 "All GHG emission metrics have limitations and uncertainties, given that they simplify the complexity of the physical climate system and its response to past and future GHG emissions.". This statement must be added to the SPM as to ensure a balanced and inclusive report	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2604	4	6	4	6	"energy sector" should be replaced by "energy production" or "energy supply" (as in lines 3 and 12) to avoid any confusion with energy-using sectors such as transport and buildings	Government of France, Ministère de la Transition écologique et solidaire
6260	4	6	4	6	Please include a footnote explaining the uncertainty range. Is the 6.6 GtCO <sub>2</sub> -eq range one standard deviation (on sigma) or two sigma or something else?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13506	4	6	4	6	Footnote 5 could start with an additional sentence to explain what CO <sub>2</sub> eq/metrics are and do in general. This might not be clear for someone unfamiliar with the application of GWPs.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13712	4	6	4	6	Please consider making a hyperlink in footnote 5 to Chp. 7 supplement material of the WGI report for GWP 100 values in order to facilitate transparency and conversion of emissions of individual gases.	Government of Norway, Norwegian Environment Agency
14344	4	7	4	8	The first sentence of this paragraph, in lines 6 and 7, states that values and percentages presented are specific to anthropogenic GHG emissions, but this sentence does not include that qualifier. Is this a different metric or should anthropogenic be included as a qualifier in this sentence too?	Government of United States of America, U.S. Department of State
2606	4	8	4	10	It would be helpful to provide also (or instead) information including indirect emissions from cement and steel production - for example, including these would increase the figure for buildings from 17% to 21%. It would also be good to confirm whether these figures also include emissions of HFCs (cf. FAQ 9.1 page 97 of chapter 9).	Government of France, Ministère de la Transition écologique et solidaire
574	4	8	4	8	The expression of "56±6.0 GtCO <sub>2</sub> " is inconsistent with "56 GtCO <sub>2</sub> " in the underlying report. It is suggested to ensure consistency with the statement of the underlying report.	Government of China, China Meteorological Administration
6264	4	8	4	8	Please be consistent with table 2.1: text: ... during the decade 2010–2019 were 56±6.0 GtCO <sub>2</sub> -eq, 9.1 GtCO <sub>2</sub> -eq higher than in 2000-2009 ...; table 2.1: 2010-2019: 56, 2000-2009: 47 -> difference = 9 GtCO <sub>2</sub> -eq.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2576	4	8	4	9	"9.1 GtCO <sub>2</sub> -eq higher than in 2000-2009" might have more impact if presented as a percentage increase from 2000-2009.	Government of France, Ministère de la Transition écologique et solidaire
13130	4	8	4	9	"This is the highest absolute decadal increase since 1850": This is a key finding that needs to be put in the lead paragraph.	Government of Switzerland, Federal Office for the Environment FOEN
10288	4	9	4	10	Please specify whether the referred average annual GHG emissions are gross or net.	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13132	4	9	4	10	"The average annual GHG emissions growth rate slowed from 2.1% between 2000 and 2009 to 1.3% between 2010 and 2019.". This sentence speaks to the growth rate that is addressed in B.1.2.. --> Move it there. Following the idea that a paragraph has one single idea/threat to present. SEE ALSO general comments to that end.	Government of Switzerland, Federal Office for the Environment FOEN
14346	4	9	4	9	Change "since 1850" to "in the period of analysis since 1850", or something similar. The current construction could be read that the absolute level was higher in or before 1850.	Government of United States of America, U.S. Department of State
2578	4	10	4	10	Please specify if the percentage "2.1%" and "1.3%" given is "per year"	Government of France, Ministère de la Transition écologique et solidaire
2580	4	10	4	10	A reference to TS.3 could be added (see page TS-12 lines 2-8)	Government of France, Ministère de la Transition écologique et solidaire
5114	4	10	4	10	It would be helpful to add one sentence with a high level explanation for why growth in emissions slowed from 2010-2019.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
52	4	11	4	11	B.1.2: The statement "Emissions growth has persisted across all GHGs since 1990." fails to provide a rationale for selecting 1990 as a reference time point. Using different years as a base of comparison for changes in GHG tends to bring more confusions than clarification/understanding of the case in question.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
54	4	11	4	11	B.1.2: Presented changes in GHG during different segments are done in isolation of associated economic growth presentations and lifecycle analysis. For clarity, it is recommended to use pre-industrial period 1850 as the base for comparison in association with economic growth, changes in lifestyle and lifecycle-based emissions analysis.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
576	4	11	4	11	The statement is inconsistent with that in the underlying report. The expression from lines 13-17, Chapter 2 of the underlying report is "Compared to 1990" rather than "since 1990". It is suggested to change "since 1990" to "Compared to 1990" to ensure consistency.	Government of China, China Meteorological Administration
2214	4	11	4	11	Suggest clarifying whether "varying" refers to variation though time, or across the different GHGs. If the former, suggest rewording as '... varying rates through time'. If the latter, replace varying with 'different'.	Government of Australia, Department of Industry, Science, Energy and Resources
5116	4	11	4	11	Has emissions growth persisted in all GHGs? I thought some HFCs had decreased - perhaps, though, if considered as a group, F-gases as a whole have increased. If so, perhaps worth saying 'F-gases, when considered as a group rather than individual warming species....', or - to make it clearer that (as the footnote states) Montreal Protocol species aren't included here, to amend main text to say 'Emissions growth has persisted across all GHGs covered by the UNFCCC Paris Agreement...'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13608	4	11	4	11	why reference point 1990 and not 1850?	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
50	4	11	4	13	B.1.2: The statement "Emissions growth has persisted across all GHGs since 1990, albeit at varying rates. The largest growth in absolute emissions occurred in CO2 followed by CH4, whereas highest growth rates occurred in F-gases" Required action: include rates based on GWP to allow policy makers to view the increases both in absolute terms and their associated GWPs.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2216	4	11	4	13	All major GHGs are included in this paragraph except for N2O. Suggest adding a short description of the trend in N2O for completeness.	Government of Australia, Department of Industry, Science, Energy and Resources
9768	4	11	4	13	Add: CO2 has remained the most important GHG (75% in 2019), followed by methane (18%) and N2O (4%).	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
14348	4	11	4	13	This finding would be more valuable if linked to sectors and actions.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
	4	11	4	11	The statement "emissions growth has persisted across all GHG" is not correct when looking at each GHG, for instance for some ozone depleting substance (eg CFC11-12 etc). The classification in figure SPM1 seems different from the classification used in the WGI report where "halogenated gases" are pooled while here only emissions of the subset of F-gases are displayed (thus without CFCs and HCFCs). How are emissions of ozone depleting substances accounted for in section B and figure SPM1?	WGI Bureau,
2422	4	12	4	13	Would it be possible to have further explanation of the growth in F-gas emissions? Could this be linked to the replacing of ozone depleting substances (Montreal Protocol regulation) with other f-gases? Figure SPM.1 states that the f-gases in here does not include CFC/HCFC. Could the increase therefore be related to the substitution of CFCs etc?	Government of Denmark, Danish Meteorological Institute
9388	4	12	4	13	"...whereas highest growth rates...": Does this sentence not depend on the fact that some of the important F-gasses are excluded as mentioned in Footnote 4?	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12526	4	12	4	13	Delete "whereas highest growth rates occurred in F-gases, starting from low levels in 1990" Reason: It is unclear to policymakers relative to other more familiar gases such as nitrous oxide etc.	Government of India, Ministry of Environment, Forests and Climate Change
2582	4	13	4	13	A reference to TS.3 could be added (see page TS-12 lines 9-20 and Fig. TS.2 page TS-13)	Government of France, Ministère de la Transition écologique et solidaire
3848	4	13	4	13	This seems to be the first mention of "F-gases" - this term should be defined.	Government of Canada, Environment and Climate Change Canada
5118	4	13	4	13	Suggest expanding "F-gases" fully as it is the only time it is used in the text (all other uses are in figures and their captions).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6266	4	13	4	13	The term F-gases is explained only in the footnote 4. We believe it would be useful to add this abbreviated term to the Greenhouse Gases (GHGs) definition in the glossary allowing the reader to find its meaning more easily. In addition, please clarify that not all F-gases are considered in this report by inserting "covered in this report" as explained in footnote 4. Please see also our comment on footnote 4 requesting to replace "F-gases" by "O3-depleting substances".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14350	4	13	4	13	The reference here to F-gases is unclear, since HFCs are covered by the Montreal Protocol but are listed in Footnote 4 as being included in the information in the WGIII report. Add "Other" before "F-gas emissions" in the second to last line of Footnote 4, since HFCs are covered by the Montreal Protocol. Add "covered herein", assuming that the F-gases referred to in line 13 are only the three categories noted. Since WGI AR6 covers all greenhouse gases, including those under the Montreal Protocol, it can be confusing that WGIII should not cover those under the Montreal Protocol, yet still include HFCs. While the reasons are understandable to many who understand the context, different choices about scope would lead to different findings.	Government of United States of America, U.S. Department of State
1206	4	14	4	14	How does the 2400 compare with the 2390 quoted in WGI report (e.g. Table SPM.2)? If the reference is the same, using the precision would improve comparability.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
3850	4	14	4	14	While presumably the estimate of historical cumulative CO2 emissions has simply been rounded up to 2400 GtCO2 from the value of 2390 Gt CO2 reported in the WGI SPM, consistency across WG SPMs is preferred. Or at a minimum, a footnote should clarify this.	Government of Canada, Environment and Climate Change Canada
5120	4	14	4	14	WG1 SPM quote 2390 + 240 CO2 emissions to 2019. Is this a real difference or just a different quoted precision? Can these be reconciled?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6872	4	14	4	14	How do the cumulative CO2 emissions given here compare to the values reported in the WGI SPM? This should be clarified in a footnote and differences between the WGI and the WGIII findings explained.	Government of Jamaica, Meteorological Service Division
9390	4	14	4	14	The rounded number of 2400 for the 1850-2019 cumulative CO2 emissions in GtCO2 is different from 2390 in WGI AR6. This difference should be noted briefly or the numbers should be consistent with WGI AR6.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
14352	4	14	4	14	State whether these CO2 emissions estimates are gross (and inclusive of all natural and anthropogenic sources), or net. And, if net, of which sinks.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
578	4	14	4	15	The confidence is inconsistent with that in the underlying report (high confidence) and the data inconsistent with that (cumulative CO2 emissions from 1850 to 2019 were 2390±240 GtCO2) in SPM of WGI Contribution (line 1, page 38). It is suggested to make verification and ensure consistency.	Government of China, China Meteorological Administration
3852	4	14	4	15	Although it is stated on line 14 that the cumulative period is 1850-2019, it might be clearer to include the end year (2019) in the other shorter periods, especially for 2010-2019, which is currently worded only as "since 2010" to emphasize that 2020-present is not included.	Government of Canada, Environment and Climate Change Canada
6038	4	14	4	15	The list of numbers is hard to read. We would like to suggest keeping only the absolute value (with uncertainty range) for the full period and providing the others (1500, 1000, and 410) as percentages.	Government of Belgium, Belgian Science Policy Office - Belspo
9392	4	14	4	15	It would be more intuitive and easier to understand to replace this part with the expression in line 3-5, page 2-23 "More than half (62%) of total emissions from 1850 to 2019 occurred since 1970 (1500±140 GtCO2), about 42% since 1990 (1000±90 GtCO2) and about 17% since 2010 (410±30 GtCO2)"	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
3854	4	14	4	17	For readability and improved communication of the message of these lines, we recommend including also the % of the total for the cumulative emissions from the different dates, as in Ch. 2 ES; that is, 62% of total CO2 emissions have been emitted since 1970, about 42% since 1990 and about 17% since 2010.	Government of Canada, Environment and Climate Change Canada
3856	4	14	4	17	We could not trace the medium confidence assessment for these conclusions to Ch. 2.2. Moreover, since there is high confidence in the overall assessment of historical cumulative CO2 emissions (Ch 2.2) and WGI did not provide a confidence level for the remaining carbon budgets for achieving specified GW levels for different likelihoods, we are puzzled about the source of the confidence level here.	Government of Canada, Environment and Climate Change Canada
13508	4	14	4	17	Could the authors provide explanations on how the cumulative CO2 emissions and carbon budget given here compare to the respective findings in the WGI report? It appears to be very similar but not identical and it would be helpful if for example a footnote could explain this further.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
2218	4	14	4	18	Suggest clarifying the wording with respect to the proportions of emissions for limiting warming to 1.5 or 2.0 degrees. The use of percentages rather than fractions may be clearer here.	Government of Australia, Department of Industry, Science, Energy and Resources
6268	4	14	4	18	It is proposed to include in para B.1.3 the following sentence (Executive Summary Chapter 2 (page 2-4; line 31-32)): "Cumulative net CO2 emissions of the last decade (2010-2019) are about the same size as the remaining carbon budget for keeping warming to 1.5°C (medium confidence)." This is a clear message for policy makers describing the actual situation.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11892	4	14	4	18	B.1.3: The statement on cumulative CO2 emissions of 2400 GtCO2 is almost the same as the carbon budget numbers in WGI SPM Table SPM.1, which states 2390 GtCO2. Could the authors ensure that information is added, e.g. in a footnote, to explain why it is not exactly the same, i.e. due to categorisation effects if that is the case (but that these near-identical numbers across WGs actually represent a remarkable level of consistency, as indicated in the Box 3.4)? This also holds for the other statements in this bullet, as 1/5 of 2400 Gt amount to 480 Gt which is similar but not exactly the same as the 500 Gt carbon budget in the WGI SPM, and as 1/3 of 2400 Gt which is 800 Gt is not directly comparable to WGI Table SPM.1 carbon budget values. It is our understanding that the WGI values would have been mostly based on concentration-driven model setups; the WGIII values are derived with emissions-driven model setups. This should also be made transparent here with regards to the different estimates. Relevant information from Chapter 3 Box 3.4 on the consistency of carbon budgets in WGI and cumulative CO2 emissions in WGIII could be elevated to the SPM. Also, could absolute values be given here instead of or in addition to fractions?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12472	4	14	4	18	Revise headline statement as following: "Cumulative CO2 emissions from 1850 to 2019 were 2400±240 GtCO2 and amount to approximately four-fifths of the total carbon budget about as likely as not to limit warming to 1.5°C and about two-thirds of the budget likely to limit warming to 2°C (medium confidence). Global net anthropogenic GHG emissions have continued to rise. Average annual GHG emissions during 2010–2019 were higher than in any previous decade, but the rate of growth between 2010 and 2019 was lower than that between 2000 and 2009." Reason: The result on cumulative emissions is very important. It is part of section B.1 and should be included in the headline statement as this is the important determinant of maximum temperature rise and as such more important than annual emissions.	Government of India, Ministry of Environment, Forests and Climate Change
13134	4	14	4	18	As in B1.1 use the same set-up of presenting the numbers, that is the % first and the GtCO2-eq in brackets, be consistent. The percentage points are missing here entirely.	Government of Switzerland, Federal Office for the Environment FOEN

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14354	4	14	4	18	Is this CO2 only or CO2eq emissions (e.g., net across all gases and processes?)	Government of United States of America, U.S. Department of State
2584	4	15	4	17	This sentence is unclear and quite challenging to understand. It might be divided into two to give the reader some space.	Government of France, Ministère de la Transition écologique et solidaire
6874	4	15	4	17	How does the budget likely to limit warming to 2°C relate to the Paris Agreement temperature goal and is the budget given here consistent with achieving this goal?	Government of Jamaica, Meteorological Service Division
14356	4	15	4	17	The sentence "Cumulative CO2 emissions since 1850 ..." is confusing and appears to perhaps be missing some key words.	Government of United States of America, U.S. Department of State
580	4	15	4	18	The content "Cumulative CO2 emissions since 1850 ... to 2 ..." and confidence are not consistent with the underlying report. The underlying report (lines 3-9, page 23, Chapter 2) states "with a 67% (50%, 33%) probability", but there is no probability given in the SPM. And "four-fifths" and "two-thirds" are also inconsistent with the underlying report. Also, the statements in Chapter 2 (in lines 47-48, page 83, and in lines 1-7, page 84) of the underlying report are inconsistent with those here. It is suggested to make verification and ensure consistency.	Government of China, China Meteorological Administration
2424	4	15	4	18	This sentence might be moved to B.1	Government of Denmark, Danish Meteorological Institute
6270	4	15	4	18	These fractions of the budgets are not helpful for policymakers without providing the absolute numbers of remaining CO2 budgets which is however only done later in the text in Table SPM.1. We, therefore, suggest to add the absolute numbers (e.g. 510 (330–710) GtCO2 for 1.5°C) in brackets. In addition, it is proposed to include in para B.1.3 the following sentence (Executive Summary Chapter 2 (page 2-4; line 31-32)): "Cumulative net CO2 emissions of the last decade (2010-2019) are about the same size as the remaining carbon budget for keeping warming to 1.5°C (medium confidence)." This is a clear message for policy makers describing the actual situation.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13434	4	15	4	18	B1.3 second sentence. It is not clear what this sentence tries to say. It seems that there might be an important message behind it, but it is not possible to understand it.	Government of Estonia, Estonian Meteorological & Hydrological Institute
14358	4	15	4	18	The sentence beginning "Cumulative CO2 emissions since 1850 ..." will be extremely confusing and awkward for any reader who has not already been exposed to the language being used to describe future warming scenarios. The reader may not have previous experience with phrases such as "about as likely as not". Footnote 6 does not explain the uncertainty level. If B.1.3 is to remain in the SPM, expand the footnote.	Government of United States of America, U.S. Department of State
13420	4	16	4	17	The confidence statement "about as likely as not to" is not very clear, consider using clearer language especially for policy makers. Or qualify it in the glossary	Government of Kenya, Kenya Meteorological Service
2042	4	16			to avoid non-native speakers, let me suggest to change some words. (present) "likely as not to" (change) "very likely or very probably"	Government of Republic of Korea, Korea Meteorological Administration
2586	4	16	4	17	We suggest to add "to" before 1.5°C	Government of France, Ministère de la Transition écologique et solidaire
14360	4	16	4	17	Be clear whether "limit warming to 1.5°C" means not ever to exceed 1.5°C or whether, in other contexts, it means overshooting 1.5°C and returning to it at a later date. The rhetoric and political statements about this often mean "overshoot and return", which is not literally what "limiting" warming or "holding a temperature increase to" means. A technical report should be extremely clear, and this is the first and best place to clarify. Analyses used in SR1.5 may have taken liberties with the concept, but the confusion created among policymakers and the public should be addressed. For example, instead of "to limit warming to", the sentence could read as "for warming to exceed then return temperatures to 1.5°C ..." The parallel adjustment should be made with reference to the 2°C statement.	Government of United States of America, U.S. Department of State
11126	4	16	4	18	the sentence is formulated in a confusing way. Is the "about as likely or not" referring to the total carbon budget or the 4/5 of the total carbon budget? Likewise the next sentence. Consider clarifying (e.g., by inserting "that is" before "about") or intergrating the statement with a discussion on total carbon budget and temperature goals.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2588	4	17	4	17	It is suggested to clarify at the beginning of section B the definition of "warming" in accordance with WG1	Government of France, Ministère de la Transition écologique et solidaire
9394	4	17	4	17	In footnote 6, it is good to add that the starting years of 1850 and 2020 are consistent with WG1 approach.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9890	4	17	4	17	Add that 1.5 and 2C temperature targets are from pre-industrial (1850-1900?)	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11128	4	17	4	17	Here it would be of great interest to also know how much of the cumulative budget has been used up if we are to likely (>66%) limit warming to 1.5 degrees.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11894	4	17	4	17	B.1.3: In line with our overarching comment regarding the Paris Agreement-compatibility of information provided, including the budget "likely to limit warming to 2°C" lacks context. This is not a budget that is consistent with the PA's long-term temperature goal.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
14362	4	17	4	17	Missing the word "to" after "warming" and before "1.5°C"	Government of United States of America, U.S. Department of State
2590	4	18	4	18	A reference to TS.3 could be added (see page TS-16 lines 10_15)	Government of France, Ministère de la Transition écologique et solidaire
830	4	19	4	19	The range from 5.1 to 6.3% is inconsistent with respective AR6 WG1 statement: 7% (Sect. 5.2.1.1 in AR6 WG1). Unfortunately, the AR6 WG1 literature in this topic is ignored in AR6 WGIII assessment	Government of Russian Federation, Institute of Global Climate and Ecology
1208	4	19	4	19	The meaning of the range is not clear. (On page 2, line 4, ranges in (-)brackets are mentioned to indicate confidence levels, but not which level of confidence. A clarification would be useful.	Government of Sweden, Swedish Meteorological and Hydrological Institute
2592	4	19	4	19	The difference between fossil fuels and industry is not straightforward for the reader since industry obviously uses fossil fuels. A definition should be given (cf footnote 5 in chapter 2, which explains that "industrial processes relate to CO2 releases from fossil fuel oxidation and carbonate decomposition"). Please also note that in chapter 5 from WG1 (Fig.5.5) anthropogenic CO2 emissions are divided between fossil fuels and "others", where "others" represent "flaring and emissions from carbonates during cement manufacture". Definitions between WG1 and WGIII should be consistent.	Government of France, Ministère de la Transition écologique et solidaire
2220	4	19	4	20	This is the first use of a range enclosed in parentheses. Suggest clarifying whether this refers to a percentile of total range, and whether this is consistent throughout the SPM.	Government of Australia, Department of Industry, Science, Energy and Resources
48	4	19	4	21	Authors should provide other gases from other sectors such as livestock, agriculture, and landfill. In addition, the use of industry implied emissions from energy generation from alternative energy and associated goods, such as spare parts and materials used for renewable/alternative energy, should be included as lifecycle assessment.	Government of Saudi Arabia, Sustainability Advisor to the Ministry of Petroleum and Mineral Resources
56	4	19	4	21	B.1.4: Provide substantive and clear rationale for singling CO2 here; also clarify the reference in the second sentence: is it all GHGs emissions that rebounded? A more prudent approach is to focus on all GHG emissions irrespective of their sources. If no clear rationale is offered, the resolution is to delete B.1.4.	Government of Saudi Arabia, Sustainability Advisor to the Ministry of Petroleum and Mineral Resources
64	4	19	4	21	The text presented in B.1.4 demonstrates the rise and decline of emissions from CO2 from fossil fuels and industry, due to the COVID-19 pandemic. The text should be emitted because it singles out CO2 only from the fossil fuels and industry. As such, the text does not reflect a balanced view of all IPCC identified GHGs, and doesn't reflect the PA which discusses emission not sources.	Government of Saudi Arabia, Sustainability Advisor to the Ministry of Petroleum and Mineral Resources
66	4	19	4	21	Covid-19 is not part of the terms of reference for this report and it is too early to provide a credible assessment of the impacts of the pandemic based on the current state of the literature. If this statement is included, a clarification on the lack of literature on the complete impact of the pandemic needs to be included as well.	Government of Saudi Arabia, Sustainability Advisor to the Ministry of Petroleum and Mineral Resources
582	4	19	4	21	The confidence level is not consistent with the underlying report. There is no statement of high confidence in the underlying report (from line 22, page 21 to line 13, page 22, Chapter 2, and in lines 19-35, page 18, Chapter 1). It is suggested to make verification and ensure consistency.	Government of China, China Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3858	4	19	4	21	The 5.8% drop in emissions was primarily due to reductions during January-June 2020 period when lockdowns were most intense. Should rephrase as "Emissions of CO2 from fossil fuels and industry dropped temporarily in the first half of 2020 but rebounded by the end of the year. The net change for 2020 was about a 5.8% (5.1-6.3%) or about 2.2 (1.9-2.4) GtCO2 reduction of emissions relative to 2019 due to the COVID-19 pandemic."	Government of Canada, Environment and Climate Change Canada
5122	4	19	4	21	In Chapter 1 (cross chapter box 1 - line 2-4 page 20) the investment in response to COVID is reportedly higher for fossil fuels (40%) than for low-carbon energy (37%). This is very relevant here where discussion of the rebound in emissions is mentioned.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5124	4	19	4	21	It would be more informative if this paragraph specified whether emissions rebounded partially or completely by the end of 2020.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5126	4	19	4	21	For better comparison with the rest of this paragraph, it would be better to express the covid-related drop in emissions as a percentage of total global GHG emissions, not just as a percentage of emissions from fossil fuels and industry	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5132	4	19	4	21	The paragraph states that CO2 emissions from fossil fuels dropped during the COVID-19 pandemic, is there any indication of whether emissions also dropped in the AFOLU/LULUCF sectors?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6272	4	19	4	21	According to Chapter 2 (page 2-4, lines 27-30), the level of confidence "high confidence" refers to the statement regarding a steep drop in CO2 emissions from fossil fuel and industry, whereas "medium confidence" is indicated for the statement on emissions having rebounded by the end of 2020. Please verify and ensure consistency.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6274	4	19	4	21	How about emissions from transport? Mobility dropped significantly, it would be interesting to get the information as well.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13140	4	19	4	21	With the approach of using one idea/threat (SEE ALSO general comments), B.1.4 could also be merged with B.1.1 as it speaks to global net GHG emissions, that is the same entity.	Government of Switzerland, Federal Office for the Environment FOEN
14364	4	19	4	21	This paragraph needs to be clarified because, as currently written, it includes some conflicting details. The described decline in GHG emissions in 2020 compared to 2019, due to COVID, of 5.8% is listed as temporary and the following sentence states that emissions rebounded by the end of 2020. This should be reworded to state that COVID led to a reduction in GHG emissions and that, even though emissions rebounded by the end of the year to pre-pandemic levels, the overall impact was a reduction of 5.8% compared to 2019. As currently written, this could be interpreted as a sharp, short-term reduction at one point in time during 2020, not cumulatively across the full year.	Government of United States of America, U.S. Department of State
3860	4	20	4	20	Suggest changing "due to" to "during", with the acknowledgement that some sectors might have had higher emissions during the pandemic and that not all areas experienced a decrease in emissions.	Government of Canada, Environment and Climate Change Canada
5128	4	20	4	20	'emissions rebounded' is imprecise language here. Could be replaced with 'global average emissions rates increased from the minimum values earlier in 2020 to higher levels by the end of the year'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6276	4	20	4	20	Please substitute 1.9 by 1.8 (GtCO2) as it is given in chapter 1 (page 1-18; line 20) or revise accordingly.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13138	4	20	4	20	Emissions "rebounded": Here we need a quantification. Are we talking a full rebound that is to levels as to before the pandemic (starting point)?	Government of Switzerland, Federal Office for the Environment FOEN
2222	4	20	4	21	The SPM states that emissions in 2020 were down but were rebounding at the end of 2020. This may be confusing to policymakers trying to reconcile the two statements. Suggest that a quantification of how much global emissions have rebounded at the end of 2020 be added to differentiate between this sentence and the previous sentence.	Government of Australia, Department of Industry, Science, Energy and Resources
5130	4	20	4	21	The sentence starting with 'Emissions rebounded' suggests we are back to a pre-pandemic normal. The 2020 (and now 2021) rebound in emissions is probably still below 2019 levels, and there are continued major perturbations. The sentence could be expanded a little to mention that global emissions were still below 2019 levels and there are still major perturbations, particularly in the transport sector.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5134	4	20	4	21	To what extent did emissions rebound in 2020 after dropping due to the pandemic, did they rebound to pre-pandemic levels, or more/less than?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6876	4	20	4	21	"emissions rebounded" after COVID: please specify statement, e.g., "to xyz levels", or add a number for the absolute level!	Government of Jamaica, Meteorological Service Division
13038	4	20	4	21	B.1.4: please quantify "emissions rebounded" after COVID for clarity.	Government of Gambia, Department of Water Resources
13610	4	20	4	21	what was that rebound like? Any figures to highlight here?	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
2594	4	21	4	21	A reference to Box TS.1 could be added (see page TS-14 line 19 to page TS-16 line 8)	Government of France, Ministère de la Transition écologique et solidaire
13436	4	21	4	22	B1.4 second sentence. What does it mean? Did the emissions go back to the 2019 levels? Please be precise.	Government of Estonia, Estonian Meteorological & Hydrological Institute
13714	4	22	4	22	In the end of footnote 4, please consider to shortly explain why the gasses covered by the Montreal Protocol are not considered here, and if "here" means in the para or in the report as a whole.	Government of Norway, Norwegian Environment Agency
13716	4	22	4	22	These footnotes (4, 5 and 6) provide useful information, please keep. However, footnote 6 should in our view be moved from line 17 to line 16 in conjunction with "total carbon budget". In addition to footnote 6, it is not entirely clear if the endpoint of carbon budget calculations are when net-zero CO2 or GHG is reached, or if endpoints are with respect to a specific time period (e.g. end of century).	Government of Norway, Norwegian Environment Agency
3862	4	23	4	23	In Footnote 4, it states that F-gas emissions covered by the Montreal Protocol are not included. This wording is correct pertaining to the original Montreal Protocol; however, the 2016 Kigali Amendment to the Montreal Protocol does cover HFCs.	Government of Canada, Environment and Climate Change Canada
7014	4		4		Comment on footnote 5: Please, include agreed language from the SPM Working Group I contribution to the AR6 in the end of the current footnote 5. The text should be read as following:  "Aggregated GHG emissions in this report are stated using the Global Warming Potential with a time horizon of 100 years (GWP100) with values based on the contribution of Working Group I to the AR6. All GHG emission metrics have limitations and uncertainties, given that they simplify the complexity of the physical climate system and its response to past and future GHG emissions. {Box TS.2, Cross-Chapter Box 2 in Chapter 2}. The choice of emissions metric depends on the purposes for which gases or forcing agents are being compared. The Working Group I contribution to the AR6 contains updated emissions metric values and assesses new approaches to aggregating gases".	Government of Brazil, Ministry of Foreign Affairs
7016	4		4		Please, change the language contained in footnote 6 by the agreed definition of carbon budget from the SPM Working Group I contribution to the AR6 (footnote 43). The text should be read as following:  "The carbon budget is the maximum amount of cumulative net global anthropogenic CO2 emissions that would result in limiting global warming to a given level with a given probability, taking into account the effect of other anthropogenic climate forcings. This is referred to as the total carbon budget when expressed starting from the pre-industrial period, and as the remaining carbon budget when expressed from a recent specified date (Glossary). Historical cumulative CO2 emissions determine to a large degree warming to date, while future emissions cause future additional warming. The remaining carbon budget indicates how much CO2 could still be emitted while keeping warming below a specific temperature level".	Government of Brazil, Ministry of Foreign Affairs
3202	5	0	5	0	The message from panel b may be hard to catch, and there is not enough information to understand it, thus we suggest to add in the main text a message about the historical evolution of GWPs and their consequences, with the figure used to illustrate the values of the differences. In the case where it is not relevant to introduce more details earlier in the summary, this description would be a good positioning to introduce in more details how the GWP works, and maybe showing some examples of values (for example to illustrate why the GWP for CH4 appears higher between AR6 and AR2). This is relevant for non-specialist readers wishing to compare gases.	Government of France, Ministère de la Transition écologique et solidaire



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3204	5	0	5	0	Figure heading and subheading 'Global Net Anthropogenic ', 'total Anthropogenic'(panel a) might be confusing.	Government of France, Ministère de la Transition écologique et solidaire
3206	5	0	5	0	Panel b : regarding the point on AR5 estimates, the use of GWP100 and the confrontation with and without climate feedbacks might lead to debate given the role of SLCFs which are poorly accounted in GWP100	Government of France, Ministère de la Transition écologique et solidaire
3208	5	0	5	0	Panel b - left column : Please precise whether numbers derived from AR6 GWP100 metrics include or exclude the climate-carbone cycle feedbacks, as specified for AR5 GWP100 metrics values.	Government of France, Ministère de la Transition écologique et solidaire
3210	5	0	5	0	Panel C :the legend for the shaded area is missing (it is presumably a confidence interval but it is no mentioned)	Government of France, Ministère de la Transition écologique et solidaire
3212	5	0	5	0	One of the key result displayed on this figure is the increasing share of CH4 in GHG emissions when using updated Global Warming Potential on the more recent assessment reports. This result could be better reflected in section B1, either in the headline or in paragraph B1.2. It could also be better reflected by adding a sentence on the matter in the legend of Figure SPM.1, on line 12, after "respectively". Eitherway, the result of the figure would benefit to be more clearly highlighted on a text format, in order to make the figure more explicit and easy to read.	Government of France, Ministère de la Transition écologique et solidaire
3214	5	0	5	0	In the title of panel b, it could be clarified that these are the emissions for the year 2019	Government of France, Ministère de la Transition écologique et solidaire
3216	5	0	5	0	The figures are not always very readable for visually impaired people (figure for the average annual growth rate of GHG emissions in grey barely darker than its background, figure in white for CH4, CO2FFI and CO2LULUCF). These figures should appear in black, to increase the contrast and make them stand out better.	Government of France, Ministère de la Transition écologique et solidaire
3218	5	0	5	0	Panel a : The figures on the average annual growth rate can create confusion with the overall increase. It should be written "+1.3% per year, +2.1% per year, +0.6% per year", otherwise it could look like the increase is for example 1.3% between 2019 and 2010, when it is actually 12%.	Government of France, Ministère de la Transition écologique et solidaire
5136	5	0	5	0	SPM.1 panel b does not appear relevant to the SPM and doesn't inform any of the key conclusions or analysis in the text. It includes more technical detailed information than needed to understand the key points, and makes the figure more complex than it needs to be. We suggest deleting this panel	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5138	5	0	5	0	Information on gross removals could be separated from gross emissions in the LULUCF category, as this is policy-relevant information. Gross removals are presented in TS.4, and the GCP produced time-series of the two curves based on several estimates. Having separate time-series here would make it more clear that there are really two levers for addressing emissions in the land sector, one to reduce deforestation and the other to better manage the storage in soils and reforestation. Even though these two levers are not independent, the information on size is very revealing.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5140	5	0	5	0	The evolution of LULUCF has been revised and updated in Friedlingstein et al. (2021). Please use the latest time-series if possible. It shows a flat trend for LULUCF in the past decades.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5142	5	0	5	0	Figure 1a - This is a really clear and understandable figure but would be clearer without the percentages against each gas for each year, which over-complicate the image	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5144	5	0	5	0	Would it be possible to indicate on the y axis of panel c that these are normalised values?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2224	5	0	5	1	Figure SPM.1: Panel a increases in time, while panel b visually seems to lead the eye 'backward' in time. The inclusion of 'waterfall' graphs for GWPs under earlier IPCC ARs does not seem to add information to this figure. The figure could be visually simplified by focusing only on AR6 GWPs.	Government of Australia, Department of Industry, Science, Energy and Resources
24	5	1	5	1	Compare Fig.SPM.1a and Fig.2.5a. The number in graph (both % and Gt) are different.	Government of Czech Republic, Czech Hydrometeorological Institute
1210	5	1	5	1	The figure SPM.1 includes a lot of information. On the SPM-level, panel (b) would seem to be on detail that is not necessary (and thus reduces the readability) for the communication of the key messages on emission trends.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
1212	5	1	5	1	SPM.1 a Text in figure shown at the top left (in light grey) is difficult to distinguish from the background grey. The different percentages in the figure might furthermore be useful to explain more explicitly (i.e., growth rates and fraction of annual emissions?)	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
3864	5	1	5	1	Figure SPM.1: We like panels a and c of this figure very much; however, we wonder whether panel b is necessary. If retained, we recommend some additional explanations are provided for this panel. On first glance, the reader would take home the message that AR6 GWP100 values do not include climate-carbon cycle feedbacks since the estimated emissions using the AR5 GWP100 value with these feedbacks is higher than the estimated emissions using the AR6 GWP100 value. If that is not the correct message to take home, then explanation is needed to avoid misinterpretation. Additionally, it may not be apparent to all readers why only the GWP100 values from the SAR, AR5 and AR6 are being shown and not those from the TAR or AR4. Adding an explanation for these selections to the caption is also recommended. If this panel is retained, please clarify that the total emissions shown in panel b are for 2019.	Government of Canada, Environment and Climate Change Canada
6278	5	1	5	1	Figure SPM.1 Panel b: Readers might wonder if AR6 also considered climate-carbon feedbacks. Please add some information on that.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6280	5	1	5	1	Figure SPM.1 part b. it seems this is for the year 2019. Please add year.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6282	5	1	5	1	Figure SPM.1 table on the right of panel c: the numbers on change in percent are not coherent with the absolute numbers.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9396	5	1	5	1	A note is needed on implications for difference between including and excluding climate-carbon cycle feedbacks, which is indicated in AR5 case only in the figure panel b.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9398	5	1	5	1	The AR4-GWP100 metric is often used for the latest national GHG inventories and NDCs of the major countries even in 2021. The additional graph in Panel b or the explanations on the total emissions using AR4-GWP100 will be helpful for many policymakers.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9770	5	1	5	1	SPM 1: panel b. is confusing and raises unnecessary questions, e.g. on the difference between AR5 values including and excluding carbon cycles feedbacks, not addressed in the explanation of the panel. It seems better to leave this panel out.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11130	5	1	5	1	In panel b, is the AR6 bar showing emissions converted to CO2eq using GWP with or without climate-carbon cycle feedbacks?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11132	5	1	5	1	Figure SPM.1 - panel c: it is surprising that the uncertainty bound around methane is relatively small (compared to N2O & F-gases for example), given the media coverage of large-scale leaks, inverse modelling etc. Are all sources of uncertainty captured in the clouds shown here.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11134	5	1	5	1	Panel c needs clarification. Emissions are shown relative to 1990, but uncertainties are not (otherwise they should be zero in 1990). Suggest rewording as "Trends in GHG emissions relative to 1990 [- and uncertainties]".	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12548	5	1	5	1	Emissions from LULUCF sector are showing unusual trend in the recent years with 33% rise in emissions from 1990 to 2019 period, need to discuss the drivers of this change and its regional break-down. Emerging issues in this sector need to be highlighted and sector specific mitigation strategies are needed for this sector	Government of India, Ministry of Environment, Forests and Climate Change
12990	5	1	5	1	In figure SPM.1, why does it only start from 1990? Why not from pre-industrial? Why do we ignore historical emissions? I propose that this is included in order to provide a complete picture. This should be consistent across the entire SPM, because it is very useful and crucial to inform policymakers and the public at large. These models really shows us that nothing has changed, in terms of emissions, since the implementation of the KP and that we are not managing to change the trajectory of GHG emissions, which is quite sad and disappointing.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13142	5	1	5	1	The title of the figure speaks of "global NET anthropogenic emission" (so does the text in B.1.1. f.ex.), a. uses "total anthropogenic GHG emissions", b. "emission totals". In the explanation text for the figure panel a. is labeled as "aggregaste GHG emission TRENDS". Please harmonize and limit to as little number of different terms as possible.	Government of Switzerland, Federal Office for the Environment FOEN
13146	5	1	5	1	GWP100: Abbreviations do only make sense if they are - after being introduced - used multiple times thereafter. With less abbreviations, the easier it is for the policy maker to read the document. Omit the abbreviation "GWP100".	Government of Switzerland, Federal Office for the Environment FOEN

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14366	5	1	5	1	Consider adding "2019" in the title of Figure SPM.1b.	Government of United States of America, U.S. Department of State
14368	5	1	5	1	In Figure SPM.1b, clarify that it is showing a single year of emissions using different methods in the chart title.	Government of United States of America, U.S. Department of State
14370	5	1	5	1	Figure SPM.1 is a bit basic and could be cut if trying to save space. At a minimum, Figure SPM.1b could be removed as it is very technical and not discussed in the SPM text, and Figure SPM.1c could also be removed as it doesn't convey much additional information. Consider instead putting Figure SPM.5 and associated text in this front section here, as it conveys more about the global challenge of mitigation and shortfall thus far, and is more relevant to Working Group III.	Government of United States of America, U.S. Department of State
14372	5	1	5	1	In Figure SPM.1, the separation of CO2 by sectors (fossil fuel and industry vs. LULUCF) could be easily misunderstood as the total emissions quantities from those sources. In reality, those sectors can also release methane, nitrous oxide, and F-gases. At minimum, explain that caveat in the figure text. As an example of potential confusion, in this figure, CO2 emissions from LULUCF is 11% of global emissions in 2019 while on page 6, line 7, AFOLU emissions are stated to be 22% of 2019 emissions.	Government of United States of America, U.S. Department of State
13718	5	1	5	12	We think Figure SPM.1 is good and would appreciate if kept. Please consider including in the caption to this figure references for the emissions shown in both panel a) and b) of Figure SPM2, and link 2019 emissions to information provided in Table SPM.1. In panel b) of this Figure it is unclear whether climate - carbon cycle feedbacks are included in AR6 and AR2, and if not, why they are included only for AR5? Please also consider to clarify if emissions from thawing permafrost is included as part of feedbacks. Further, as the figure stands now, a quick look at panel b) could give the wrong impression that the climate effect of methane is lower in AR6 than in AR5, perhaps switch the order of the AR5 bars.	Government of Norway, Norwegian Environment Agency
13720	5	1	5	16	Please consider to write in the legend "CO2 from fossil fuel and industry (CO2-FFI)" and CO2 from Land use, landuse change and forestry (CO2-LULUCF)" in order to be consistent with the other parts of the legend where other GHGs are named. Please clarify if also the removals included in CO2-LULUCF are anthropogenic (as the figure caption seems to indicate) by consider to add "anthropogenic" in front of CO2-LULUCF emissions, if appropriate.	Government of Norway, Norwegian Environment Agency
14374	5	1	5	16	Figure SPM.1 shows a more traditional view of the main GHGs responsible for climate change. This figure is not consistent with the WGI AR6 SPM which showed methane to have roughly equal forcing on temperature.	Government of United States of America, U.S. Department of State
70	5	1	5	18	Figure SPM.1: Please provide reasoning for selecting the period starting in 1990.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2168	5	1	5	18	Panel b is does not seem as relevant as the other panels in SPM.1.	Government of Finland, Finnish Meteorological Institute (FMI)
13722	5	1	5	18	The table in figure SPM.1. is the only place in the SPM where absolute emissions of CO2, CH4, N2O and F-gases are listed. This table should be kept. If not, this information should be included in e.g. B.1.2. We appreciate that it is clearly stated that it is net CO2 numbers, and understand that this is valid for the CO2-LULUCF numbers.	Government of Norway, Norwegian Environment Agency
14376	5	1	5	18	The 250% increase in F-gas emissions visualized in Figure SPM.1 is not sufficiently addressed. F-gases are longlasting GHGs that have important consequences in the long term.	Government of United States of America, U.S. Department of State
584	5	1	5	19	1. AR2 in Figure SPM.1 should be SAR. 2. It is suggested to add a note about percentages in Panel A of SPM.1. 3. The time period here is 1990-2019. The authors are requested to make verification with the underlying report and to expand the time period of SPM.1 to 1850-2019 in order to comprehensively and objectively display the global anthropogenic GHG emissions.	Government of China, China Meteorological Administration
9400	5	1	5	19	The figure is inconsistent with Figure 2.5 in Chapter 2. Please be consistent between two figures.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11136	5	1	5	2	It is 2022. Presenting data only up to 2019 seems outdated. COVID 19 made an impact on GHG emissions. It was mentioned in the report, also inside the report the data from 2020 are presented, so in the figures as "Figure SPM.1: Total anthropogenic GHG emissions (GtCO2-eq yr-1) 1990–2019" it also have to be presented and reflected.	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
72	5	1	5	7	In Figure SPM.1 and its caption, the listing addresses sources and gases. PA focuses on emissions not sources, therefore, the author should update both the figure and caption and limit their listing to gases. Replace sources with gases only.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
6284	5	2	43	2	SPM Fig.1.Panel b. Why does AR6 report 59 Gt and AR5 62Gt? Is it because AR5 includes climate-carbon cycle feedbacks? If so, how come these climate-carbon cycle feedbacks were not included in the AR6 assessment for WG III? We believe there needs to be a clear explanation for this gap.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
864	5	2	5	2	Emission totals based on different GWP100 values provide a rather confusing level of detail for an SPM. Readers may be puzzled why they vary,including within same report. This may give the misleading impression that this breakdown is metric-independent. Most of the left-most column is redundant as it replicates information in panel a (error bars could simply be added on the right of panel a). Comparison with the AR5 helpful, although since the case with Climate feedbacks has not been widely used, this could perhaps be moved to a chapter.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
866	5	2	5	2	It would be useful to provide the breakdown of contributions to warming from different forcing agents, both since 1850-1900 and over the period shown, i.e. since 1990. These data are in figure SPM2c and figure 7.8 of Chapter 7 of the IPCC WG1 report. Presenting error bars on fractional contributions along with an error bar on total warming would be informative, and all of that information is available from the IPCC WG1 Ch7 authors.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5146	5	2	5	2	Choice of scales in part c doesn't seem optimum. Lots of empty space in first 4 panels and then a shift in y-axis scale for final panel gives a misleading sense of relative trends. All panels should have a consistent scale of 0 - 5. The y-axis would also be more intuitive if presented as a percentage number (e.g. 0% - 500%). Numbers in table should align with those in the figures - it is needlessly confusing to not have this as readers naturally expect to be able to read the table numbers (approximately) off the graphs - this could be achieved by changing unit of final column in table to be '% of 1990 level' instead.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14378	5	2	5	2	The Figure SPM.1 caption should be total NET anthropogenic GHG emissions.	Government of United States of America, U.S. Department of State
14380	5	2	5	2	The Figure SPM.1 caption should include "net" (as should the subtitle for panel a), if "net" is going to be used throughout the document. However, since the rest of the SPM mostly does not include the term "net", authors could eliminate it from the title in pursuit of consistency across the SPM. Panel b title should include "2019".	Government of United States of America, U.S. Department of State
862	5	2	5	6	A more precise statement about the GHGs can be provided, also information on different rates of increase and the drivers of these.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
10290	5	3	5	3	Please specify whether the referred anthropogenic GHG emissions are gross or net.	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
6286	5	3	5	7	The caption is more or less the repetition of footnote 4. Please refer to footnote 4 to shorten the report.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14382	5	3	5	7	The variation in emissions among different GWP values is almost too small to discern, so why allocate a precious figure panel to illustrating that point? Also, as always -- but especially in light of the widespread participation in the Global Methane Pledge -- what matters more than variation among estimates for GWP parameters for a given time horizon is the different implications of varying the time horizon itself. Although not a traditional practice for the IPCC, including emissions with GWP20 and GWP50 would be very informative in a panel like this.	Government of United States of America, U.S. Department of State
14384	5	3	5	7	This is very in-the-weeds. Not clear it adds to the SPM and may well distract from the many clear and powerful findings elsewhere in this SPM. Maybe move to glossary?	Government of United States of America, U.S. Department of State
	5	3	5	7	The classification in figure SPM1 seems different from the classification used in the WGI report where "halogenated gases" are pooled while here only emissions of the subset of F-gases are displayed (thus without CFCs and HCFCs). How are emissions of ozone depleting substances accounted for in this figure? Another question for coherency with WGI is the issue of how the effect of methane is accounted for (does this include the effect of methane on tropospheric ozone formation consistent with the WGI assessment, which increases the climate effect attributable to methane)?	WGI Bureau,

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5148	5	4	5	13	Considering GHG inventory are the main way country consider their emissions, it would be really useful to escalate to the SPM a clear statement that LULUCF is not represented in a way consistent with countries GHG inventories but as reported in global carbon cycle models in this SPM. For instance, it is said in chapter 2 (page 2-10) that ""Note that the definition of CO2- LULUCF emissions by global carbon cycle models, as used here, differs from IPCC definitions (IPCC, 2006) applied in national greenhouse gas inventories (NGHG) for reporting under the climate convention (Grassi et al., 2018, 2021) and, similarly, from FAO estimates of carbon fluxes on forest land (Tubiello et al., 2021). We use the global carbon cycle models' approach for consistency with Working Group I (Canadell et al., 2021) and to comprehensively distinguish natural from anthropogenic drivers, while NGHGI generally report as anthropogenic all CO2 fluxes from lands considered managed (see Section 7.2.2 in Chapter 7).[...]"	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6040	5	4	5	4	For consistency, "land use, land use change and forestry" (CO2-LULUCF) should always appear without any capitals, as it is the case in footnote 4 on page 4.	Government of Belgium, Belgian Science Policy Office - Belspo
14386	5	4	5	4	Add "net" before CO2 at the beginning of the line. Clarify whether LULUCF is anthropogenic-only, or all land-based sources and sinks.	Government of United States of America, U.S. Department of State
2044	5	5			consistent capitalization (present) Land use (change) land use	Government of Republic of Korea, Korea Meteorological Administration
1214	5	5	5	5	The statement on CO2-LULUCF emissions including both gross removals and emissions should be further clarified, not least in the light of the different breakdowns of LULUCF-related emissions in national reporting and bookkeeping/earth system models (cf. footnote 7 on page 6).	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
11138	5	5	5	5	For LULUCF, it is unclear what "gross removals" means here. Are these anthropogenic removals? Is it not sufficient to say "net anthropogenic GHG emissions"? In any case, it should be clarified whether the figures are based on inventories (and the managed land proxy) or top-down estimates or a combination (cf. footnote 7)	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13724	5	5	5	5	Please consider removing "gross" in this sentence.	Government of Norway, Norwegian Environment Agency
1216	5	5	5	7	The significance of the F-gas emissions which are not included could be explained - how much of the present radiative forcing do they cause (in order to understand the importance of the omission).	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2226	5	5	5	7	Suggest clarifying why the omitted F-gases are "important". Is it for their warming contribution?	Government of Australia, Department of Industry, Science, Energy and Resources
9402	5	5	5	7	A brief description of the reason why they (CFCs and HCFCs) are not included would be helpful.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
1168	5	6	5	7	Remove bracket before chlorofluorocarbons, such as (chlorofluorocarbons 7 (CFCs) and hydrochlorofluorocarbons (HCFCs).	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2152	5	6	5	7	About F-gas, including some species covered by Montreal Protocol(CFCs, HCFCs..) may be more helpful for policymaker. Is there any reason about calculating F-gas emissions, except CFCs or HCFCs?	Government of Republic of Korea, Korea Meteorological Administration
11140	5	7	7	7	It would be helpful to provide some rationale for not considering Montreal CFCs and HCFCs - with the collective forcing quite substantial (0.338 Wm-2 in 2019; Annex 2, wg1).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14388	5	8	5	10	Clarify the sources of different pieces of information, while keeping the text clean and easy to digest. This note is ambiguous as to whether it is only the GWPs that come from WGI AR6, or also the GHG emissions estimates. And, if the GHG emission estimates are from WGI AR6, it would be beneficial to cite from where, because the WGI report also includes all GHG, at least in some parts, and not the scope apparently used in this WGIII report. If the GHG emissions estimates are not from the WGI report, then the reference should be identified here.	Government of United States of America, U.S. Department of State
770	5	8	5	12	In many talks among policymakers and in media, GWP 20 is used instead GWP 100. Therefore it is important to add information in terms of GWP 20. Suggestion: withdraw the information related to AR2 from the figure (it is not important for decision-makers) and present the diagram with GWP 20; it will be especially essential for methane	Government of Russian Federation, Institute of Global Climate and Ecology

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5150	5	8	5	12	Suggest adding a reference to footnote 5 to instances of GWP100 (and elsewhere in the text).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13144	5	8	5	8	Panel a. is labeled as a "trend" whereas c. does depict the trends?	Government of Switzerland, Federal Office for the Environment FOEN
2046	5	11			Please delete 'converted based on global warming potentials with a 100-year time horizon (GWP100) from the IPCC Sixth Assessment Report Working Group I'. It is redundant since it is already explained in footnote 5.	Government of Republic of Korea, Korea Meteorological Administration
1218	5	11	5	12	It would seem that panel (b) could be removed in Figure SPM.1 It does not seem have much key relevance for the overall message, but rather "crowds" the presentation. The emission trends over time are well characterised in the other panels.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2228	5	11	5	12	Suggest adding an explanation of why this comparison is useful for Policy Makers	Government of Australia, Department of Industry, Science, Energy and Resources
12530	5	11	5	12	Delete lines 11-12. Reason: The panel figure is confusing and has no clear declaration of the intent behind its presentation.	Government of India, Ministry of Environment, Forests and Climate Change
14390	5	11	5	12	The language is unclear whether the uncertainties are only those of the GWPs, or a combination of the uncertainties of the underlying quantity of emissions AND the GWPs. This chart is hard to read and could be a candidate for omission, especially because it does not show the uncertainty in the total net GHG emissions.	Government of United States of America, U.S. Department of State
868	5	12	5	12	Need to add that error bars do not reflect the impact of metric choice	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
12532	5	13	5	15	Panel C: Delete F gases and others. Y axis to be labelled in absolute GtCO2 eq. The legend for panel C to be rewritten in line with suggestion to reliable axis.	Government of India, Ministry of Environment, Forests and Climate Change
2230	5	13	5	17	Suggest that shaded areas in panel c of SPM Figure 1 need to be defined. It is unclear if these are standard deviations or uncertainties. Because they are normalised they are not comparable to the uncertainties given in the table.	Government of Australia, Department of Industry, Science, Energy and Resources
5152	5	13	5	17	For completeness, can it confirm that the figures in the table in panel C are also presented in AR6 GWP100 terms. (This is specified separately for each of the other individual panels where relevant, so not strictly specified for this table)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6288	5	13	5	17	Figure SPM.1 text on graphs in panel c: The shading around the graphs indicating uncertainties must please be explained, otherwise it is unclear what the graph in attenuated colour is supposed to represent.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
870	5	13	5	24	A lot of these data could be provided in a clear and accessible manner in a table. This would make the content easier to communicate.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6290	5	14	5	14	We suggest providing the increase in %.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14392	5	14	5	14	Add "the included" before "F-gases". Had this report chosen to include all GHG, including CFC and HCFC, or omitted HFC covered under the Kigali Amendment, this figure would look very different (and likely wouldn't need to use a different scale).	Government of United States of America, U.S. Department of State
5154	5	15	5	15	Change "growth" to "increase" as in Figure SPM.1 panel c, where "increase" is used in the table column headers.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13726	5	15	5	16	Here the term "absolute emission and absolute change is used. Since removals are included in CO2-LULUCF, we would appreciate if you could highlight that for this sector we talk about net anthropogenic emissions. Also, please consider to insert "anthropogenic" at the right places.	Government of Norway, Norwegian Environment Agency
11142	5	16	5	16	Insert "of the central estimate" between "percentage change" and "relative". It would be useful to give some indication of the trend uncertainty.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
6042	5	16	5	17	This seems too detailed for an SPM: is the interannual variability large enough that it needs to be mentioned? Please check and consider deleting to save space if it is not important to have this sentence.	Government of Belgium, Belgian Science Policy Office - Belspo
3866	5	17	5	17	A comment is needed to explain/clarify the uncertainty ranges for panel c.	Government of Canada, Environment and Climate Change Canada
6292	5	18	5	18	Please clarify if the given source in brackets is only mentioned for panel c or if it is for the entire figure?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2048	5				Panel b is unnecessary. The GWP metric value has been updated, however, the GHG emissions using different GWP metric values could give misunderstanding to policy makers.	Government of Republic of Korea, Korea Meteorological Administration
3868	5				Figure SPM.1 We encourage the authors to consider including the Montreal Protocol gases on this figure. They make a substantial contribution to radiative forcing, and the decreasing trend in their emissions provides an example of how emissions of greenhouse gases can be reduced by international agreement, as noted in E6.5 of this SPM.	Government of Canada, Environment and Climate Change Canada
13372	5				The key at the bottom with the colours needs to be moved to align to ensure clarity. This may be confusing especially where F-gases are put as it is right below another figure.	Government of Kenya, Kenya Meteorological Service
12528	5		5		Delete Panel b SPM Figure 1. Reason: Confusing, unclear, difficult to explain	Government of India, Ministry of Environment, Forests and Climate Change
88	6	0	6	0	footnote 8: It is not clear how the authors came to conclude likely outcome at a low level of probability such as 67%. One missing thing is how sensitive these scenarios when changing their assumptions and how that could impacts the final results.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
2638	6	0	6	0	Footnote 7 : In what sense is this gap defined? an overestimation of the models with respect to the national inventories or conversely: We suggest to specify	Government of France, Ministère de la Transition écologique et solidaire
2640	6	0	6	0	Footnote 7 : This information is policy relevant and it may be useful to introduce it directly in the text.	Government of France, Ministère de la Transition écologique et solidaire
2642	6	0	6	0	Footnote 7 : A reference to TS.3 could be added (see page TS-23 lines 22-32)	Government of France, Ministère de la Transition écologique et solidaire
2644	6	0	6	0	Footnote 8: it may be worth mentioning how the probabilities were calculated (e.g. the proportion of models for which a given scenario reaches a certain temperature)	Government of France, Ministère de la Transition écologique et solidaire
2646	6	0	6	0	Footnote 8 is also very relevant as it introduces for the first time in the summary a description and naming for scenarios - it could be useful to formalize it directly in the main text, maybe under the form of a table	Government of France, Ministère de la Transition écologique et solidaire
2648	6	0	6	0	We raise the attention of the authors about the fact that the definition of "scenarios limiting warming to 1.5°C with high overshoot" given here does not require fulfilling a criterion about the magnitude of the overshoot. Therefore, we suggest to explain in the footnote that indeed such scenarios involve overshoots higher than 1.6°C, which explains that "high overshoot" is used in the definition (reference to Table SPM.1 recommended).	Government of France, Ministère de la Transition écologique et solidaire
90	6	0	7	0	The following statement from Ch7 P112 L38-42 "Many AFOLU measures require carbon to be compensated to generate positive returns, reducing the likelihood of implementation without clear financial incentives. Research to show costs and benefits is lacking in most parts of the world." is needed to be added to the SPM as it demonstrates a gap of research with regards to AFOLU measures. This statement must be added to the SPM as to ensure a balanced and inclusive report	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
12400	6	1	6	5	The Headline Statement has been stated in a negative and confusing manner. The Improvement in Energy Efficiency and carbon Intensity have been subdued in the formulation. It will be useful to characterise it. 2 percent improvement in global energy efficiency is a good development,	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
12402	6	1	6	6	Why reference iss made to 2010 and 2019?	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
84	6	1	6	1	B.2: The statement "GHG emissions have increased since 2010 across all sectors" fails to offer a reason for selection of 2010 as a starting point. Required actions: remove or clarify the reasoning for selecting 2010.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
5156	6	1	6	1	This needs to be clear that this is for global average sectoral emissions - it is not true that GHG emissions have increased in all sectors at a regional or national level.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12996	6	1	6	1	Please indicate CL in the first sentence.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13620	6	1	6	1	It is important to add "Globally" at the beginning of the statement	Government of New Zealand, Ministry%20for%20the%20Environment
14400	6	1	6	17	Lines 1-4 assert that "GHG emissions have increased since 2010 across all sectors. For CO2 emissions from fossil fuels and industry, improvements in energy efficiency and carbon intensity have not been sufficient to compensate for growing global activity levels in industry, energy supply, transport, buildings, agriculture and land-use change, as well as urbanisation." Though emissions are still increasing, the main finding as written here does not highlight how annual emissions growth over the last decade is either slowing (so increasing at a decreasing rate) or constant, which is good news. Most of the supporting elements here, such as lines 11-17, indicate the rates of growth are slowing, which is a very important point that should be included in the bold-faced finding.	Government of United States of America, U.S. Department of State
14402	6	1	6	17	Line 1 states that "GHG emissions have increased since 2010 across all sectors"; however, the statements in lines 15-17 assert that "Net CO2-LULUCF emissions, which are subject to large uncertainties and high annual variability, show no discernible long-term trend. Emission growth in AFOLU is more uncertain due to the high share of CO2-LULUCF emissions." Per this text and Figure SPM 1c, as this sector has such variability and uncertainty, it does not seem clear that emissions have increased. Also, if this is a net number (gross emissions and removals as indicated in the figure), it is unclear whether emissions indeed have grown or removals have decreased. Chapter 7 (page 7-4, lines 16-28) offers different emissions estimates for AFOLU (not solely LULUCF) but is very unclear -- as it oscillates between two different sets of estimates from different accounting approaches. Ultimately, the statement made here in the SPM about all sectors having increased emissions seems to be an overstatement (yet given a "high confidence" ranking).	Government of United States of America, U.S. Department of State
5160	6	1	6	23	This section uses both LULUCF and AFOLU acronyms. While the acronyms are defined, the difference between them is not defined – e.g. is one a subset of the other? Do they both refer to all GHGs? A footnote to explain how they are related/differ would be useful.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11146	6	1	6	23	It is confusing to see AFOLU and LULUCF terminology mixed in the same text. The headline statement refers to "agriculture and land-use change" (i.e., not LULUCF, only LUC), line 8 to AFOLU (which includes non-LUC LULUCF), then "net CO2-LULUCF, later just "CO2-LULUCF" (i.e., not "net"). If all these differences are intentional and significant, they should be explained. Otherwise they should be simplified and harmonised and used more consistently.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
586	6	1	6	4	The term "urbanization" has different interpretations in different disciplines, which can lead to ambiguity and overlap with the previously listed aspects of "industry, energy supply, transportation". It is suggested that the term urbanization be noted with its meaning in the report.	Government of China, China Meteorological Administration
3870	6	1	6	4	As written, this sentence is somewhat confusing. We think the first phrase could be deleted ("For CO2 emissions from fossil fuels and industry"), in which case the sentence would just start with "Improvements in energy efficiency and carbon intensity have not been sufficient to compensate for growing global activity levels in.....(the sectors listed).	Government of Canada, Environment and Climate Change Canada
5158	6	1	6	4	"Across all sectors" seems wrong given there are no discernible trends in LULUCF. The second sentence which refers to fossil fuel related CO2 emissions, agriculture and land-use change should not be included in the list.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11144	6	1	6	4	"as well as urbanisation", not sure this is needed. Urbanisation is a trend that drives increased activity levels in other sectors. Also, urbanisation is not mentioned at all in the body of this chapter	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11896	6	1	6	4	B.2: In the sentence starting "For CO2 emissions from fossil fuels and industry..." it is confusing that this sentence includes in the latter part emissions from land use change, which are not related to emissions from fossil fuels and industry.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12476	6	1	6	4	Delete B.2. Replace with " GHG emissions have increased since 2010 across all sectors, except for AFOLU where there are significant uncertainties in determining the long-term trends" Reason 1: Urbanisation is not a sector under IPCC GHG Inventory guidelines. Urbanisation is moreover a process and not a sector, and thus the meaning of the term is unclear. All emissions due to urbanisation are accounted for in other sectors mentioned in the same sentence. Reason 2: According to B 2.2 -Net CO2-LULUCF emissions are subject to large uncertainties and high annual variability, show no discernible long-term trend.	Government of India, Ministry of Environment, Forests and Climate Change
92	6	1	6	5	B.2: The headline statement starts with "GHG emissions have increased since 2010 across all sectors." However, the remaining of the statement is focused on one gas and one source and ignores other sources when discussing sectoral GHG emissions drivers and their trends. The authors should update the headline statement and focus discussion on sectors and include other GHG gases.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2232	6	1	6	5	Suggest the IPCC consider the inconsistency between the inclusions of urbanisation here, where it is attributed to increased emissions, and later in C.6 where urbanisation is cited as a possible mechanism for emission reduction.	Government of Australia, Department of Industry, Science, Energy and Resources
13148	6	1	6	5	The lead should take up each most important finding from the subparas that follow the lead (SEE ALSO the general comments). Here, we are missing the findings on "growth" and "energy efficiency" and "carbon intensity"	Government of Switzerland, Federal Office for the Environment FOEN
14394	6	1	6	5	Headlines statement B.2 states that "GHG emissions have increased since 2010 across all sectors." The use of "sectors" here is somewhat unclear, particularly since the preceding figure breaks out emissions by gas with CO2 further broken down to FFI and LULUCF CO2 sources. Additionally, as stated in B.2.2, there is no discernible long-term trend for CO2-LULUCF emissions, so are those meant to be included or excluded from this statement? The next line begins "For CO2 emissions from fossil fuels and industry ...", further drawing the comparison to the grouping in Figure SPM.1, but the sentence then goes on to say "improvements in energy efficiency and carbon intensity have not been sufficient to compensate for growing global activity levels in industry, energy supply, transport, buildings, agriculture and land-use change, as well as urbanisation". This starts with a further breakout of CO2-FFI emissions by economic sector, but then adds agriculture and land-use change to the list which should be part of CO2-LULUCF instead and should not be listed here as part of a statement about CO2-FFI.	Government of United States of America, U.S. Department of State
14396	6	1	6	5	The SPM (here or later in Section C) should cover the important finding relating historical trends in emissions with emission scenarios to emphasize that the world is no longer on track to the "no climate policy" scenarios. Chapter 2-23, lines 26-30, states "Comparisons between historic GHG emissions and baseline projections provide increased evidence that global emissions are not tracking high-end scenarios (Hausfather and Peters, 2020), and rather followed 'middle-of-the-road' scenario narratives in the earlier series, and by combinations of 'global sustainability' and 'middle-of-the-road' narratives in the most recent series (SRES and SSP-baselines) (Strandsbjerg Tristan Pedersen et al., 2021; Pedersen et al., 2020). As countries increasingly implement climate policies and technology costs continue to evolve, it is expected emissions will continually shift away from scenarios that assume no climate policy but remain insufficient to limit warming to below 2°C (Hausfather and Peters, 2020; Vrontisi et al., 2018; UNEP, 2020b; Roelfsema et al., 2020)."	Government of United States of America, U.S. Department of State
14398	6	1	6	5	Consider providing definitions for these sectors in the SPM footnotes. Reference to specific chapters/sections is helpful, but footnoted definitions in the SPM will increase understanding for policymakers.	Government of United States of America, U.S. Department of State
6294	6	1	9	18	Section B misses a discussion of consumption-based emissions drawing on the underlying chapter 2.3.2 "Trends in global and regional CBES trajectories". We urge the authors to add this information.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2234	6	2	6	2	Unclear what is meant by 'carbon intensity' - suggest expanding/defining here as it is used in the subsequent text	Government of Australia, Department of Industry, Science, Energy and Resources

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5162	6	2	6	3	have not been sufficient' is needlessly complex language. 'did not' would serve exactly the same purpose here and is much easier to read.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11148	6	2	6	3	"energy efficiency ... have not been sufficient to compensate": A reference to the Jevons paradox would seem necessary. In the absence of other measures, increased efficiency itself can drive and increase in energy demand. The SPM should recognise this and other rebound effects.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14404	6	2	6	3	Replace "been sufficient to compensate for" with "have not offset", to provide less normative language. Just keep it factual.	Government of United States of America, U.S. Department of State
6296	6	3	6	3	We do not understand the term "growing global activity levels". It might be perceived as if all activity leads to higher emissions. But it is rather a question of how and what than only how much. The wording in the SOD was much more appropriate: "Materials and energy consumption associated with rising incomes have been the strongest driver of CO2 emissions growth from fossil fuel combustion, with a smaller contribution from population growth. (SOD B2.1)" or found in the TS 3: p12, 21-22: "Globally, Gross Domestic Product (GDP) per capita and population growth remained the strongest drivers of CO2 emissions from fossil fuel combustion in the last decade. {2.4.1, Figure 2.19}".  We request the authors to consider a wording which is more exact and makes clear, that there is activity that is a driver for emission growth but also activities that lead to a reduction in emission. Also, it should be made clear that there is a driver due to increasing GDP and a driver due to population growth. Quantifying both drivers would be very much appreciated.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
86	6	3	6	4	B.3: Required action: clarify "elsewhere".	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
880	6	3	6	5	This would suggest urbanisation is a bad thing from an emissions perspective. Also that 'activity' as such is a bad thing. Covid demonstrates the structural problems that have not been addressed, the transformation that has not occurred.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
3220	6	3	6	7	This paragraph is repetitive from Footnote 4 just above, are the two necessary? If they are kept in this way, make them consistent by adding the detail of the F-gas emissions in the footnote 4.	Government of France, Ministère de la Transition écologique et solidaire
3222	6	5	6	7	The choice of the non inclusion of CFCs and HCFCs among the F-gas emissions should benefit from a short explanation (e.g. a footnote that gives the corresponding reference to the decision)	Government of France, Ministère de la Transition écologique et solidaire
12318	6	6	6	10	One of the sources of greenhouse gas emissions are reservoirs resembling dams, wetlands and lakes with nutritional issues. Apparently these repositories are not listed in the AFOLU category according to the footnote on Chapter 7: Agriculture, Forestry and Other Land Uses (AFOLU) report. Given that there are solutions to control emissions from these reservoirs, is it possible that these cases are also being considered?	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12316	6	6	6	8	It is mentioned that "In 2019, approximately 34% of global GHG emissions came from the energy sector, 24% from industry, 22% from agriculture, forestry and other land use (AFOLU), 15% from transport and 6% from buildings.". The sum of the numbers is 101%. It is better to be corrected.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
534	6	6	6	10	The percentages breakdown for global GHG emissions add up to 101%, which causes confusion to the reader. Understand that the figures were also referred to in Technical Summary, Figure TS.6, where buildings were quoted to have contributed to 5.6% of total emissions, which was rounded off to 6% in this paragraph. This caused the total to add up to 101%. Suggest to make necessary amendments such that the total percentages add up to 100%.	Government of Singapore, Ministry of Environment and Natural Resources
588	6	6	6	10	According to the generally accepted classification, GHG emissions sources include energy activities (including transportation and buildings), industrial processes, Agriculture, Forestry and Other Land Use (AFOLU), and waste treatment. The contribution of emissions from waste treatment is absent here. Please explain reasons for the omission.	Government of China, China Meteorological Administration
590	6	6	6	10	The data used in the SPM is not consistent with the underlying report. For example, the SPM indicates the building sector contributes 6% (3.3 GtCO2 equivalent), a figure that is 5.6% (3.3 GtCO2 equivalent) in the underlying report. And the sum of the data in this paragraph is 101%, which is not reasonable. It is suggested to be consistent with the underlying report.	Government of China, China Meteorological Administration

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592	6	6	6	10	<p>1. AFOLU accounts for 22% of the total GHG emissions, or about 13 GtCO<sub>2</sub>-eq, ranking third in the industry. However, compared with other industries (fields), AFOLU is specially characterized as both carbon sinks and sources. Although the IPCC 2006 Guidelines considers AFOLU as a sector, it is necessary to provide a comprehensive understanding to decision makers, considering that several countries have put forward carbon peaking and neutrality pledges. It is suggested to explain, in the AFOLU, how much emission from agriculture and how much sequestered by carbon sinks from forest and land use.</p> <p>2. It is suggested to give a description and explanation of whether natural ecosystems, such as forests, are carbon sinks or sources in a global context, and what activities they come from.</p>	Government of China, China Meteorological Administration
6044	6	6	6	10	This paragraph is complex, with many numbers. Could you please consider keeping only the "indirect" allocation of emissions? (the sentence would become something like this: In 2019, approximately 34% (20 GtCO <sub>2</sub> -eq) of global GHG emissions came from industry, including its indirect energy emissions, 22% (13 GtCO <sub>2</sub> -eq) from agriculture, forestry and other land use (AFOLU), 17% (10 GtCO <sub>2</sub> -eq) from buildings, including their indirect energy emissions, 15% (8.7 GtCO <sub>2</sub> -eq) from transport and 13% (7.5 GtCO <sub>2</sub> -eq) from the energy sector.)	Government of Belgium, Belgian Science Policy Office - Belspo
6298	6	6	6	10	Please check the sector-specific global emissions, since the numbers as referred to some sectors are in part not fully consistent to the numbers named in fig. TS.6 (page TS-24); e.g.: energy: 34% (SPM;B2.1) vs. 33% (fig.TS.6); buildings: 17% (SPM;B2.1) vs. 16% (fig.TS.6).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11898	6	6	6	10	B.2.1: Could at least the top bar of figure TS.6 (also referenced in the line of sight) be elevated to the SPM level and merged with Figure SPM.1? That would make the sectoral information much easier to grasp at one glance. This would be relevant information for policymakers working in the different areas.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13730	6	6	6	10	Chapter 7 explains that deforestation still contribute to a large share of GHG emissions, although there are substantial regional differences, and that losses of carbon are generally observed in tropical regions. Please consider to include information about the share of emissions associated with deforestation in the AFOLU-sector. From ES, ch 7; deforestation accounts for 45% of total AFOLU emissions.	Government of Norway, Norwegian Environment Agency
14408	6	6	6	10	The clarity of this paragraph can be enhanced, in particular the discussion of indirect emissions and shares by sector. First, authors can consider adding reference to "direct GHG emissions" in the first sentence. Second, in the second sentence where indirect emissions from energy use are distributed to end use sectors, it would be good to also provide information on the share of other sectors. For instance, do shares for transport and AFLOLU change as well?	Government of United States of America, U.S. Department of State
14410	6	6	6	10	Shouldn't the confidence intervals be included here, as with other cited estimates? The size of the confidence intervals would vary significantly across the source categories.	Government of United States of America, U.S. Department of State
5164	6	6	6	12	For all figures of implied emissions by NDC or current policy scenarios, it would be useful to include somewhere a reference in the SPM (e.g. a footnote) that makes clear the convention used for the inclusion of emissions and removals from LULUCF in "global GHG emissions", especially for the central estimates. Indeed, in chapter 4 (p 4.22), it is explained "The aggregation of targets results in large uncertainty (Benveniste et al. 2018; Rogelj et al. 2017). In particular, clarity on the contributions from the land use sector to NDCs is needed "to prevent high LULUCF uncertainties from undermining the strength and clarity of mitigation in other sectors" (Fyson and Jeffery 2019). Methodological differences in the accounting of the LULUCF anthropogenic CO <sub>2</sub> sink between scientific studies and national GHG inventories (as submitted to UNFCCC) further complicate the comparison and aggregation of emissions of NDC implementation (Grassi et al. 2018, 2021) (Section 7.2.3 and Cross-Chapter Box 6).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
74	6	6	6	6	B.2.1: Required action: explain the choice of 2019	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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2154	6	6	6	6	(Basis) I think numerical values in SPM should be same with TS. In Figure TS.6, Total emission, other energy(10%)+ Electricity heat(23%) match with Energy sector(34%) in SPM, but the numerical values are different. (33% vs 34%) It needs to be checked. Also, if there is some explanation about, both energy part and electricity heat part means energy sector in Figure TS.6, it would be easier for policymaker to understand the paragraph. (present) Energy sector(34%) (change) Energy sector(33%. other energy + electricity heat)	Government of Republic of Korea, Korea Meteorological Administration
3872	6	6	6	6	Please clarify (in a footnote?) what is encompassed by the term "energy sector" and ensuring consistent usage throughout the SPM is encouraged. The Energy Sector chapter explains that mitigation options were assessed in energy supply, energy transformation, energy transportation and transmission, excluding end uses of energy. This is important to state at first use of this term.	Government of Canada, Environment and Climate Change Canada
11150	6	6	6	6	"from the energy sector", this term is not clear as usually the energy sector is meant to include also industry, buildings and transport. It probably refers to the power and heat sector, refineries and energy transformation. Consider using another term like "energy production and conversion sector".	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12992	6	6	6	6	It says in 2019, but not relative to which year or time horizon. Could this please be included and clarified for policymakers.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
2066	6	6	6	8	(Basis) According to FGD chapter 7, page 12, 21% of global GHG emission came from AFOLU. (present) 22% of global GHG emissions from agriculture (change) 21% of global GHG emissions from agriculture	Government of Republic of Korea, Korea Meteorological Administration
2608	6	6	6	8	Emissions linked to the digital sector could be mentioned. Digital sector emissions are of the same order of magnitude as the air transport sector and are increasing faster.  Digital is mentioned as an important tool for mitigation. Dematerialization and teleworking are also mentioned in paragraphs C.8.2, B.4 line 4. and B.4.3	Government of France, Ministère de la Transition écologique et solidaire
13728	6	6	6	8	Please consider to change "global" to "anthropogenic" in line 6, and also it would be helpful to clarify whether the numbers given for AFOLU are net emissions including anthropogenic uptake, or if it is gross emissions.	Government of Norway, Norwegian Environment Agency
14406	6	6	6	8	Total adds up to 101%. Replace zero decimal percentages with one decimal percentages.	Government of United States of America, U.S. Department of State
13622	6	7	6	8	The statement "22% (13 GtCO <sub>2</sub> -eq) from agriculture, forestry and other land use (AFOLU)" is not very meaningful in a policy context. It is not helpful in a policy context to combine emissions from agriculture with emissions/removals from forestry and land-use change. Emissions from transport are separated out from the rest of the energy sector, and the same approach could usefully be applied here.	Government of New Zealand, Ministry of the Environment
13732	6	7	6	8	We appreciate the use of AFOLU as it is very useful to see these sectors together. Please consider if it would be possible to add a footnote explaining AFOLU vs. LULUCF + agriculture, as they are both used in the SPM, and sometimes in the same sentence (B.2.2)? Also, consider explaining if land-use change is included in AFOLU?	Government of Norway, Norwegian Environment Agency
14412	6	7	6	8	How does IPCC define "other land use"? Chapter 7 does not provide a clear definition. Does this include conservation land? Consider footnoting a definition in the SPM so that policymakers can accurately understand and interpret these trends.	Government of United States of America, U.S. Department of State
2082	6	8	6	10	Please, check the value 17% from building with indirect emissions from energy use compared to the SOD report. (Basis) (ar6wg3_sod_Chapter-9_p.p.4_p.p.7).	Government of Republic of Korea, Korea Meteorological Administration
2084	6	8	6	10	Please, review the C.7.1 part in SPM-24 page.	Government of Republic of Korea, Korea Meteorological Administration
5166	6	8	6	10	A sentence could be added here to provide the gross emissions and the gross sinks from LULUCF. This information is policy-relevant and it specifies the current state of removals as well as the (very high) potential for reducing emissions from deforestation.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11152	6	8	6	10	For consistency recommend to give the same numbers also for AFOLU and transport. Note that recent papers claim that agriculture alone account for more than 25 % of all GHG emissions if including indirect emissions (LCA analysis). It would be good to have the numbers consistently together.	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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12478	6	8	6	10	The last sentence, i.e. " The relative shares of industry and buildings rise to 34% and 17%, respectively, if indirect emissions from energy use in these sectors are included." should be removed. Reason: These numbers are not comparable with the estimates in the first sentence. If we consider indirect emissions then numbers in the energy sector have to be adjusted so that the percentages add up to 100%.	Government of India, Ministry of Environment, Forests and Climate Change
14414	6	8	6	10	Since the shares for industry and buildings increase when indirect emissions are included, can authors also provide information on the share of the energy sector emissions when the indirect emissions are deducted from that sector and allocated to the industry and buildings sectors?	Government of United States of America, U.S. Department of State
2610	6	9	6	10	Does "if indirect emissions from energy use in these sectors are included" mean that a large part of the 20 GtCO <sub>2</sub> -eq from the "energy sector" are included here?	Government of France, Ministère de la Transition écologique et solidaire
6878	6	9	6	10	Could this statement please clarify what it means that indirect emissions are included in this assessment, and what would change if indirect emissions were not included?	Government of Jamaica, Meteorological Service Division
13150	6	9	6	10	"if indirect emissions from energy use in these sectors are included." Too technical explanation/add on. Can be omitted.	Government of Switzerland, Federal Office for the Environment FOEN
13152	6	9	6	10	"significantly" Was the growth slow down statistically significant? If yes, add it the finding.	Government of Switzerland, Federal Office for the Environment FOEN
2612	6	9	6	9	17% should be replaced by "16%" to be consistent with 2-47, line 31	Government of France, Ministère de la Transition écologique et solidaire
2614	6	9	6	9	Why do "indirect emissions" exclude the "embodied emissions" ? In 2019, according to 9-4 and SPM-24, global GHG emissions from buildings stood for 21 % of global GHG emissions including direct, indirect and embodied emissions.	Government of France, Ministère de la Transition écologique et solidaire
5168	6	9	6	9	Consider clarifying the meaning of "indirect emissions" (possibly in a footnote).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11900	6	9	6	9	B.2.1: The statement on "indirect emissions" is not clear, also how it compares to Figure TS.6?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13040	6	9	6	9	B.2.1: Clarify here what is meant by "indirect emissions"?	Government of Gambia, Department of Water Resources
13154	6	9	6	9	To what starting point does the rise correspond to?	Government of Switzerland, Federal Office for the Environment FOEN
14416	6	9	6	9	Change "if" to "when".	Government of United States of America, U.S. Department of State
2616	6	10	6	10	A reference to TS.3 could be added (see page TS-23 lines 12-17)	Government of France, Ministère de la Transition écologique et solidaire
5170	6	10	6	10	A figure such as TS.6 (or similar to SPM.2 from WGIII contribution to AR5) showing the GHG breakdown by economic sector would be valuable to include in the SPM	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5172	6	11	6	11	significantly' is imprecise here and not needed as numeric values are given in the parentheses.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
76	6	11	6	12	B.2.2 The statement "Average annual GHG emissions growth between 2010 and 2019 slowed significantly compared to the previous decade" does not provide an objective reason for selecting the time period. Required actions: remove or provide clear rationale for the choice of 2010-2019 period and associate with a confidence level.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
11154	6	11	6	12	Here "energy supply" is probably the same thing called "energy sector" in line 6. Consistency of terminology should be checked here and throughout. Broadly speaking, "energy sector" refers to issues covering both supply and demand (i.e. including also demand side management, energy efficiency, etc).	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
594	6	11	6	13	It is not consistent with the data in the underlying report. The data given in the underlying report for industry "reduced from 3.4% to 1.4%" is only for direct emissions, but this important information is missing in the current SPM. In this regard, it is suggested to maintain consistency.	Government of China, China Meteorological Administration
80	6	11	6	17	B.2.2: Required actions: remove: most of the content of the statement is of medium confidence and lacks any clear rationale for the choice of 2010-2019 period.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
82	6	11	6	17	B.2.2: The lack of a uniform method to define anthropogenic emissions as presented in footnote 7 weakens the argument of this entire point and support removing it from the SPM. Remove this text.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
96	6	11	6	17	The text in B.2.2 demonstrates unclear and conflicting confidence levels. It is not clear if the "medium confidence" applies to the entirety of the paragraph or the last sentence only, since there is various levels of confidence level throughout the paragraph. Clarify the correct confidence level throughout the paragraph.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
872	6	11	6	17	Confusing in the way CO2 and non CO2 emissions and sources are discussed. The last two sentences in particular which appear to be about CO2 emissions only, neglecting the significant non-CO2 component of AFOLU, or are these to be included in the scope of the sentence.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5174	6	11	6	17	The second sentence in B2.2 is made less useful due to the exclusion of aviation, shipping and biogenic sources. If this statement is still true when those sectors are included, then the parentheses should be deleted. If it is not true, then the whole statement could be misleading and should be deleted.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5176	6	11	6	17	A separate sub-section could be used to detail the trends in LULUCF and AFOLU. These are important and quite different from the trends in energy-related sectors, and some information about the removals are missing.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9892	6	11	6	17	(B2.2): Add underlying trends in production volume and decarbonisation in the energy supply sector, to underpin the compounded trend shown here.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
882	6	12	6	15	Clarify wording so that this doesn't be communicated that urban areas are the problem.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
14418	6	13	6	13	It would be useful to indicate which transport segments/modes have highest emissions.	Government of United States of America, U.S. Department of State
2618	6	13	6	15	A percentage could be needed here to illustrate the relative contribution of activities in urban areas when excluding aviation, shipping and biogenic sources.	Government of France, Ministère de la Transition écologique et solidaire
2620	6	13	6	15	This sentence has inconsistencies with TS.5.2 lines 16-17 which has high confidence and does not mention the exclusion of aviation, shipping and biogenic sources	Government of France, Ministère de la Transition écologique et solidaire
3394	6	13	6	15	It should specify if the growth of population living in urban areas (or growth of urban area extents) is considered or not here.	Government of France, Ministère de la Transition écologique et solidaire
3874	6	13	6	15	This sentence notes that an increasing share of CO2 and CH4 emissions comes from urban areas, but it excludes aviation, shipping and biogenic sources - these sources are mainly in non-urban areas and have probably increased. So this makes it hard for the reader to interpret. Can the authors reach a similar assessment for the share of emissions from urban areas considering all sources of emissions?	Government of Canada, Environment and Climate Change Canada
3876	6	13	6	15	Please clarify if landfills are included in "biogenic sources" here. It seems odd to group biogenic sources of CO2 and CH4 with aviation and shipping as sources to be excluded in the estimation of urban emissions. In addition, this statement in the SPM is given medium confidence whereas a similar statement in the TS-61 (lines 16-17) says "The urban share of combined global CO2 and CH4 emissions is substantial and continues to increase (high confidence)".	Government of Canada, Environment and Climate Change Canada

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5178	6	13	6	15	Please add the quantitative numbers corresponding to the increasing share of emissions due to activities in urban areas, and make it clear if this is predominantly CO <sub>2</sub> , or if there is a similar contribution from CO <sub>2</sub> and CH <sub>4</sub> . This is important for guiding the appropriate actions.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5180	6	13	6	15	The text reads that urban areas are drivers of emissions, implying that rural areas are not or less so (had activity increased in these areas) – worth clarifying that, other things constant, urban areas are more emissions efficient places to live, as per section C.6 or to add clarify that urbanisation can drive income growth, with implications for emissions..	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6046	6	13	6	15	This suggests that urban areas are a specific source of GHGs. We have the impression that it is hard to interpret this finding: the reader will not know if it is due to an increasing share of the population living in cities, or the consumption habits in urban areas, and may imply that living outside urban areas is better for the climate. Could you clarify the message? If needed, it might be that a footnote could provide examples of "activities in urban areas" that contribute to this trend.	Government of Belgium, Belgian Science Policy Office - Belspo
11156	6	13	6	15	The statement claims that "An increasing share of global CO <sub>2</sub> and CH <sub>4</sub> emissions (excluding aviation, shipping and biogenic sources) is due to activities in urban areas (medium confidence)". We question whether that this is true for CH <sub>4</sub> and also not able to find evidence for it in Section 2.2. In Figure 2.13 panel d in Section 2.2., it is evident that CH <sub>4</sub> emissions from waste increased by about 0.3 Gt CO <sub>2</sub> eq between 2010-2019, which is likely mainly in urban areas. But from the same figure it can also be read that CH <sub>4</sub> emissions from enteric fermentation increased by about 0.2 Gt CO <sub>2</sub> eq, from oil and gas fugitive emissions by about 0.25 Gt CO <sub>2</sub> eq, from coal mining fugitive emissions by about 0.15 Gt CO <sub>2</sub> eq, i.e., CH <sub>4</sub> emissions from mainly rural activities increased by about 0.6 Gt CO <sub>2</sub> eq over the same period. It is therefore likely that the statement is wrong for CH <sub>4</sub> , but probably correct for CO <sub>2</sub> .	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12480	6	13	6	15	Delete the following "An increasing share of global CO <sub>2</sub> and CH <sub>4</sub> emission (excluding aviation, shipping and biogenic sources) is due to activities in urban areas (medium confidence)." Reason: The definition of urban areas (in terms of what areas, activities and phenomena are included in it) are not specified and these vary widely in the literature and across regions.	Government of India, Ministry of Environment, Forests and Climate Change
14420	6	13	6	15	Consider footnoting or explaining what aviation, shipping, and biogenic sources are excluded.	Government of United States of America, U.S. Department of State
14422	6	13	6	15	Delete the sentence beginning "An increasing share ...." Of course, if authors omit most of the categories of CH <sub>4</sub> and CO <sub>2</sub> emissions that come from outside of urban areas, it will show an increasing share in urban areas. If you include all sources in the denominator, it may have some value but as it stands now, it is a good place to cut text. It would be more interesting to know what is happening to the shares of emissions from buildings and industry if indirect emissions were included, especially in the context of policies to promote electrification.	Government of United States of America, U.S. Department of State
876	6	13	6	16	For climate the focus should be on emissions from Fossil Fuel as an energy solution not energy per GDP which is different,	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
878	6	13	6	16	A more refined reference to population and energy use as opposed to fossil energy use is needed.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
78	6	13	6	17	B.2.2 The statement is confusing and provides incomplete information as includes discussion on emission by some sectors and emission by gases in different sectors. Required Action: provide complete information on GHG emissions trends by each sector including buildings.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
11158	6	14	6	14	"...(excluding emissions from aviation, shipping and biogenic sources).....". Please clarify if it refers to the exclusion of biogenic CO <sub>2</sub> sources only. Excluding biogenic CH <sub>4</sub> sources would mean excluding all CH <sub>4</sub> from organic waste, wastewater, rice cultivation, livestock, which is about 60% of anthropogenic methane emissions.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11160	6	14	6	14	Exclusion in brackets: What is meant by "biogenic" CO <sub>2</sub> sources? LULUCF? CO <sub>2</sub> from the combustion of biomass? Or both? How about CO <sub>2</sub> sinks? Are they also excluded? Presumably, aviation and shipping refers to "international" aviation and shipping?	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2050	6	15			CO2-LULUCF expression needs to be modified or needs footnote.	Government of Republic of Korea, Korea Meteorological Administration
2622	6	15	6	15	It would be interesting to specify which urban activities, or whether this corresponds to urbanisation in general.	Government of France, Ministère de la Transition écologique et solidaire
3224	6	15	6	15	We suggest to precise the meaning of absolute in the sentence	Government of France, Ministère de la Transition écologique et solidaire
3226	6	15	6	15	According to Footnote 4, emissions from LULUCF in the report are net emissions. Please clarify in the caption to avoid mis-understanding.	Government of France, Ministère de la Transition écologique et solidaire
13156	6	15	6	15	In contrast to AFOLU (page 6, line 7-8), LULUCF is not properly introduced in the text.	Government of Switzerland, Federal Office for the Environment FOEN
14424	6	15	6	15	At regional, and at shorter timescales than 2000-2019, there are significant and important trends in deforestation taking place. The language that "no discernible trend in LULUCF" is not helpful and could give a misimpression of actual patterns of land cover change.	Government of United States of America, U.S. Department of State
2236	6	15	6	16	This passage states 'Net CO2-LULUCF emissions ... show no discernible long-term trend.' Yet visually in Figure SPM.1c, LULUCF emissions seem to show a rising trend. Suggest clarifying what is meant by 'discernible'.	Government of Australia, Department of Industry, Science, Energy and Resources
3878	6	15	6	16	Figure SPM.1c appears to show an increase in LULUCF CO2 emissions, but perhaps the increase is within the uncertainties. It would be helpful to at least include a reference to this figure here so that the link between the statement and the figure is clear.	Government of Canada, Environment and Climate Change Canada
5182	6	15	6	16	This states that gross LULUCF emissions show no discernible trend. However, gross LULUCF removals appear to be growing (see the Global Carbon Budget of Friedlingstein et al. ESSD 2020).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5184	6	15	6	16	If CO2-LULUCF represents a high share of AFOLU, should there also be no discernible long-term trend? Could you distinguish the agriculture emissions here from LULUCF for additional policy-relevant information?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13374	6	15	6	16	It would be good to include a confidence statement here because this is a strong statement '-Net CO2-LULUCF emissions, which are subject to large uncertainties 16 and high annual variability, show no discernible long-term trend'.	Government of Kenya, Kenya Meteorological Service
13734	6	15	6	16	Please consider to quantify both anthropogenic gross emissions and uptake from the LULUCF sector, if possible.	Government of Norway, Norwegian Environment Agency
14426	6	15	6	16	If individual regions were considered rather than global averages, the large uncertainties in LULUCF should be lower and thus more manageable for mitigation.	Government of United States of America, U.S. Department of State
596	6	15	6	17	1. It is suggested to explain whether "Net CO2-LULUCF emissions" refers to the results obtained by LULUCF's carbon sink minus carbon emission or means otherwise. Because it is not clearly specified here. 2. When describing LULUCF emissions with large uncertainties and high interannual variability, it is suggested to give the associated uncertainty values.	Government of China, China Meteorological Administration
598	6	15	6	17	The confidence level is not consistent with the underlying report. There is no statement of medium confidence in the underlying report (from lines 15-17, page 4, and in line 1, page 6, Chapter 2). It is suggested to make verification and ensure consistency.	Government of China, China Meteorological Administration
2624	6	15	6	17	Because of the proximity of the concepts incorporated in CO2-LULUCF and AFOLU, it would be useful, in the context of such a summary for policy makers, to clarify matters and the link between the two.	Government of France, Ministère de la Transition écologique et solidaire
6300	6	15	6	17	In B.2.2, AFOLU as well as LULUCF are referred to as sectors to describe emissions from land use. This might be confusing for readers which are not familiar with the two approaches. As footnote 7 already describes differences in reporting emissions from land, the difference between AFOLU and LULUCF and why both approaches are used in the report should please be briefly explained as well.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6880	6	15	6	17	Please add a short explanation why "net CO2-LULUCF emissions ... are subject to large uncertainties and high annual variability" (maybe as a summary statement from footnote 7). Can a number be added to the statement "emission growth in AFOLU", even if it is uncertain, i.e. giving an uncertainty range?	Government of Jamaica, Meteorological Service Division
13042	6	15	6	17	B.2.2:Include a range for the rise in emissions and explain "... large uncertainties and high annual variability" for the net CO2 emissions.	Government of Gambia, Department of Water Resources



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3880	6	16	6	17	Unclear what emission growth in AFOLU is being compared to when it says emission growth is "more uncertain". More uncertain than what? In the TS (TS-23 lines 20-21) the comparison is to other sectors but here in the SPM, it is not clear what is being compared, especially as LULUCF emissions (previous sentence) have not shown a trend. Also, is the medium confidence (outside the final period) intended to apply to the last 2 sentences? These are general statements of fact and would not seem to need a confidence qualifier. There is no confidence qualifier with the last sentence where it appears in the TS.	Government of Canada, Environment and Climate Change Canada
6048	6	16	6	17	This sentence is not clear: "more uncertain ..." than what? Please clarify.	Government of Belgium, Belgian Science Policy Office - Belspo
11162	6	16	6	17	"Emissions growth is more uncertain" Suggest replacing "more" with another term such as "therefore". The previous sentence refers to uncertainty in LULUCF CO2 emissions. Therefore, saying that AFOLU emissions growth is "more uncertain" is confusing. More uncertain compared to what?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13624	6	16	6	17	Perhaps if emissions from agriculture were not combined with emissions/removals from forestry and land-use change, a different conclusion could be reached because these two emission sources could be dealt with separately. The previous sentence covers net CO2-LULUCF emissions (and their high uncertainty) and a standalone sentence about emissions growth from agriculture would be more policy relevant than the current sentence.	Government of New Zealand, Ministry of the Environment
14428	6	16	6	17	Not clear what is meant by "Emission growth in AFOLU is more uncertain due to the high share of CO2-LULUCF emissions."	Government of United States of America, U.S. Department of State
14430	6	16	6	17	This sentence is confusing and needs editing: "trend. Emission growth in AFOLU is more uncertain due to the high share of CO2-LULUCF emissions.7 (medium confidence)"	Government of United States of America, U.S. Department of State
14432	6	16	6	17	Clarify what is meant by the sentence "Emission growth in AFOLU is more uncertain due to the high share of CO2-LULUCF emissions." It is not clear to the reader why a high share of CO2-LULUCF emissions would result in more uncertainty for emissions growth. Perhaps add to the end of the sentence: "... uncertain due to the high share of CO2 LULUCF emissions, which are challenging to predict because ..."	Government of United States of America, U.S. Department of State
2626	6	17	6	17	A reference to TS.3 and TS.5 could be added (see page TS-23 lines 17-21, page TS-61 lines 16-17, page TS-12 lines 16-18)	Government of France, Ministère de la Transition écologique et solidaire
14434	6	17	6	17	Footnote 7 is an important one. These distinctions are also very important for understanding the estimates provided in Figure SPM. 1 and there should be some explanation there (page 6, line 4) about what CO2-LULUCF does or doesn't include, and that these are not total land use-related emissions, and that there are different views about what constitutes "anthropogenic".	Government of United States of America, U.S. Department of State
14436	6	17	6	17	In Footnote 7, regarding the large gap, which is higher? The estimate from the global models or the inventory reporting? Is there any indication about which is likely to be more accurate?	Government of United States of America, U.S. Department of State
2630	6	18	6	18	"Global energy efficiency improved by 2% between 2010–2019."  It would be interesting to mention how is energy efficiency measured ? Energy per unit of GDP ?	Government of France, Ministère de la Transition écologique et solidaire
3228	6	18	6	18	Chapter references in Figures are "isolated", apparently by design. Why not add them in the caption?	Government of France, Ministère de la Transition écologique et solidaire
6302	6	18	6	18	Given the very general definition of "energy efficiency" in the glossary, please clarify: what kind of data are the "2% yr-1" referring to? This is important since the rest of the paragraph deals with the carbon intensity of energy, not the energy intensity of output. The text in 2-4-20 to 2-4-25 is even clearer since it does not need these expressions: "Globally, GDP per capita and population growth remained the strongest drivers of CO2 emissions from fossil fuel combustion in the last decade (robust evidence, high agreement). Trends since 1990 continued in the years 2010 to 2019 with GDP per capita and population growth increasing emissions by 2.3% and 1.2% yr-1, respectively. This growth outpaced the reduction in the use of energy per unit of GDP (-2% yr-1, globally) as well as improvements in the carbon intensity of energy (-0.3%yr-1)."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11164	6	18	6	18	What does "Global energy efficiency" mean in this context? Is this a combined indicator such as ODEX used in the EU? Or is it energy intensity? In chapter 2 at page 50 line 11 this is defined as Energy Intensity and the same in figure 2.20. By the way, the improvement in energy intensity in chapter 2 at page 50 line 11 is estimated at 1.5% per year, while in the SPM is at 2% per year, which number is the correct one?	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12994	6	18	6	18	Why do we specifically use the time horizons of 2010-2019 and 2000-2009? The time horizons are not coherent across B.2 or with figure SPM.1. I suggest we maintain consistency in time periods as well as expand to historical or pre-industrial time periods. This would be very valuable for policymakers.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
14438	6	18	6	18	"Global energy efficiency": Does this mean "efficiency of global energy production"?	Government of United States of America, U.S. Department of State
5186	6	18	6	19	Suggest to harmonise the language. The first sentence uses "improved" when referring to energy efficiency. The second sentence uses "decreased" where referring to carbon intensity. Both are improving or decreasing and it would be clearer to use the same word.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9880	6	18	6	19	how is 'global energy efficiency' calculated? Units? And 'carbon intensity: what are the units? Neither glossary or Annex II seem to provide the answers	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11166	6	18	6	19	How is the "carbon intensity of energy supply" defined? Is it only electricity, or all energy? Does it include CO2 emissions from bioenergy (biogenic emissions are explicitly excluded elsewhere, but not here)?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
600	6	18	6	21	The relevant content and data are not consistent with the underlying report (line 6, page 6, Chapter 2), which are suggested to be verified and consistent.	Government of China, China Meteorological Administration
13510	6	18	6	21	Does mentioning "switching from coal to gas" first mean that it is the principal reason why "carbon intensity of energy supply decreased"? It would seem that the "reduced expansion of coal capacity" and "increased use of renewables" would be more significant reasons?	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
94	6	18	6	23	The naming of scenarios is misleading. First, the likelihood is missing in C1 scenarios, the names should reflect the likelihood of "more likely than not". Second, as indicated in the footnote, limiting warming to 1.6 is included in scenarios limiting to 1.5, this is confusing for the decision makers as it is not clear the case of other levels such as 1.7, for example. There is a need to carefully verify the range of each scenario or category of scenarios and provide the likelihood in the name consistently.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
874	6	18	6	23	The use of fractions (one sixth to one ninth) is challenging even for native speakers. Suggest use percentages	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2628	6	18	6	23	This paragraph begins with a sentence about energy efficiency and everything that follows in the paragraph is about carbon intensity. These are two different concepts, and a linking term between the first sentence and the rest would clarify the reading. For example, insert "Similarly" at the beginning of the sentence starting with "Carbon intensity of energy...".	Government of France, Ministère de la Transition écologique et solidaire
3882	6	18	6	23	In B.2.3 (p6), the Summary acknowledges a decline in carbon intensity of energy supply from 2010-2019 due to fuel switching (coal to gas), but there is no other discussion or assessment of how and to what extent fuel switching would contribute to reductions under different scenarios. The report itself does contain multiple disparate references to fuel switching (chapter 3 for example), but it would be useful and appropriate to include dedicated reference to contributions of fuel switching to reductions forecasts in the Summary.	Government of Canada, Environment and Climate Change Canada

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12482	6	18	6	23	<p>Section B.2.3 should be rewritten as follows:                      "Global energy intensity of GDP reduced by 2% yr-1 between 2010–2019. Carbon intensity of energy supply decreased by 0.3% yr-1 over the same period, reversing the increasing carbon intensity of energy supply during 2000–2009".                      Reason 1: The sentence in the SPM attributes the reduction of 2% per year to improvements in global energy efficiency, which seems ambiguous, as it does not provide clarity as to how this global energy efficiency result has been arrived at?                      The following sections from Chapter 2 (Executive Summary, line numbers 22-25; Sec 2.4.1, line numbers 15-22 and Fig 2.16) from where this sentence has been referenced reads as follows:                      "Trends since 1990 continued in the years 2010 to 2019 with GDP per capita and population growth increasing emissions by 2.3% and 1.2% yr-1, respectively. This growth outpaced the reduction in the use of energy per unit of GDP (-2% yr-1, globally) as well as improvements in the carbon intensity of energy (-0.3% yr-1)."                      "The main counteracting, yet insufficient, factor that led to emissions reductions was decreased energy use per unit of GDP in almost all regions (-2.0% yr-1 between 2010 and 2019 globally (Figure 2.16), see also (Lamb et al., 2021b) (robust evidence, high agreement). These reductions in energy intensity are a result of technological innovation, structural changes, regulation, fiscal support, and direct investment, as well as increased economic efficiency in underlying sectors (Yao et al., 2015; Sanchez and Stern, 2016; Chang et al., 2019; Dong et al., 2019a; Mohammed et al., 2019; Stern, 2019; Azhgaliyeva et al., 2020; Goldemberg, 2020; Gao et al., 2021; Liddle and Huntington, 2021; Xia et al., 2021; Liu et al., 2019b)."                      As indicated by the above statements, this 2% annual reduction is a reduction in the energy intensity (energy per unit of GDP) which cannot be assumed to be a resultant of improvements in global energy efficiency alone. For e.g., structural changes in the economy are capable of majorly affecting energy intensity, but may not necessarily be related to energy efficiency improvements.                      Since changes in carbon intensity are also attributable to many reasons, to mention only a few is not necessary here.                      Also remove the sentence "However the current rate... 2 deg. C".                      Reason 2: This is a comparison with a specific scenario in the literature and this section is speaking of existing changes. A scenario comparison is not relevant here.</p>	Government of India, Ministry of Environment, Forests and Climate Change
11902	6	19	6	20	<p>B.2.3: In the sentence on the reduction in carbon intensity, is the ordering of the causes (switch from coal to gas, reduced coal expansion and renewables) indicative of their relative importance? In terms of the effect per unit of energy, the expansion of renewables and the switch from coal to renewables are surely the most important. Starting this list with the switch from coal to gas implies that this is the key driver, which is misleading given that Paris Agreement compatible pathways see a reduction in the use of gas. Please reorder or remove the coal-to-gas switch and simply keep the reduced coal expansion and increased use of renewables.</p>	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
14440	6	20	6	20	<p>Recommend a change from "increased use of renewables" to something more precise, like "increased use of low-carbon energy sources". Not all renewables added to the grid during this time were carbon-mitigating, and nuclear power, while not typically considered renewable, contributed to carbon mitigation worldwide through both capacity and capacity factor increases. Between 2010 and 2019, plants were shut down (primarily after the Great Japan Earthquake and Tsunami in 2011) but, due to improvements in capacity factors as well as some new builds, annual nuclear generation globally was higher in 2019 than in 2010.</p>	Government of United States of America, U.S. Department of State
11168	6	20	6	21	<p>Consider adding "trend" after "increasing carbon intensity".</p>	Philippe Tulkens, European Union (EU) - DG Research & Innovation
10	6	21	6	23	<p>This sentence lacks clarity: Is the current rate of reduction in carbon intensity adequate for limiting warming likely to 2°C? Or should this rate be enhanced six times to meet that goal or is such enhancement only required to limit warming to 1.5°C? Or should it better be even nine times enhancement? And if so - what is the corresponding confidence? The following structure of the sentence is suggested: However, the current rate of reduction in carbon intensity is only about .... to ... of the rates of reduction in scenarios that are likely to limit warming to 2°C and only about ... to ... of the rates of reduction in scenarios that are likely to limit warming to 1.5°C.</p>	Government of Austria, Federal Ministry of Agriculture, Forestry

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2636	6	21	6	21	Timeframe to be precised : "current"potentially refers to the average value over 2010-2019, but this should be explicit, not to the latest available value. Sentence proposal : 'However, the rate of reduction in carbon intensity observed between 2010-2019 is only...'	Government of France, Ministère de la Transition écologique et solidaire
5188	6	21	6	21	Needs to be specific that it is the 'carbon intensity of energy supply' being referred to here to avoid confusion with other possible carbon intensities (e.g. of GDP)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2634	6	21	6	22	What is the meaning of 'about' if a range is given ? We guess that the "likely" is assigned to this range	Government of France, Ministère de la Transition écologique et solidaire
5190	6	21	6	22	Please provide the absolute value of the rates needed in addition to the "one sixth to one ninth", as relative numbers are tricky and subject to misinterpretation when the growth is close to zero.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5192	6	21	6	22	Needs to be specific over what time period the scenario rate of change is calculated for to be fully transparent.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5194	6	21	6	22	Suggest to be consistent with the report and use percentages rather than fractions in describing the current rate of reduction in carbon intensity in relation to necessary reductions for 1.5	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13158	6	21	6	22	"one sixth to one ninth of the": translate to percentages. Use the same entity throughout the document	Government of Switzerland, Federal Office for the Environment FOEN
602	6	21	6	23	1. It lacks sufficient support to put a high confidence level on the conclusion that "The current rate of reduction in carbon intensity is only one sixth to one ninth of the rates of reduction in scenarios that limit warming to 1.5°C...to 2°C", because carbon intensity is only one aspect of emissions reductions. It is suggested to change it to a medium confidence level. 2. One sixth corresponds to 2°C and one ninth corresponds to 1.5°C. The expressions may be ambiguous and it is suggested to verify them and make them easy for decision-makers to understand.	Government of China, China Meteorological Administration
2426	6	21	6	23	Suggest moving sentence to B.1	Government of Denmark, Danish Meteorological Institute
2632	6	21	6	23	The sentence seems to be unclear. We suggest to divide it into two sentences	Government of France, Ministère de la Transition écologique et solidaire
6050	6	21	6	23	To improve clarity, we suggest to write "However, the current rate of reduction in carbon intensity is only about one ninth to one sixth of the rates of reduction in scenarios that respectively limit warming to 1.5°C with no or limited overshoot, or are likely to limit warming to 2°C."	Government of Belgium, Belgian Science Policy Office - Belspo
9882	6	21	6	23	the conclusion that 'current rate of reduction in carbon intensity is only about one sixth to one ninth of the rate of reduction in scenarios limiting warming to 1.5 C' should be promoted to a headline statement given its importance- and suggest to turn the phrase around: the current rate of reduction in carbon intensity would need to increase six to nine-fold for warming to be limited to 1.5 C with no or limited overshoot or to likely to 2 C. And suggest to provide numbers as as well - we understand that the current rate of reduction of carbon intensity is 0.3% per year.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
14442	6	21	6	23	This sentence states that the current rate of reduction is one-sixth to one-ninth of the rates needed in scenarios for 1.5 and 2°C, but how are those values linked? Does that range apply to both pathways or is the one-sixth supposed to be linked to 2°C and one-ninth to 1.5°C?	Government of United States of America, U.S. Department of State
14444	6	21	6	23	This sentence is out of place here, in a section which is entirely factual. It switches to an as-yet undescribed set of scenarios and norms proposed in them. Omit it here (although it may have a place in a later, more relevant section of the SPM).	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11904	6	22	6	23	B.2.3: This sentence is misleading as it implies that pathways with low or limited overshoot are also "likely to limit warming to 1.5°C". Similar sentence structures are used throughout this SPM and a more clear structure should be considered.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
15624	6	22	6	23	Here and in many instances in the SPM, one single statement is made on scenarios that limit warming to 1.5°C with no or limited overshoot and likely to limit warming to 2°C. Such statements should not be combined but instead, findings should be presented individually for 1.5°C and 2°C scenarios. Political discussions and not least the Glasgow Climate Pact reemphasise the focus on 1.5°C, and this SPM needs to be relevant in this regard. 1.5°C is a matter of survival for small islands, every increment of a degree matters, and the SPM must provide adequate information on getting us there.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
536	6	23	6	23	For Footnote 8, there are some overlaps for scenarios that limit warming to 1.5°C in 2100 with a probability of 50% or greater, and have a probability of exactly 67% of exceeding warming of 1.5°C at some point during the 21st century. This p(exceed 1.5)=67% scenario could either fall under "scenarios limiting warming to 1.5°C with high overshoot" or "scenarios limiting warming to 1.5°C with no or limited overshoot". Suggest to be clearer which scenario p(exceed 1.5)=67% will fall under, e.g. by amending the "no or limited overshoot" scenario from a "probability of 67% or less" to a "probability of less than 67%"	Government of Singapore, Ministry of Environment and Natural Resources
2238	6	23	6	23	Consider converting Footnote 8 to a table.	Government of Australia, Department of Industry, Science, Energy and Resources
3884	6	23	6	23	Footnote 8: We are concerned about the lack of consistency between the description of the scenario categories here and how the same scenario categories are described in the footnotes to Table SPM.1. Here, the scenario categories are described in terms of limiting warming TO a specified level (e.g. 1.5C, 2C) whereas in the footnotes to Table SPM.1, the same scenario categories are described in terms of limiting warming TO BELOW a specified level (e.g. 1.5C, 2C). As per our general comment on this topic, we recommend consistent use of "to BELOW a GW level". We note that Table 3.1 also uses the "TO BELOW" 1.5C, 2C language to categorize the various scenarios. Also, please specify that the 3rd group of scenarios described - the ones described as scenarios limiting warming to 1.5C with high overshoot - are those referred to as category C2 in Table SPM.1 (and table 3.1).	Government of Canada, Environment and Climate Change Canada
3886	6	23	6	23	Footnote 8 may include the pros and cons of overshoot. The implication of overshoot is not well understood.	Government of Canada, Environment and Climate Change Canada
11906	6	23	6	23	B.2.3, footnote 8: The pathway information contained in this footnote is critical and must be presented in a way that can be fully absorbed by readers, including information on the rationale for assessing "pathways compatible with the Paris Agreement" as per Chapter 3 approved outline. Placing this information in a footnote, and in a footnote as part of a bullet that otherwise does not talk about pathways, does not give this critical information the appropriate space, and could even be confusing. Similar to the WGI SPM, this important pathway information could be elevated to a box? It is fundamentally important that categories and associated likelihoods can be more easily digested and interpreted. Also, the C2 category is not mentioned in the footnote text.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13736	6	23	6	23	Please also add a reference to Table SPM.1 in the footnote 8 where relevant.	Government of Norway, Norwegian Environment Agency
14446	6	23	6	23	In Footnote 8, the phrase "scenarios that limit warming to 1.5°C in 2100" is misleading and should be stated more clearly, such as: "scenarios in which warming exceeds 1.5°C (in mid-century) and, with substantial negative emissions, then is modeled to return to 1.5°C in 2100." This kind of language has led to confusion and misunderstanding among policymakers and the public about what 1.5°C scenarios are, believing that temperatures do not rise above 1.5°C ever.	Government of United States of America, U.S. Department of State
14448	6	23	6	23	In Footnote 8, does "and have a probability of 67% or greater of exceeding warming of 1.5°C at some point during the 21st century, are referred to as scenarios limiting warming to 1.5°C with high overshoot" mean a "high" overshoot? It seems to be mixing up concepts between the likelihood that 1.5°C would be exceeded with the amount by which it might be exceeded, and those two concepts should be kept separate. Indeed, since the methods for estimating probabilities in these scenarios are crude, at best, it makes more sense to identify the temperature amount (and time period) of the overshoot. This belongs in the main text in a section that describes the scenarios. Policymakers do not read footnotes and the nature of the scenarios is too important to relegate. When the SPM discusses probabilities, it should be clear about what it means by them (how they were derived), as it is not from probabilistic modeling or any strong method for estimating probabilities.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14450	6	23	6	23	Footnote 8 would communicate better as a table, rather than text.	Government of United States of America, U.S. Department of State
6882	6	23	6	24	Footnote 8 with this important information is overwhelming here and does not fit well. It should instead be moved to an introduction section or a Box. Otherwise this information will get lost, which would be detrimental to ensuring that the SPM can be understood by all readers.	Government of Jamaica, Meteorological Service Division
13512	6	23	6	24	It is unclear why the information explaining the different scenarios is almost hidden away in this footnote. This should instead be moved to a prominent place in the SPM, possibly at the start of section C where it would make the most sense. It is of utmost importance that policy makers are presented with the scenario information which play such an important role in the SPM and the WGIII report as a whole.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
772	6	24	6	24	Footnote 7. Please, clarify which flux is meant: land-atmosphere or atmosphere-land. Is it a net-flux? This footnote is unclear and some editing is needed.	Government of Russian Federation, Institute of Global Climate and Ecology
774	6	24	6	24	Footnote 8 and in all the text further on: why 67% instead of 66% as used in footnote 2 in accordance with Mastrandrea M.D., Field C.B., Stocker T.F., Edenhofer O., Ebi K.L., Frame D.J., Held H., Kriegler E., Mach K.J., Matschoss P.R., Plattner G.-K., Yohe G.W., Zwiers F.W. 2010. Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties. IPCC Cross-Working Group Meeting on Consistent Treatment of Uncertainties. Jasper Ridge, CA, USA 6-7 July 2010. <u>Intergovernmental Panel on Climate Change (IPCC)</u>	Government of Russian Federation, Institute of Global Climate and Ecology
5196	6	24	6	24	"Currently, there is a large gap of ~5.5 GtCO <sub>2</sub> yr <sup>-1</sup> between land fluxes reported by global models used here, and the aggregate global levels derived from national GHG inventories." Could you please clarify in which direction the gap lies i.e. are emissions lower in inventory reports.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5198	6	24	6	24	Footnote 7 could briefly explain the difference between LULUCF and AFOLU and how they are related to help the reader navigate through the text.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5200	6	24	6	24	Footnote 8: The categorisation for low/high overshoot is needlessly complex and highly likely to confuse readers as it is currently written. It could be substantially simplified by removing the categorisation based on greater or less than 67% chance of exceeding warming at peak and relying entirely on much simpler categorisation of peak warming being lower than 1.6 with 50% of greater chance as the footnote makes clear that this identifies the same scenarios.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6052	6	24	6	24	Footnote 8 is too long, with a lot of text to explain scenarios. Could that be provided as a table?	Government of Belgium, Belgian Science Policy Office - Belspo
6304	6	24	6	24	_SCENARIOS AND PATHWAYS - TRANSPARENCY: Very important information about the categorization of pathways used in this report, including the relation between the C-categories and the IPs/IMPs as well as the mapping with WG I and the SSP framework, is provided in footnote 8, the footnotes to Table SPM.1, and the caption to Figure SPM.6. However, such important information should not be hidden in footnotes, but should be presented in a box, including possibly building on Box TS.5 Table.1 as well as 3-11 last paragraph.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2170	6		6		Footnote 8 does not specify or mention scenarios C3a ja C3b.	Government of Finland, Finnish Meteorological Institute (FMI)
	6		6		There is an inconsistency between the 2019 GHG emissions indicated here and displayed in figure SPM1 (around 59 Gt CO <sub>2</sub> -e) and those discussed in section B6, figure SPM5 and table SPM1. I think that this arises from different levels for 2019 from emission inventories and from IAM models. There should be a way to reconcile these approaches and make sure that future emission changes are reported against the estimate of 2019 level.	WGI Bureau,
12404	7	1	7	5	The headline need to be improved, If Access to modern energy will contribute to reduced emission it should be clearly stated in the headline statement B3	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
776	7	1	7	1	The term 'mirror' is a bit misleading here, because the differences cannot be explained by the inequalities for 100%. Please, replace 'mirror' with 'reflect first of all the'.	Government of Russian Federation, Institute of Global Climate and Ecology

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
778	7	1	7	1	Suggestion: replace 'regions and' with 'regions, countries and'	Government of Russian Federation, Institute of Global Climate and Ecology
2652	7	1	7	1	Please specify between regions or between households at different scales	Government of France, Ministère de la Transition écologique et solidaire
5210	7	1	7	1	'mirror' implies a 1-to-1 mapping which is clearly too strong for this statement. Could be replaced by 'associated with' or similar.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9772	7	1	7	1	Add at the start of B.3 : Global GHG emissions are distributed unevenly across regions, both currently and historically.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12484	7	1	7	1	Replace sentence by: "Differences in emissions mirror income inequalities between regions globally and between households globally (high confidence)." Reason: Rewriting reflects the literature from the chapter and rest of Sec B.3	Government of India, Ministry of Environment, Forests and Climate Change
1222	7	1	7	15	Please consider adding relevant information on land use change related emissions (CO2-LULUCF) either in B.3.1 or as a new paragraph B.3.x, to complete the overall information on anthropogenic GHG fluxes.	Government of Sweden, Swedish Meteorological and Hydrological Institute
12382	7	1	7	15	According to Ch5.P26.L8-15. It could be mentioned that some studies suggest no relationship between emissions and income inequality in short term(Wu and Xie, 2020).	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
11172	7	1	7	18	Comment on energy access improvement - B3 lines 2-3 & B3.2 lines 16-18: Instead of referring to the impact of providing universal energy access as "marginal", it would be better to place the formulation "at most a few per cent" in the headline statement rather than in B3.2 (lines 16-18). Also, B3.2 should clarify the basis for saying that the effect is only marginal / at most a few per cent, otherwise it could be misinterpreted. It is simply not true that only emissions from high income groups affect the climate. In particular, it would be useful to highlight how energy access can be improved at low (or even negative) environmental impact. E.g. from chapter 2: "Shifts from biomass to more efficient energy sources and collective provisioning systems for safe water, health, and education are associated with reduced energy demand". The great importance of technological leapfrogging so that the industrialisation phase (highly reliant of fossil fuels) is bypassed and the access is as much as possible to clean energy.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14458	7	1	7	18	It is not clear why providing universal access to modern energy would only increase global emissions by a few percent. That seems counter-intuitive to much of the rest of the findings on this page. Additional context would be helpful.	Government of United States of America, U.S. Department of State
2206	7	1	7	2	First sentence could be reformulated. Does it talk about differences in regional emissions? Perhaps start by defining that?	Government of Finland, Finnish Meteorological Institute (FMI)
2240	7	1	7	2	Consider replacing 'income inequality' with 'income level or 'differences in economic prosperity' to avoid confusion. Currently the sentence could be interpreted as stating that emission levels vary according to the extent of income inequality within countries, whereas the intended message is that emission intensity varies according to income level (i.e. wealthier countries and households emit more).	Government of Australia, Department of Industry, Science, Energy and Resources
3888	7	1	7	2	Should it be "differences in emissions per capita" rather than "differences in emissions"?	Government of Canada, Environment and Climate Change Canada
9894	7	1	7	2	(B3 and Footnote 6): Explain what "access" to modern energy implies, e.g. what (basic) levels are assumed to be provided.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
13438	7	1	7	2	B.2 and also elsewhere. What is meant by emissions here. Are these total emissions per country? Per capita? CO2? GHG? Air pollution (the term of modern energy is associated with air pollution). Please be precise.	Government of Estonia, Estonian Meteorological & Hydrological Institute
14452	7	1	7	2	Differences in GHG emissions do not mirror income inequalities at the country level. There are large differences in per capita energy consumption and GHG emissions/GDP in countries with similar per capita GDP levels.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
604	7	1	7	23	<p>B1, B2, and B3 evaluate global GHG emissions. Given that B1 focuses on overall changes and B2 sectoral differences, B3 should have expounded on regional differences and the underlying causes. Instead, it misplaces emphasis on income imbalances, overlooking the fact that countries are in different stages of development and that the per capita GHG emissions in the three major developing countries are less than half of those in developed countries. Without showing that regional differences result from different levels of development, B3 might mislead decision-makers.</p> <p>By logic, B3 should have discussed the regional differences resulting from the primary reason: different stages of development. Income imbalance is only a secondary cause. Though B3.3 points out that developed countries have reduced emissions during economic growth, it overlooks the fundamental reason behind the decoupling: those countries have transferred emissions in production while emissions in the consumer's market tell a different story. The 24 countries in this part are cited from a single source, making it underrepresented. We suggest a re-write of B3. The suggestions are:</p> <p>The B3 headline. By logic, B3 should explore regional differences and causes in GHG emissions. We suggest that the headline statement of B3 should center on the causes of the increasing global GHG emissions, expounded in current B3.1. The headline statement should also emphasize the characteristics of regional differences--the per capita emissions of developed countries are much higher than the three major developing countries. This part has been expounded in current B3.2.</p> <p>Therefore, it is suggested to change the B3 headline to:</p> <p>Globally, Gross Domestic Product (GDP) per capita and population growth remained the strongest drivers of CO2 emissions in the last decade (high confidence). GHG and CO2-FFI levels diverge starkly between countries and regions (high confidence). Developed Countries sustained high levels of per capita CO2-FFI emissions at 9.5 t CO2/cap in 2019, which is more than double that of the three developing regions.</p> <p>The Section B3.1. According to B3 headline, Section B3.1 should give the main causes of global GHG emissions, i.e., economic growth and population growth contribute positively to global GHG emissions, while changes in energy intensity and carbon intensity contribute negatively to global GHG emissions. It is suggested to revise B3.1 to:</p> <p>B3.1 From 2010 to 2019, GDP per capita and population growth increased emissions by 2.3% and 1.2% yr-1, respectively. This growth outpaced the reduction in the use of energy per unit of GDP (-2% yr-1, globally) as well as improvements in the carbon intensity of energy (-0.3% yr-1). {2.4.1, Figure 2.19}</p> <p>The Section B3.2. According to B3 headline, Section B3.2 should give the regional differences in global GHG emissions. In terms of current emissions, developed countries contribute 27% of the world's GHG emissions with 16% of the global population, while per capita emissions in developed countries are at least twice as high as those of developing countries. In terms of historical accumulation, developing countries account for 28% of cumulative emissions from 1850-2019. It is suggested to revise B3.2 to:</p> <p>B3.2 Developed countries with 16% global population emitted 27% of global GHG emissions in 2019. Average 2019 per capita CO2-FFI emissions in three developing regions Africa (1.2 tCO2), Asia and developing Pacific (4.4 tCO2), and Latin America and Caribbean (2.7 tCO2) remained less than half of developed countries 2019 CO2-FFI emissions (9.5 tCO2). Historically, these three developing regions together contributed 28% to cumulative CO2-FFI emissions between 1850 and 2019, whereas developed countries contributed 57%, and least</p>	Government of China, China Meteorological Administration
1220	7	1	7	23	<p>There are also significant differences within the regions which are used in the SPM to characterise the amount and of emissions and their trends. Section B.3 compares regions on one hand, and households on the other. Differences between countries are mentioned only by "some countries have" (B.3) and "at least 24 countries" (B.3.3), but this does not make it clear that the regions are homogeneous.</p>	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
9404	7	1	7	23	<p>The boundary of CO2 emissions is explicitly stated in some cases as being territorial and consumption-based (B.3.2) or production-based (Figure SPM.3), but in other cases, including those of GHG emissions, there is no such statement. Also, mixed descriptions of CO2 and GHG may be confusing. We would like to see a revision to make them clearer overall.</p>	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
13738	7	1	7	23	<p>The text in B3 contains very valuable regional information on historical emissions and their regional distribution. This is very useful information from a policy-making perspective and the inclusion of this information in the SPM is supported. Please keep.</p>	Government of Norway, Norwegian Environment Agency



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14460	7	1	7	23	Section B.3 almost entirely refers to historical data except for two statements. Page SPM-7, lines 2-3, states, "Providing universal access to modern energy would increase global CO2 emissions marginally," and this point is made again in B.3.2 on SPM-7, lines 16-18, "Providing universal access to modern energy in these regions would increase global GHG emissions by at most a few percent. (high confidence) (Figure SPM.3) {2.6, 6.7}." Unlike the rest of B.3, these statements appear to be about a modeled future, and the specific assertion is contingent on what scenario is being modeled, which is not specified. Under a scenario with little to no climate policy, providing universal access to modern energy might involve significant expansion of fossil fuel-based generation and result in increased emissions; whereas, under a 1.5°C scenario, providing universal access to modern energy may be accomplished by leapfrogging fossil generation technologies and might be accomplished while also decreasing emissions. The point made here is important, but it is made as an afterthought in both the topline statement B.3 and in the underlying B.3.2. Instead, it would be worth making this point with the appropriate context in a new B.3.4 that discusses the importance of providing universal access to modern energy and how the emissions implications are generally expected to be marginal but can vary depending on the scenario.	Government of United States of America, U.S. Department of State
14462	7	1	7	23	Throughout Section B.3, there is a general lack of specificity as to the country groupings.	Government of United States of America, U.S. Department of State
2650	7	1	7	3	The two sentences seem contradictory. It would be useful to indicate that modern energy refers to decent living standards and minimum energy requirements as in page TS-24 lines 21-24 and footnote 10. The equivalent of the second sentence has high confidence at page TS-24 lines 12-22 and chapter 2 page 2-6 lines 19-20. A reference to TS.3 could be added.	Government of France, Ministère de la Transition écologique et solidaire
11170	7	1	7	3	Consider rephrasing the beginning of the headline. What are the authors trying to say here? That emissions are (strongly) positively related to income? Or that inequality increases emissions? I presume it is the former, but readers may understand the latter. Is there really evidence that equality reduces emissions (irrespective of its other merits)?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
606	7	1	7	5	The B3 headline. By logic, B3 should explore regional differences and causes in GHG emissions. We suggest that the headline statement of B3 should center on the causes of the increasing global GHG emissions, expounded in current B3.1. The headline statement should also emphasize the characteristics of regional differences--the per capita emissions of developed countries are much higher than the three major developing countries. This part has been expounded in current B3.2. Therefore, it is suggested to change the B3 headline to: Globally, Gross Domestic Product (GDP) per capita and population growth remained the strongest drivers of CO2 emissions in the last decade (high confidence). GHG and CO2-FFI levels diverge starkly between countries and regions (high confidence). Developed Countries sustained high levels of per capita CO2-FFI emissions at 9.5 t CO2/cap in 2019, which is more than double that of the three developing regions.	Government of China, China Meteorological Administration
890	7	1	7	5	"Mirror" is not correct and seems poorly considered given points on reductions made earlier, it also misses major differences withing economies and regions. The message to policy is?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
892	7	1	7	5	Renewable energy *is* modern energy and cost effective, see later SPM data. What is the message for policy?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
894	7	1	7	5	Very mixed group of sttements: clarify or delete.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5204	7	1	7	5	Despite footnote 9, the term 'modern energy' is still not clear, and could be confused with a low-carbon or renewable-based energy system, meaning this paragraph could imply that giving universal access to such an energy system would increase emissions. This could be resolved by changing the sentence to 'Providing universal access to modern energy would increase global CO2 emissions marginally, but this would be more than offset by the transformation to a low-carbon energy system', making it a more balanced statement.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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5206	7	1	7	5	This section could also discuss the distribution of emissions from AFOLU, to stress that action on AFOLU can be taken even by those countries that have low energy emissions (with support from developed countries). The focus on the energy sector here provides only part of the picture.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5208	7	1	7	5	It feels like a simplistic or naive statement to say that 'providing universal access to modern energy would increase global CO2 emissions marginally'. This is surely dependent upon the energy generation method. There's a large number of people to add to the demand side, based in developing countries largely.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12280	7	1	7	5	Ch5.P26.L8-15. It could be mentioend that some studies suggest no relationship between emissions and income inequality in short term(Wu and Xie, 2020).	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
13160	7	1	7	5	The lead should take up each most important finding from the subparas that follow the lead (SEE ALSO the general comments). Here, we are missing the findings on "per capita".	Government of Switzerland, Federal Office for the Environment FOEN
14454	7	1	7	5	This is good as far as it goes. Perhaps a point that links inequalities not only to energy but to land use/management would make it even stronger.	Government of United States of America, U.S. Department of State
14456	7	1	7	5	This headline statement seems to switch to some kind of policy analysis. There are at least three different concepts in this one paragraph and it confuses more than it helps.	Government of United States of America, U.S. Department of State
13166	7	1	9	16	B.3 and the associated figures do mix up the assessment entities: B.3. and the title of SPM2 speak of the differentiation between regions. In the text and in the figures, however, the assessment do mix up the assessment per region with other differentiation methods like developing and developed countries (and least developing countries) as well as with household incomes. Please differentiate between assessing the regional differences and the assessment between other entities, like the household income.	Government of Switzerland, Federal Office for the Environment FOEN
13168	7	1	9	16	If you have relevant findings for the differentiation between developing and developed countries, then first, make a footnote explaining on how this differentiation is made (OECD? UNFCCC Annex?). Second, when depicting the difference between developing and developed countries, also show the per capita contributions.	Government of Switzerland, Federal Office for the Environment FOEN
5202	7	1	9	19	Throughout this sectio, groupings of countries, either regionally or along developing/developed lines are not consistent, nor logical or transparent. It needs to be clear why specific groupings have been used (ideally showing that the groupings are representative of their members), that they can be compared with other analyses (particularly within the WGIII report but also across all the WG reports and aligned with the UNFCCC) and it must be obvious which countries are in groups when they are used. The definitions of 'least developed countries' and 'developed countries' are not stated in the report and should be explained. If 'least developed countries' corresponds to the Least Developed Countries, as recognised by the UN, then the phrase should be capitalised for clarity.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13740	7	1	9	19	In the paragraphs in B3 and in figure SPM.2 and SPM.3, the reader might be confused whether the emission numbers and shares represent territorial or consumption based emissions (CBE). Please consider clarifying in the text, and/or additionally reflecting results from chapter 2.3.1, in particular that the share of emissions from developed countries is higher if considering CBE vs. Production-based emissions or territorial emissions.	Government of Norway, Norwegian Environment Agency
12300	7	1	7	1	images of third row have not good quality, they are not obvious	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
14466	7	2	7	17	Rephrase and also change footnotes. "modern energy use" excludes renewable energy forms.	Government of United States of America, U.S. Department of State
5214	7	2	7	18	lack of consistency in confidence about impact of providing universal energy access between lines 2-3 (medium confidence) and lines 17-18 (high confidence)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2458	7	2	7	2	Please avoid use of footnotes in headline statements; these should preferable be able to stand alone	Government of Denmark, Danish Meteorological Institute
2468	7	2	7	2	The term Modern energy might be mistaken as renewable energy. Suggesting writing access to electricity or clean cooking services as in line 16	Government of Denmark, Danish Meteorological Institute
2654	7	2	7	2	In order to remain policy relevant and consistent with the framing introduced in section A, it would be more relevant to use the framework of the sustainable development goals. This framework, through SDG 7, does not refer to solely "modern energy" but rather access to "affordable, reliable, sustainable and modern energy".	Government of France, Ministère de la Transition écologique et solidaire

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11174	7	2	7	2	Footnote 9: Does "electricity" imply (national) grid connection or also autonomous sources? Suggest replacing "that reduce indoor" with "low or no indoor", as the definition of "modern energy" should be independent of what it replaces or whether it replaces anything (it can be a new source due to expanding demand).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
102	7	2	7	3	B.3. states, "Providing universal access to modern energy would increase global CO2 emissions marginally (medium confidence)" In light of SE4ALL principles of "affordable and sustainable energy", that encompasses all fuels and technologies, hence, encompasses various GHG emissions, therefore, the focus should be on GHG regardless of sources. It is imperative that the SPM is reflective of IPCC's definition of ALL identified gases contributing to global warming. Replacing "CO2 emissions" with "GHG emissions" will bring better balance to the text.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
116	7	2	7	3	In the following statement in B.3 "Providing universal access to modern energy would increase global CO2 emissions marginally". The use of the term "marginally" is not quantified and should be replaced with a quantifiable term.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2208	7	2	7	3	The second sentence of the headline statement B.3 seems to talk about the future development, although the figures and sub-paras are about historical. Please consider placing the sentence elsewhere in the SPM or reformulating.	Government of Finland, Finnish Meteorological Institute (FMI)
2242	7	2	7	3	Footnote 9: it would be useful to indicate whether a particular energy mix is assumed in the definition of 'modern energy' (e.g. what mix of renewables and fossil fuels is assumed?). Since lines 2-3 state that access to modern energy would increase emissions, there must be some fossil fuels in that mix. It is unclear what 'marginally' means here - suggest providing an estimate in percentage terms. Suggest more context is needed for Figure SPM.3 to demonstrate how it backs-up this comment.	Government of Australia, Department of Industry, Science, Energy and Resources
5212	7	2	7	3	The summary line about the climate impacts of universal energy access is misleading in its drafting and also needs qualification/context. If the sentence read "...may increase emissions only marginally" that would be clearer and more likely to be correct. It should also however be qualified by saying something similar to "however this depends strongly on the way in which universal energy access is provided" (at the moment the sentence is unqualified in terms of how energy access is achieved).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6884	7	2	7	3	"Providing universal access to modern energy would increase global CO2 emissions marginally": What message is intended here? The current formulation could be misleading, suggesting that providing energy for all would be bad for the climate, even if just "marginally" or "a few percent". Couldn't the provision of universal no-emissions energy also not increase emissions at all? Please phrase this high-level statement more carefully.	Government of Jamaica, Meteorological Service Division
9776	7	2	7	3	B.3: This seems a confusing and non factual statement that is based on a very specific interpretation of modern energy use: energy demand needed to support decent standards of living. However, this qualification is missing: providing access to modern energy may well result in much higher emissions if going up with increasing development / income levels. It is proposed to delete as it is more about the future than the present state and substitute with a statement from B3.2 : Globally, households with income in the top 10% contribute 36–45% of global GHGs, with about two thirds living in developed countries and one third in other economies.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
10292	7	2	7	3	This statement is qualified with medium confidence, but the same statement below (lines 16-18) is qualified with high confidence.	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
13044	7	2	7	3	B.3: There is need for more clarity regarding, "Providing universal access to modern energy would increase global CO2 emissions marginally" to enhance clarity as this is confusing and may be taken to imply that this is not the best decision/option for policymakers and other actors.	Government of Gambia, Department of Water Resources
14464	7	2	7	3	The sentence that spans these two lines appears to separate two sentences that would be better if they followed one another. It might be better suited as the third sentence of this paragraph or it could be dropped, as this sentiment is also included in lines 16 to 18 on this page.	Government of United States of America, U.S. Department of State
12534	7	2	7	7	Add before sentence "Providing universal access to modern...marginally:" "Modelling results suggest	Government of India, Ministry of Environment, Forests and Climate Change
11176	7	3	7	18	Why medium confidence in line 3 and high confidence in line 18?	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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2656	7	3	7	3	We suggest to replace "some countries" in the Headlines directly by "24 countries".	Government of France, Ministère de la Transition écologique et solidaire
6306	7	3	7	3	Please substitute 'medium' confidence by 'high' confidence as it is mentioned in the Executive Summary of chapter 2 (page 2-6; line 20).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6308	7	3	7	4	Please use alternative wording to emphasize the achievement: "Some countries have achieved GHG continuous emission reductions while maintaining economic growth, but [...]".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
5216	7	3	7	5	This sentence seems to be factually true so shouldn't need a confidence statement. The final part of this sentence seems to be a different point from the first half and not connected to the rest of the headline statement so could be dropped.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12536	7	3	7	7	Delete from "Some countries...emissions growth elsewhere" Reason: Sustained GHG reductions are also in various cases inadequate and not meeting commitments and hence may also contribute to lack of reduction globally. For instance, "while a few countries do achieve consistent and rapid year on year reductions of -4%/yr (such as Greece, Denmark, and Ukraine), most other countries only reach such rates in a few consecutive years. Three countries – the US, Germany and the Netherlands – were not able to achieve rapid rolling average reduction rates of -4% in any year. Thus, while country growth rates do approach Paris-compatible rates in some individual years, it is more uncommon to reach these rates consistently." (Lamb et al, 2021 page 10)"	Government of India, Ministry of Environment, Forests and Climate Change
2658	7	4	7	4	We suggest to replace "elsewhere" by "elsewhere in the world"	Government of France, Ministère de la Transition écologique et solidaire
608	7	6	7	10	The Section B3.1. According to B3 headline, Section B3.1 should give the main causes of global GHG emissions, i.e., economic growth and population growth contribute positively to global GHG emissions, while changes in energy intensity and carbon intensity contribute negatively to global GHG emissions. It is suggested to revise B3.1 to: B3.1 From 2010 to 2019, GDP per capita and population growth increased emissions by 2.3% and 1.2% yr-1, respectively. This growth outpaced the reduction in the use of energy per unit of GDP (-2% yr-1, globally) as well as improvements in the carbon intensity of energy (-0.3% yr-1). {2.4.1, Figure 2.19}	Government of China, China Meteorological Administration
884	7	6	7	10	Not sure what insight is being communicated in this section. Developed countries emitted more than developing countries: Given that development included use of fossil use this is understood and does not add to the content. Least Developed countries (despite having a larger share of population only emit 3% of emissions, just speaks to the historic fact that development was (literally) fuelled by fossil fuels. The 83% net growth is somewhat meaningless without context. <del>likewise the 1.1 of figure and the throwaway remark about cumulative emissions since 1850 lacks context.</del>	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5222	7	6	7	10	This bullet seems to a rather random set of statistics which doesn't allow many of the numbers included to be put in context. Shares of emissions in 2019, emissions growth 2010-19 and absolute reduction in emissions relative to 2010 are all included with different regions/groupings used for each. As such it is very difficult to understand what overall point is trying to be made here.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6312	7	6	7	10	In this paragraph, reference is made to Figures SPM.2 and SPM.3. While the first sentence in this paragraph refers to the share / regional proportion (%) of population and emissions of developed countries resp. least developed countries in 2019, EXCLUDING CO2-LULUCF, Figures SPM.2 (panel a) and SPM.3 (panels a and b) are based on GHG emissions INCLUDING CO2-LULUCF. Please verify and rephrase to ensure comparability and to prevent misunderstandings.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13164	7	6	7	10	B.3 these refer to regions and households. In addition here there is another entity used "least developed countries". Why are we taking out one single subentity and are reporting on them? Stick to the analysis between regions and income related household contributions, also being consistent with the figures SPM2 and 3 that do not differentiate in least developing countries. By singling out "developed countries" and "least developed countries": with such a differentiation, we leave out high-emitting developing countries, such as emerging economies. We therefore suggest including as well a reference to emerging economies. We do find it useful to focus on least-developed countries instead of "developing countries" as a block.	Government of Switzerland, Federal Office for the Environment FOEN

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13440	7	6	7	10	What is the definition of developed countries here? The glossary talks about three different approaches. Which one is used. Please add the shares of middle income and developing country emissions. What is the share of developed countries in the cumulative emissions and how this has changed over the latest 10 years?	Government of Estonia, Estonian Meteorological & Hydrological Institute
13514	7	6	7	10	Please add numbers on the emissions and population share of small island developing states to this bullet.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
14470	7	6	7	10	There has not been any basis for dividing countries into "developed" and "developing" categories, and it is unclear here which countries are in which categories or why. It is a very unrefined approach to a spectrum of countries ranging from high, to high-middle, low-middle, low-income, and the least developed countries. It also lends itself to political manipulation without providing clear criteria for categorizing countries. To be more factual, consider replacing the existing sentence with "GHG emission levels tend to correlate with income levels; high income countries and segments of populations generally have higher emission levels than lower income countries and segments of populations -- although factors including resource endowments, energy and environmental policies, and other factors can modify the relationship between incomes and emissions." The designation of "developed countries" is arbitrary and should be revised or omitted from the text and figures to be more clear about either geographic regions, income levels, or something else. The categories do not conform, for example, to the categories of the International Monetary Fund (IMF). Using IMF income categories would make more sense and be more parallel to the discussion in the paragraph that follows, across income groups within countries. Modify or delete B.3.1.	Government of United States of America, U.S. Department of State
780	7	6	7	6	Please, replace 'Developed countries' with 'the UNFCCC Annex 1 countries' or clarify definition of 'Developed'	Government of Russian Federation, Institute of Global Climate and Ecology
2662	7	6	7	6	We suggest to give clarification about which countries is in the "developed countries" and in the "developing countries", a footnote could be added on this matter.	Government of France, Ministère de la Transition écologique et solidaire
5218	7	6	7	6	The SPM needs to be clearer on how countries have been grouped together, and a consistent and transparent methodology needs to be applied. The glossary states that there are many different ways of categorising developed and developing countries, therefore B3.1 should specify which categorisation it is using. In particular, the term 'least developed countries' should be clear if it is referring to the UN Statistic Definition or not (and should be capitalised if so), as there is a negotiating group of the same name in the UNFCCC which will be a key user of this report. Would be good to be clear, particularly as the percentage changes are precise.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9406	7	6	7	6	According to Figure SPM.2 panel a, developed countries emitted 24% of global GHG emissions in 2019, excluding CO2-LULUCF, not 27%. Please check this inconsistency.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
13162	7	6	7	6	Harmonize the terminology: here we use "global GHG emissions" , elsewhere we are using "global net anthropogenic emissions" and others. Also here we sepak of "net growth in GHGs": How does it relate to "growth" in the abovementioned paras?	Government of Switzerland, Federal Office for the Environment FOEN
14468	7	6	7	6	What is the definition of "developed countries"? Are these Annex-1 or is some other definition being used?	Government of United States of America, U.S. Department of State
2660	7	6	7	7	It would be useful to specify that the contrast between developed and least developed countries increases when consumption-based emissions are considered as for example in Chap. 2 page 2-5 lines 10-11 and page TS-21 lines 1-2	Government of France, Ministère de la Transition écologique et solidaire
5220	7	6	7	7	Other income groupings here are needed to give the indicative 100% total picture of emissions; currently it only covers 30% of emissions and 30% of countries.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6310	7	6	7	7	The respective parts of the sentence compare "developed" and "least-developed" countries in terms of their share in global population as well as GHG emissions. While the message of this sentence is certainly important, it lacks proper documentation of the underlying data. The numbers mentioned here originate from Fig. 2.10 in Ch. 2.2.3 of the full report. The caption of this figure states that the data source is "Friedlingstein et al. (2020)" but this study is missing in the reference list. Therefore, it is not possible to check the original data.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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9778	7	6	7	7	What are the figures when land use emissions are included?; better to provide both.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11178	7	6	7	7	Please re-phrase these lines without the developed/developing bifurcation. It is valid to point out that there are wide disparities in national emissions both on a per capita and per-\$-GDP basis, and that countries with high emissions intensity therefore need to reduce the most in % terms. However, these differences cut across some of the developed/developing classifications. It is possible to have high emissions per capita and/or per unit of GDP and still be classified as a developing country by some definitions (and vice versa). Also, by concentrating only on the richest and poorest countries, the figures quoted conceal an even more important point as far as global mitigation is concerned - that the countries in between the two extremes account for 70% of global emissions and 70% of GDP - and must therefore account for the majority of emissions reductions in absolute terms.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11908	7	6	7	7	B.3.1: Could the population and emissions share of SIDS be added here as well? This would be relevant information for policymakers of our region.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
2244	7	6	7	8	Suggest including justification for the exclusion of CO2-LULUCF here (noting it is provided later in Figure SPM.2 Panel b), perhaps as a footnote.	Government of Australia, Department of Industry, Science, Energy and Resources
896	7	6	7	9	What does practically unchanged mean?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
886	7	7	7	7	Why is LULUCF excluded in this discussion?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1224	7	7	7	7	It is not clear why CO2-LULUCF are excluded. A reasoning should be provided here. (Footnote 7 is not very lucid either.) How would the different findings reported in B.3.1 change, if CO2-LULUCF were included?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2664	7	7	7	7	We suggest to give the number without the exclusion of CO2-LULUCF as well.	Government of France, Ministère de la Transition écologique et solidaire
6314	7	7	7	7	The share of people living in least developed countries is referred to 13.5% in chapter 2 (page 2-26; line 18), please be consistent.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
898	7	8	7	10	Important statement, why have these emissions dropped and what are the economic and social consequences?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
3892	7	8	7	10	For a balanced view, how much the emissions increase in Asia is due to net increase in exports to other parts of the world should be reported.	Government of Canada, Environment and Climate Change Canada
11182	7	8	7	10	How does this account for the emissions embedded in imports from developing countries?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12486	7	8	7	10	Rewrite the 2 sentences "Regionally.....since 1850" as follows: "Since 2010, 83% of net growth in GHGs since occurred in Asia and the Developing Pacific, but developed countries have contributed most to cumulative CO2 emissions since 1850 (high confidence)." Since developed countries are starting from a high base value of total and per capita emissions, comparing their reductions to growth in Asia presents an imbalanced view.	Government of India, Ministry of Environment, Forests and Climate Change
2666	7	8	7	8	"GHGs" seem to refer to GHG emissions, not GHG atmospheric concentration. Explicitly mention "GHG emissions" would be clearer. (Same remark in paragraph B.3.2)	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3890	7	8	7	8	The phrase 'Developing Pacific' should be defined on first use. The text indicates that 83% of GHG growth occurred 'in Asia and the Developing Pacific'. Given that Asia is listed separately, the reader might reasonably infer that 'Developing Pacific' must refer to developing countries adjacent to the Pacific which are not in Asia - perhaps in south or central America? Please define clearly.	Government of Canada, Environment and Climate Change Canada
14472	7	8	7	8	Unclear whether this includes both developed and developing countries in Asia.	Government of United States of America, U.S. Department of State
14474	7	8	7	8	While Asia and the Developing Pacific is helpful context to understand where emissions have grown in the last decade, it misses conveying that this growth was driven by a handful of countries. Text should reflect the important finding that 50% of greenhouse gas emission growth between 2010-2019 came from just two countries and 75% of the growth came from only ten countries (page 2-26).	Government of United States of America, U.S. Department of State
5224	7	8	7	9	Please include the absolute value corresponding to the global growth in GHG emissions (also note the word "emissions" is currently missing), as in: "83% of the XX GtCO <sub>2</sub> -eq net growth in GHG emissions since 2010..."	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11180	7	8	7	9	does this take into account carbon leakage?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13516	7	9	7	10	The sentence stating that "developed countries ... have contributed most to cumulative CO <sub>2</sub> emissions since 1850" should be given with the precise number instead of just saying "most". This information is available and should be added. The same goes for other statements throughout the SPM.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
14476	7	9	7	10	This statement is unclear about how developed countries have reduced emissions since 2010 but contributed the most toward cumulative emissions. This is a stock vs. flow argument. This statement should be revised to indicate that developed countries have contributed the most toward cumulative emissions (or the stock of total emissions in the atmosphere) based on historic (pre-2010) activities.	Government of United States of America, U.S. Department of State
1226	7	9	7	9	Please provide a more substantive quantification than "most".	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2668	7	9	7	9	Expression in % of the "1.1 GtCO <sub>2</sub> -eq" would be more consistent with the paragraph	Government of France, Ministère de la Transition écologique et solidaire
2670	7	9	7	9	We suggest to add "still" before "have contributed".	Government of France, Ministère de la Transition écologique et solidaire
6316	7	9	7	9	To illustrate the share of cumulative CO <sub>2</sub> -emissions resulting from developed countries since 1850, the information as mentioned in chapter 2 (page 2-26; line 21 and 24) [57% without LULUCF and 45% if LULUCF is included] should be added.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6886	7	9	7	9	"most" should be replaced with a percentage value	Government of Jamaica, Meteorological Service Division
11910	7	9	7	9	B.3.1: "Developed countries ... have contributed most to cumulative CO <sub>2</sub> emissions": Could the statement "most" be specified with a percentage value? Chapter 2.2 provides the following details: "Developed Countries have the highest share of historic cumulative emissions (Matthews, 2016; Gütschow et al., 2016; Rocha et al., 2015), contributing approximately 57%"	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13418	7	9	7	9	we suggest quantification of the statement "contributed most" This would complement the very important attribution between high/low income earners in B.3.3	Government of Kenya, Kenya Meteorological Service
12320	7	10	7	10	It is suggested that the historical share of developed countries in GHGs be expressed as a percentage.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
2672	7	11	7	11	The notion of "contribution" to global GHG emissions could be clarified: does it refer to both direct emissions? or consumption-based emissions (including indirect emissions)?	Government of France, Ministère de la Transition écologique et solidaire
2674	7	11	7	11	We suggest to add "emission" after "36-45% of global GHG"	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5226	7	11	7	12	Needs to be clear over what time period these statistics are correct for	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5228	7	11	7	12	Could authors please clarify how they have allocated all GHG emissions to "households" in different wealth categories? Are there GHG usages in e.g. government services and activities which are hard to allocate to individual households?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6318	7	11	7	12	Please state the time period these numbers are referring to.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
10294	7	11	7	12	Please elaborate on the concept of "households with income in the top 10%", is this income calculated globally or for each country. Plee also specify the refence year for this statement.	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
14478	7	11	7	12	How is this attribution of GHG emissions to households consistent with the statement in B.2 that 80% of emissions are from energy, industry, and AFOLU? If this was some sort of GHG footprinting/supply chain analysis, then that should be clarified here.	Government of United States of America, U.S. Department of State
9780	7	11	7	13	Are these figures based on consumption based emissions instead of production/territory based? If so , this should be indicated.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11184	7	11	7	13	Please explain briefly how emissions by households and per capita is interpreted/calculated. Emissions by households seems to suggests a consumption-based estimate, but it is unclear whether it includes their emissions arising in their home countries or anywhere in the world. Per capita emissions presumably refer to national estimates (territorial emissions/population), but it is not entirely clear.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
118	7	11	7	18	In the following statement in B3.2 "About two thirds of the top 10% live in developed countries and one third in other economies." The use of the term "other economies" is unclear and should be replaced with a definitive term.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
610	7	11	7	18	The Section B3.2. According to B3 headline, Section B3.2 should give the regional differences in global GHG emissions. In terms of current emissions, developed countries contribute 27% of the world's GHG emissions with 16% of the global population, while per capita emissions in developed countries are at least twice as high as those of developing countries. In terms of historical accumulation, developing countries account for 28% of cumulative emissions from 1850-2019. It is suggested to revise B3.2 to: B3.2 Developed countries with 16% global population emitted 27% of global GHG emissions in 2019. Average 2019 per capita CO2-FFI emissions in three developing regions Africa (1.2 tCO2), Asia and developing Pacific (4.4 tCO2), and Latin America and Caribbean (2.7 tCO2) remained less than half of developed countries 2019 CO2-FFI emissions (9.5 tCO2). Historically, these three developing regions together contributed 28% to cumulative CO2-FFI emissions between 1850 and 2019, whereas developed countries contributed 57%, and least developed countries contributed 0.4%.	Government of China, China Meteorological Administration
888	7	11	7	18	This paragraph need development in order to inform policy otherwise it is not useful; e.g. should consumption be reduced ? How e.g. consume less emission intense services/products etc? Probably as they have resources to make this transition. A more pertinent observation might be can the global rich be incentives to reduce emissions, and can the global poor be incentivited to develop on low emission pathways. And what might enable these pathways.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
3894	7	11	7	18	The subsection "B.3.2" reveals a very interesting dimension related to households' income and GHG emissions. Lines 11-12 explained about the contribution of top 10% and below 50% income groups in global GHG emissions. It will be interesting to know which regions mainly represent the remaining income group (i.e. 11-49%). This can be a valuable information to understand the income growth across regions and its impact in global future GHG trends.	Government of Canada, Environment and Climate Change Canada



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5230	7	11	7	18	Does this paragraph refer to GHG including or excluding AFOLU? This needs to be clear in the text itself rather than with a reference to the footnote. If possible, information on the distribution of AFOLU should be added to give a comprehensive picture, and to stress that action on AFOLU can be taken even by those countries that have low energy emissions (with support from developed countries).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5232	7	11	7	18	This paragraph has a lot of statistics. It could be split into two, covering high and low income groups, respectively.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11186	7	11	7	18	For a balanced description of inequalities in this paragraph, it is suggested to also mention a key message from the Ch.5 Executive Summary, as follows: "Wealthy individuals contribute disproportionately to higher emissions and have a high potential for emissions reductions while maintaining decent living standards and well-being (high confidence)".	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13176	7	11	7	18	"most without access to electricity or clean cooking services. Providing universal access to modern energy in these regions would increase global GHG emissions by at most a few percent." --> Omit this part of the sentence. This is the only place in this section that i) has a different level of assessment (technical, low level and low flying) and ii) provides a solution to a problem of subset of actors (qualitative assessment). This qualitative assessment is better suited in the sections dealing with mitigation pathways or the way towards sustainable development.	Government of Switzerland, Federal Office for the Environment FOEN
13442	7	11	7	18	This section is very confusing. Please delete. It mixes up different definitions of regional definitions, income groups etc. This report should be focussing on climate change mitigation and not where people live and how much they earn. We don't see that this section adds any value to the SPM and it is rather very confusing.	Government of Estonia, Estonian Meteorological & Hydrological Institute
14480	7	11	7	18	"About two thirds of [households with income in] the top 10% live in developed countries and one third in other economies." The underlying material on page 2-67 simply says "one-third live in emerging economies". The change in language between the underlying chapter and the SPM generalizes the finding about a particular set of countries to a broader classification, resulting in a loss of policy-relevant information. The SPM should be edited to mirror the finding in the underlying text.	Government of United States of America, U.S. Department of State
13172	7	12	7	12	"top 10%": What measure is used to define this number? Explain in a footnote.	Government of Switzerland, Federal Office for the Environment FOEN
13170	7	12	7	15	Harmonize: "bottom 50%" and "lower 50%"	Government of Switzerland, Federal Office for the Environment FOEN
104	7	13	7	15	B3.2:Per capita is not acceptable methodology to distribute emissions. a more sensible way may be to use accumulated emissions since 1751 to present as % of occupied space. That should provide estimate of how much each country has contributed to pollute the atmosphere since 1751 and not only over 10 years span.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
124	7	13	7	15	Footnote 10 text should be emitted because it singles out CO2 only from the fossil fuels and industry. As such, the text does not reflect a balanced view of all IPCC identified GHGs, and doesn't reflect the PA which discusses emission not sources.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
6320	7	13	7	15	In this paragraph, reference is made to Figure SPM.3. While this statement regarding "per capita emissions" refers to CO2 emissions per capita from fossil fuels and industry, according to footnote 10, Figure SPM.3 (panel a) shows the distribution of regional GHG emissions per capita including CO2-FFI, CO2-LULUCF and other GHG emissions. Please clarify to avoid misunderstandings.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14482	7	13	7	15	It would be informative to cite per capita emissions between urban vs. rural populations (among higher-income households).	Government of United States of America, U.S. Department of State
9782	7	13	7	16	Here it would be better to use all GHGs as in SPM 3 or all CO2 instead of just energy/industry	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
2676	7	14	7	14	Even if it is specified by a footnote at the end of the sentence, it might be better to specify here that we are only talking about CO2FFI emissions, by adding "tCO2-FFI per capita"	Government of France, Ministère de la Transition écologique et solidaire
2678	7	14	7	14	Please, add "and per year" after "per capita".	Government of France, Ministère de la Transition écologique et solidaire
2680	7	15	7	15	Please, add "and per year" after "per capita".	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11188	7	15	7	15	Footnote 10: Are these CO2 emissions calculated on a territorial or consumption basis?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13174	7	15	7	15	"majority" of the lower 50% refers to how much (exact quantification)?	Government of Switzerland, Federal Office for the Environment FOEN
3896	7	15	7	16	We could not find support for the assessment that most of the lower 50% of emitters lack access to electricity in either of the cited sections (2.6 and 6.7). Please verify that this assessment is supported in the underlying assessment, and add additional section references if necessary.	Government of Canada, Environment and Climate Change Canada
5234	7	15	7	16	The statement that "the majority of the lower 50% of emitters...most without access to electricity or clean cooking services" is almost certainly incorrect. Only 13% of the global population does not have access to electricity, primarily in Africa, while the SPM statement suggests more than 25% do not have access. It is true that 40% of the global population do not have access to clean fuels for cooking (see reference: <a href="https://ourworldindata.org/energy-access#access-to-clean-fuels-for-cooking">https://ourworldindata.org/energy-access#access-to-clean-fuels-for-cooking</a> ).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5236	7	15	7	16	The sentence "The majority of the lower 50% of emitters live in Africa, Southern and South-East 16 Asia, Latin America and Caribbean, most without access to electricity or clean cooking services" requires clarification and nuance as it does not reflect differences between electricity access and clean cooking and is not accurate (less than 1bn people now lack access to electricity. ca. 800 m) or regional differences (access to electricity is high in Latin America for example)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6054	7	15	7	16	Please check this sentence: we have the impression that the statement may be too general because it applies to 50% of the world population. This could be confusing, as one might read that 50% of the world population does not have electricity or clean cooking services (although the word "most" may perhaps mean that it is > 25% (that is, most of the people in the 50%), it is not made very clear).	Government of Belgium, Belgian Science Policy Office - Belspo
910	7	15	7	18	This paragraph's presentation is unfortunate as it would read to some that increasing people's prosperity and well being will necessarily lead to emissions growth. That is not the case.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2686	7	16	7	16	It would be clearer to say "... most of whom do not have access to ... Instead of "most without access to electricity.."	Government of France, Ministère de la Transition écologique et solidaire
98	7	16	7	18	B.3.2: The statement reads as a recommendation against providing universal access to modern energy. It should provide actual numbers than percentages and use of all fuels, all technologies and considering lifecycle emissions for higher accuracy evaluation.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
900	7	16	7	18	As written, this would be an argument for not providing access to "modern energy" as it would increase global emissions. Whereas, providing people in developed countries access to modern energy would decrease global emissions	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
902	7	16	7	18	Providing access to lean energy is on of the SDGs, and therefore needs to be addressed in the context of Climate Action.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1228	7	16	7	18	It is not clear why this statement is included here and in the context of Section B. Section D could be a more appropriate place for this, given that Section D considers linkages between mitigation and the overall Sustainable Development.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2246	7	16	7	18	Suggest that the 'by at most a few percent' be replaced with a quantified range.	Government of Australia, Department of Industry, Science, Energy and Resources
2682	7	16	7	18	the sentence seems to give the same message as B.3 line 2&3, except that in B.3 it's given with medium confidence. it's unclear why.	Government of France, Ministère de la Transition écologique et solidaire
2684	7	16	7	18	Does this calculation takes into account the reduction of traditional fuelwood and charcoal that represent a dominant share of total wood consumption in low-income countries (7.3.1.5) (that should include less deforestation and less CO2 emission) ?	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
7036	7	16	7	18	This phrase, as it is, implies that granting access to energy for developing countries' citizens is not desirable, since it will represent an increase in GHG emissions.	Government of Brazil, Ministry of Foreign Affairs
11190	7	16	7	18	It would be important to briefly explain why providing universal access to modern energy would lead only to marginal increase in GHG emissions. Also, the definition of "modern energy" in footnote 9 suggests that such electricity could be based on fossil fuels, including from coal based plants. What would be the implications?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12488	7	16	7	18	Remove the sentence "Providing universal...percent". The papers referred to for this statement speak only about electricity access in one case and the eradication of extreme poverty in another. The quantification of clean cooking fuels and electricity together is not discussed in the papers and when it is a minimum provision for the eradication of extreme deprivation alone. Therefore, without this context, the statement is misleading.	Government of India, Ministry of Environment, Forests and Climate Change
13378	7	16	7	18	We are opposed to the message conveyed here as it seems to cast access to energy in poor areas in unfavourable light while this is important for development in these countries. This especially following the sentence in line 15 & 16 indicating that Africa, among other regions are the lowest emitters. We would be comfortable with alternative sentences indicating the potential for widespread access to green or alternative energy in developing countries.	Government of Kenya, Kenya Meteorological Service
13626	7	16	7	18	The SPM needs to be clearer about why this sentence is included	Government of New Zealand, Ministry of the Environment
14484	7	16	7	18	"at most a few percent" reads somewhat odd here given the precision included in the plentiful numbers/data leading up to this statement.	Government of United States of America, U.S. Department of State
14486	7	16	7	18	Is the emissions from providing access to modern energy dependent on the approach? If so, indicate the approach.	Government of United States of America, U.S. Department of State
2688	7	17	7	17	A "few" is vague. It would be better to provide a figure or range.	Government of France, Ministère de la Transition écologique et solidaire
5238	7	17	7	17	a few percent' - would be good to provide an approximate number here. As in our comment on the headline statement, it would be helpful to clarify that the emissions associated with a transfer to modern energy are dependent on the type of energy system used, for example, a low-carbon energy system would not generate the same additional emissions as a fossil-fuel based energy system.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
122	7	17	7	18	B.3.2: The use of "few percent" does not quantify to specific value. Provide numerical values.	Government of Saudi Arabia, Sustainability Advisor to the Minister of Petroleum and Mineral Resources
904	7	17	7	18	Not clear in text whether "modern energy" includes fossil fuel technologies, or is limited to low carbon technologies (which may include FF with CCS). The definition makes no reference to the carbon emissions associated with these modern energy sources, and appears to only consider the air quality properties.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6322	7	17	7	18	Please specify the statement "by at most a few percent" referring to the accurate numbers given before.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13376	7	17	7	18	Few percent' should be quantified even if it is with a range to give a full idea of what this means thus enhancing clarity.	Government of Kenya, Kenya Meteorological Service
2690	7	18	7	18	A reference to TS.3 could be added (see page TS-21 lines 17-24)	Government of France, Ministère de la Transition écologique et solidaire
5240	7	18	7	18	ref to Figure SPM.3 appears mid-placed as it does not relate to the preceding sentence.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14488	7	18	7	18	The reference to Figure SPM.3 should be attached to the previous sentence, as it has no relationship to the statement made in this sentence.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
100	7	19	6	23	B.3.3.: Required action: re-write to focus on all GHG emissions rather than CO2 only.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1230	7	19	7	19	It would be informative to list these 24 countries, e.g. in a footnote, not least with some information on possible commonalities in the drivers and measures taken behind the emission reductions. (The underlying Chapter provides some information on this in figures, but does not seem to provide the full list.) Or, in some other way, provide useful information that there are significant differences within the country groups which are used in the SPM (including those displayed in B.3.1, Fig SPM.2, Fig SPM.10). This would provide a relevant dimension in addition to the assessed differences between regions (on regional level) and households.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2692	7	19	7	19	To add some details about the "24 countries", One could add this sentence from the TSM p. 9 : 'Of these, six are Western and Northern European countries that started reducing in the 1970s, six are former Eastern Bloc countries with consistent reductions since the 1990s, and 12 more have reduced since the mid-2000s'. It might be consider to add a footnote with the 24 countries or the way to access such information.	Government of France, Ministère de la Transition écologique et solidaire
6324	7	19	7	19	Please add the word "developed" in the first sentence of B.3.3: 'At least 24 DEVELOPED countries have sustained territorial...'	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9408	7	19	7	19	The difference between territorial and consumption-based emissions is not clear for many policy makers. Although the latter can be found in the glossary, the former cannot. I would suggest to replace "territorial" with "production-based", which is in the glossary, if the context allows. Otherwise, the definition of territorial emission should be clearly given somewhere.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11192	7	19	7	19	What does "territorial" mean here? It would be good to specify the spatial granularity meant.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11194	7	19	7	19	it would be useful to define consumption-based CO2 in a footnote	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11196	7	19	7	19	Have all these countries sustained both territorial and consumption-based reductions simultaneously? If both of these changes can be traced with similar accuracy, can they reveal some interesting insight (like divergences in trends)?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13178	7	19	7	19	Level of assessment is not adequate. Here we speak of countries, while this section does assess it by regions. In addition, the reader cannot understand which countries are referred to, in reference to which region, household income?	Government of Switzerland, Federal Office for the Environment FOEN
14490	7	19	7	20	Unclear whether consumption-based CO2 emission reductions account for emissions outside the country from imports.	Government of United States of America, U.S. Department of State
112	7	19	7	21	B3.3: The authors should be precise when using the term "reductions" . Reductions should be used when removal technologies such as CCS, CCUS, DAC, etc, are employed. Otherwise, the term 'avoidance' should be used. Action Required: Replace the term "reductions" with "Avoidance" if removal technologies were not employed	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
906	7	19	7	21	Some more information on how these reductions were enabled and achieved and any lessons from this from the at least 24 countries.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2248	7	19	7	21	It is unclear whether 'reducing energy demand' is due to greater efficiency, or lower production (the latter could suggest carbon leakage as industries shift countries). Suggest that this is clarified if possible.	Government of Australia, Department of Industry, Science, Energy and Resources
2474	7	19	7	21	These 24 countries could be mentioned.	Government of Hungary, Ministry of Innovation and Technology - Climate Policy Department

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9410	7	19	7	21	The phrase "by decarbonising their energy supply and stabilising or reducing energy demand" should be placed before "along side sustained energy demand". The original text misleads the reader into thinking that the phrase "by decarbonising . . . . ." modifies "along side sustained economic growth".	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
10296	7	19	7	21	Please indicate the relative importance of the 24 countries in terms of GHG emissions	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
13742	7	19	7	21	This sentence claims that: "At least 24 countries have sustained territorial and consumption-based CO2 emission reductions for longer than 10 years...". This is a slightly different formulation compared to the statement in the Executive Summary in the underlying chapter (page 2-5). Please clarify and provide references to relevant finding of sustained CBE reductions.	Government of Norway, Norwegian Environment Agency
14492	7	19	7	21	This sentence mentions 24 countries that have sustained emissions reductions. Are they developed, developing, or a mix of both?	Government of United States of America, U.S. Department of State
2250	7	19	7	22	It is unclear from the paragraph or the line of sight to section 2.2 which countries make-up the 'at least 24 countries' and any common attributes between them. Suggest being more transparent in the SPM and the underlying assessment to ensure that findings in the SPM have the greatest possible use to policymakers.	Government of Australia, Department of Industry, Science, Energy and Resources
106	7	19	7	23	B.3.3 demonstrates policy prescriptive language, in particular "decarbonizing the energy supply". The text stated "at least 24 countries have sustained...or reducing energy demand" is not supported by a confidence level and the language is deemed policy-prescriptive.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
108	7	19	7	23	B.3.3: The text focuses only on 2C, while neglecting to capture all degree targets.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
110	7	19	7	23	B.3.3: From the graph it is not clear if it is reduction in emissions that implies removal or avoidance that implies growth at a declining rate or negative growth due to avoidance before accounting for lifecycle emissions of the alternatives.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
114	7	19	7	23	HS B.3.3 demonstrates policy prescriptive language, in particular "decarbonizing the energy supply". The text stated "at least 24 countries have sustained...or reducing energy demand" is not supported by a confidence level and the language is deemed policy-prescriptive. Similarly, the text focuses only on 2C, while neglecting to capture all degree targets. All degree targets must be demonstrated to ensure a balanced and accurate information. Include all degree targets, accurate confidence levels and replace "decarbonizing the energy supply" with policy-neutral language.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
612	7	19	7	23	The Section B3.3. Section B3.3 assesses regional differences in changes in emission trends. According to the underlying report, first, it should point out that some developed countries have achieved emission reductions, which are not sufficient to meet the Paris Agreement targets. Secondly, it should analyze the fact that some developed countries have achieved emission reductions because they have shifted emissions from the production side, while this is not the case from the consumption side. Finally, it should clearly note that the countries that have achieved emission reductions are characterized with high GDP per capita and high emission per capita.	Government of China, China Meteorological Administration
1152	7	19	7	23	If using regional comparators in subsections above, useful to also determine of the 24 countries there regional origins as possible.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2068	7	19	7	23	It would be helpful if the CO2 emission of 24 countries is provided to be straightforwardly compared to the total global CO2 emission	Government of Republic of Korea, Korea Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2694	7	19	7	23	It should be mentioned that the reduction in greenhouse gas emissions in the 24 countries in question can partly be explained by changes in the structure of industrial production (linked to changes in competitiveness relative to countries with lower production costs, a trend in which "carbon leakage" may be hidden). Saying that reductions of 4% yr-1 are in line with scenarios likely limiting warming to 2°C is highly disputable: indeed these reductions do not account for imported emissions which means that it is likely that these reductions were counterbalanced by increases in other countries, which is not a good illustration of a 4% yr-1 reduction globally.	Government of France, Ministère de la Transition écologique et solidaire
5242	7	19	7	23	It is currently unclear whether the 4% quoted in B3.3 relates to emissions reduction in an individual country, or a collective emissions reduction across multiple countries. This should be specified for clarity.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11198	7	19	7	23	While it is important to recognise that decoupling of absolute, consumption-based emissions from GDP has occurred, this paragraph provides no insight into the context, and whether this 'achievement' can be replicated more broadly. For example, Ch 2.3 mentions that CO2 emissions embodied in trade between developing and developed countries more than doubled early this century, but also says that reductions in emissions intensity have offset increased volume over roughly the same period. Can we really say that international trade contributes to emissions reductions, even though it contributes to increased economic activity at the margin? If so, this is an important message	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12490	7	19	7	23	Remove this entire bullet as it is misleading. Reason: There is only one study cited for this bullet and as such it does not warrant being in the SPM. Also, the 24 countries included here are developed countries and the message is misleading without the context of their already high levels of infrastructure, high per capita and absolute energy emissions from which a reduction is easier than if a country is starting at a much lower level. Additionally, the paper which has been used as the reference study for the last sentence (Lamb et al, 2021) itself mentions that emissions reductions of 4% per year have to be sustained over extended time periods and not achieved for some years alone, to limit warming to 2 degree C. The SPM statement does not correctly represent this qualifier, while this is implied in the source chapter (Chapter 2, page 26, lines 44-45).	Government of India, Ministry of Environment, Forests and Climate Change
13744	7	19	7	23	Please consider to mention the risk of carbon leakage when talking about the reduction of consumption-based CO2 emissions.	Government of Norway, Norwegian Environment Agency
2696	7	20	7	20	Section 2.2.3 (L27-43) and TS indeed mentions a decrease in CO2 and GHG emissions, but sustained economic growth is not mentioned.	Government of France, Ministère de la Transition écologique et solidaire
2698	7	21	7	21	"In some years" seems too imprecise and vague to be keeping as such.	Government of France, Ministère de la Transition écologique et solidaire
5244	7	21	7	21	Suggest to change "in line with" to "comparable to" because "in line with" suggests that 4% is the reduction needed in all countries over the past decade. It is not. The timeframe is different, as is the growth change, given a country's specific circumstances.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5248	7	21	7	21	Could you please specify where emission reductions reached 4%/yr? Is it in all 24 countries?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11200	7	21	7	21	Please clarify whether the 4% is "territorial" or "consumption-based" reduction and whether it was reached for the mentioned countries as a group, or just some of the countries in some years	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14494	7	21	7	21	"Emission reductions": Should this be country-specific emission reductions?	Government of United States of America, U.S. Department of State
14496	7	21	7	21	Is the 4% emission reductions per year specific to one country? Or is this figure representative of emission reductions across this group of 24 countries?	Government of United States of America, U.S. Department of State
3898	7	21	7	22	Presumably, what is meant here is that the annual emission reduction rate of 4% per year achieved in these countries is in line with the global annual emission reduction rate of 4% per year (over what time frame?) in scenarios likely to limit warming to 2C. This should be clarified.	Government of Canada, Environment and Climate Change Canada

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5246	7	21	7	22	"Emission reductions reached 4% yr-1 in some years, in line with scenarios likely to limit warming to 2°C (high confidence)." It's hard to tell this from the chart, which is too small - but the framing of the text also suggests that reaching 4% in some years might be sufficient whereas it needs to be 4% sustained. In which case can it be reworded so as not to give an overly optimistic picture, while still highlighting the progress made.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6056	7	21	7	22	Could you clarify to which countries and periods the 4% applies to?	Government of Belgium, Belgian Science Policy Office - Belspo
6058	7	21	7	22	We do not understand what is meant by "in line with (...) 2°C": if these reductions are for single countries, how is it possible to state they are consistent with a global goal which may aggregate different rates of reduction depending on regional or national circumstances? The extent to which emission reductions from particular countries are in line or not with global pathways likely to limit warming to any temperature level depends on many factors, including ethical aspects involving value judgments, which should be avoided by the IPCC.	Government of Belgium, Belgian Science Policy Office - Belspo
9412	7	21	7	22	It is more accurate to add "in a few countries," in line with the Chapter 2 Executive Summary (Chapter2, page 2-5, lines 2-3 ).	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9850	7	21	7	22	Unclear which emission reductions are being referred to when stating these reached 4 percent.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
14498	7	21	7	22	The scope of each half of this sentence, and their correspondence, is unclear. Are the 4% per year reductions only for those countries identified in the prior sentence, and are the scenarios for which this reduction is consistent also only for these countries as well, or for the whole world?	Government of United States of America, U.S. Department of State
2052	7	21	7	23	some years' is vague. If the expression does not mean some consecutive years or some (separate) specific years, it needs to be clarified.	Government of Republic of Korea, Korea Meteorological Administration
2252	7	21	7	23	Because this sentence compares national and global emissions reductions, suggest clarifying by rewording '...', in line with the global reductions in scenarios likely to limit warming...'	Government of Australia, Department of Industry, Science, Energy and Resources
5250	7	21	7	23	Emissions reduction in some countries' is needed to be accurate in these sentences.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
10298	7	21	7	23	Please specify if the figure of 4% emissions reductions per year refers to the average of the 24 countries or to the aggregate level of these 24 countries.	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
14500	7	21	7	23	Comparing an annual rate of decrease to a sustained rate suggested by scenarios is inappropriate and this sentence should be deleted. Emissions can vary a lot interannually for a lot of reasons and at the level of a single country but it is not valid to suggest that a single year's rate of change is feasible over a long period. For example, a small country might shut down a single coal-fired powerplant in a year and achieve a marked emissions reduction but that is not an indication that it could do that repeatedly over a long period.	Government of United States of America, U.S. Department of State
2700	7	22	7	22	We suggest to give the % of the decrease if the information are available in the sentence "there reductions are small"	Government of France, Ministère de la Transition écologique et solidaire
120	7	22	7	23	B.3.3: Statement on "reductions are small" is not specific to number or percentage. Provide proportional quantities or omit from the text.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
908	7	22	7	23	The additional insight provide by the remark "In total...growth". The substantive point about growth in global emissions has already been made. Is the point here that the growth was not due to these 24 countries?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5252	7	22	7	23	The reference to "small" here is relative, it would be more useful to give a quantitative idea of scale here.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5254	7	22	7	23	A number is needed here to make this sentence meaningful. How small? Give % of global emissions in 24 countries or size of reduction relative to global increase?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9414	7	22	7	23	The difference between "these reductions" and global emission growth is unclear. "About 3.2 GtCO2 eq/yr" as the description should be added, in line with Chapter 2 Executive Summary (Chapter2, page 2-5, lines 3-5).	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
14502	7	22	7	23	Change the last sentence to: "In total, these reductions are small compared to global emissions growth. (Figure SPM.2) {2.2}" Recommend simply deleting the clause from the boldfaced header while leaving the more detailed information in the supporting material.	Government of United States of America, U.S. Department of State
2702	7	23	7	23	A reference to TS.3 could be added (see page TS-16 line 26 to page TS-17 line 2)	Government of France, Ministère de la Transition écologique et solidaire
14504	7	23	7	23	Can the 24 countries be listed, or can generalized regions be listed?	Government of United States of America, U.S. Department of State
5256	7	25	7	25	Footnote 9: What does modern energy access mean in terms of future population and demand assumptions?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6060	7	25	7	25	Footnote 9 : For clarity, we think that it would be useful to add the definition of "energy efficient carriers".	Government of Belgium, Belgian Science Policy Office - Belspo
14506	7	25	7	26	Unclear whether LPG and kerosene were classified as modern energy under this definition and whether they should be.	Government of United States of America, U.S. Department of State
12298	7	27	9	1	in each column of the table, writing is not well arranged, it needs more gap from starting line of the column	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
9774	7				In section B.3 different GHG emissions categories are used: all GHG, only CO2 , only CO2 from energy and industry; emissions on a territory vs consumption basis. This is potentially confusing. Please try to be as clear as possible, e.g. by adding an footnote to explain.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
15656	7	8	7	10	How much they contributed?	Government of Algeria, Ministère de l'Enseignement supérieur et de la Recherche Scientifique
15626	8	0			This information for different regions is insightful but remains too coarse in order to provide added value for policymakers of those regions as categories aggregate over countries and sub-regions with large differences. This is particularly true for small islands, which in the case of the Pacific region are included in the very large and diverse "Asia and Developing Pacific" category. The categories should be as differentiated as possible and comparable also with Figures SPM.3 and SPM.11 which currently do not all have the same categories. Please also consider adding a separate category for Small Island Developing States.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
3232	8	0	6	0	The title says "(2010-2019) and future paths (2020-2040)": it is not clear what is what on the figure. Please better precise in the subtitle that it displays past changes by both regions and countries and better precise in the subtitle that future pathways are at global level not regional level. "Future pathways" in the title of (b) is unclear as well- it might be better to align with the title of the figure "rates of change compatible with warming targets" - a bit long, but clearer	Government of France, Ministère de la Transition écologique et solidaire
3234	8	0	6	0	The message of this panel b is difficult to grasp an maybe misleading grey lines "illustrative" do not allow to have a good idea of the gap between observed national trend and national target. <sup>134</sup>	Government of France, Ministère de la Transition écologique et solidaire
3236	8	0	6	0	The pale blue colour used in graphic (a) for international shipping and aviation is hard to see against the background at least on a screen	Government of France, Ministère de la Transition écologique et solidaire
3238	8	0	6	0	Please consider changing in the subtitle of panel b "future pathways" with "Magnitude of changes in Scenarios ..."	Government of France, Ministère de la Transition écologique et solidaire
3240	8	0	6	0	Error in the unit of the y-axis of the panel b: Please put « % yr-1 » instead of « % / yr-1 »	Government of France, Ministère de la Transition écologique et solidaire
3230	8	0	8	0	The color scheme is hard to read on a screen, esp for the reddish/Brown colors (	Government of France, Ministère de la Transition écologique et solidaire



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5258	8	0	8	0	The title of SPM.2 panel b should make it clear that these are energy-related emissions only.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13444	8	0	8	0	Figure SPM2. Again the regional classification mixes together geographical regions and developed countries. The latter has three definitions in the glossary and it is not clear what is used here. Please use geographical regions only.	Government of Estonia, Estonian Meteorological & Hydrological Institute
11912	8	1			Figure SPM.2: There is an issue with how the regional categories are drawn. Small Island Developing States in the Caribbean and Pacific regions are thrown in to larger categories that cannot capture the regional specifics, in particular for when it comes to "Asia and the Developing Pacific". We would therefore like to ask for all SIDS (Caribbean, Pacific, AIS) to be represented in their own (additional) category, which we understand would be in line with the "SIDS" grouping as described on the UNSD M49 website. We would also like to note, that the other regional figures SPM.3, SPM.11 provide more regional specificity through reflecting the "intermediate level" of the UN classification scheme, which is already much more useful than the regional information provided in Figure SPM.2, reflecting only the broader "high level". All SPM figures should be consistent and use the same categories of regions, meaning Figure SPM.2 should at least also make use of the 10 intermediate levels. Also, information should be added in Figure SPM.2 caption that the full list of countries subsumed under each region can be found in Annex II.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11914	8	1			Figure SPM.2 summary statement: Could the "some countries" statement be specified? It seems from panel (b) that while "some" countries may have achieved emission reductions, only very few of these are in line with likely below 2°C scenarios. The figure statement should reflect this distinction, e.g. by adding "some countries have achieved sustained emission reductions but only very few of these are in line with 2°C scenarios, and none are in line with below 1.5°C scenarios" or similar.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13046	8	1			Figure SPM.2: We would like the authors to provide more consistency in grouping the countries - as already highlighted there appears to be inconsistent grouping in this figure and in SPM.3 and SPM.11. This is important to capture specifics for LDCs and also for SIDs whose circumstances seem hidden in the broader classification.	Government of Gambia, Department of Water Resources
14524	8	1			In Figure SPM.2b, substitute the word "regions" in the key "countries (size based on total emissions in 2019)" as no individual country emissions are shown. What are the smaller circles in that figure? They are not explained.	Government of United States of America, U.S. Department of State
1232	8	1	8	1	The regional breakdown in panel (a) risks misinterpretation as the definitions of the regions/country groups are not intuitive. (The same applies to the relevant underlying chapters, and the glossary.) An explicit reference to Annex II, section 1.1-1.2 would be very helpful and an elegant way forward here, as it is there the inclusion of countries in respective region (as used) is explained. This would enable the reader to find out, for example, that, for example, some of Eastern Europe and Asia is included in Developed Countries, and not the Eastern Europe and Asia, respectively, (partly) titled regions. There are different ways. For example, a footnote such as: "The inclusion of specific countries in each region as used here is detailed in Annex II, section 1.1-1.2. See also the Glossary." Reference for the glossary aims to capture that regions can (and are) defined in more than one way in the report.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
1234	8	1	8	1	Figure SPM.2, panel b... It would be useful to also see the change in international shipping and aviation. Even though these emissions cannot be distributed across the regions, an option could be to show them as a (total) sector on their own. This would give a more comprehensive account of the overall emissions.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
3900	8	1	8	1	Figure SPM.2. Suggest adding to the title the word "recently" before "achieved sustained emission reductions" so as not to make or imply assumptions that this achievement will persist into the future. Alternatively, consistent with panel (b), the title could refer to "in the last decade".	Government of Canada, Environment and Climate Change Canada
5262	8	1	8	1	Figure SPM2: panel b -This plot is not very clear to me and excludes international aviation and shipping which is an opportunity lost. Including this sector would highlight how big a global problem this sector is and put it in the context of regional emissions. The aviation and shipping sector could still be included in panel b in a category of its own and therefore not allocated to a region.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
7038	8	1	8	1	SPM 2 and SPM 3 should have the same regional categorization to provide a better base of comparison.	Government of Brazil, Ministry of Foreign Affairs

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11202	8	1	8	1	Panel b) at a minimum needs a footnote defining or listing "developed" countries. However, it is better to avoid this hybrid approach of mixing developed/developing and regional classification. It is particularly confusing for regions that contain a mixture of countries at different income levels - such as East Asia and Eastern Europe. Perhaps it would be more informative to have a plot of regional income per capita against recent GHG changes. Furthermore, the horizontal line for global pathways is misleading since it implies that an equal % reduction is needed from all regions in the short-term. Global scenario data should only be compared against historical emissions also at a global level.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11204	8	1	8	1	Figure SPM2b: Figure b not super clear: Do the different bubbles on the same vertical line indicate the change in emissions by COUNTRIES in that region? Why don't just show a single bubble for the aggregated region and not for every single country? As we do not know to which country the bubbles correspond, so it is not transparent and it does not add much, better to have just one bubble per region	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12546	8	1	8	1	As per AR5-SPM WGIII, ( <a href="https://www.ipcc.ch/report/ar5/wg3/summary-for-policymakers/">https://www.ipcc.ch/report/ar5/wg3/summary-for-policymakers/</a> ) Total Anthropogenic GHG emissions in 2010 was 49 GtCO <sub>2</sub> e per year; Now as per the new SPM WGIII - AR6, total anthropogenic GHG emissions in 2010 were 52 GtCO <sub>2</sub> e - this is a massive change that will apply to the whole time-series and has implications for the cumulative CO <sub>2</sub> emissions and carbon budget. It needs to be discussed as to why this revision is made and what are its implications for carbon budget, etc.?	Government of India, Ministry of Environment, Forests and Climate Change
13748	8	1	8	1	Figure SPM 2, panel b) is interesting, and illustrates how far away we are from pathways for 1.5 degrees and 2 degrees. Given the importance of both reducing deforestation and increase afforestation in large areas (322 Mha by 2050 according to Chapter 3, p.65), we suggest that LULUCF should be included in the figure. If this is not possible to include LULUCF in the figure, please address this important finding elsewhere in the SPM. The other measures are not as relevant if they are "eaten up" by emissions from LULUCF due to a further high level of deforestation.	Government of Norway, Norwegian Environment Agency
14508	8	1	8	1	Unclear whether China was classified as a developed or developing country here.	Government of United States of America, U.S. Department of State
14510	8	1	8	1	Other SPM figures break out developing countries by region. Suggest using a consistent approach for dividing up regions across figures.	Government of United States of America, U.S. Department of State
14512	8	1	8	1	Figure SPM.2b needs to be rethought. (1) As the legend says, this panel excludes LULUCF. It seems almost misleading to include a figure in the SPM that reports trends in GHG emissions and that in fine print says it does not include LULUCF, which account for a large share of emissions and the vast majority in some countries. If it included LULUCF, would LAC have a rate of average change far above the zero line? (2) The panel is simply too complex for an SPM figure. For the average reader, it is too hard to extract a main message.	Government of United States of America, U.S. Department of State
14514	8	1	8	1	Figure SPM.2b is complex, hard to read, and difficult to understand. If trying to reduce the number of graphics to conserve space, this is a good candidate to be cut.	Government of United States of America, U.S. Department of State
14516	8	1	8	1	The use of scaled markers for emissions in Figure SPM.8b risks muddling the message of this graphic, as they could be misinterpreted as showing a range in the vertical axis. This is particularly problematic for the largest markers where it appears that they span the x-axis zero line. Update the vertical scale or use another method to show scale of emissions. Consider also showing only the major emitters, as these results are less relevant for small emitters.	Government of United States of America, U.S. Department of State
6328	8	1	8	12	Figure SPM.2 states that "International Aviation and Shipping" cause 2% of annual global CO <sub>2</sub> eq. It should be mentioned that domestic aviation causes 30- 40% of overall aviation emissions (See Chapter 2, figure 2.12 - domestic aviation 0.7% and international aviation 1.1% in 2019) and that, therefore, the share of overall aviation and shipping is higher (3.4%) (See also Chapter 2, figure 2.12 (inland shipping 0.3% and international shipping 1.3%)). Otherwise it should be explained that domestic aviation is included in regional emissions. Furthermore, it needs to be explained that non-CO <sub>2</sub> effects of aviation have a climate impact that is approx. 3 times that of the here stated CO <sub>2</sub> emissions (See Chapter 10.5.2, which states that "In total, the net ERF from aviation's non-CO <sub>2</sub> SLCFs is estimated to be approximately 66% of aviation's current total forcing." with the rest coming from CO <sub>2</sub> ) and that these non-CO <sub>2</sub> effects are not included in the figure.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
912	8	1	8	13	Evidently from the figure SPM2, developing economies are not "leap frogging" develop economies in deploying low carbon technologies and achieving sustainable development. Elsewhere this is highlighted as a mitigation option. It would be useful if the text could elaborate on the underlying drivers of unsustainable development especially given that clean technologies have cost advantage (also evidenced elsewhere in the document).	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
13180	8	1	8	13	Title of SPM.2 does carry one of the main messages for this section, the text however is not that clear. Take this sentence to the lead in B.3.	Government of Switzerland, Federal Office for the Environment FOEN

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13182	8	1	8	13	B.3 and the associated figures do mix up the assessment entities: B.3. and the title of SPM2 speak of the differentiation between regions. In the text and in the figures, however, the assessment do mix up the assessment per region with other differentiation methods like developing and developed countries (and least developing countries) as well as with household incomes. Please differentiate between assessing the regional differences and the assessment between other entities, like the household income.	Government of Switzerland, Federal Office for the Environment FOEN
13184	8	1	8	13	Title of SPM2 a.: Harmonize with other figures and text: "total" or "cumulative" or "net ... emissions"?	Government of Switzerland, Federal Office for the Environment FOEN
13186	8	1	8	13	Title of SPM2 b.: Delete "recent"	Government of Switzerland, Federal Office for the Environment FOEN
14526	8	1	8	13	Should SPM.2 have a LULUCF panel given importance for NCS/NBS?	Government of United States of America, U.S. Department of State
126	8	1	8	14	Figure SPM.2 should depict all GWL degree target levels, not only 2C scenarios. Include all degree targets.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
128	8	1	8	14	The trends in Panel A in Figure SPM.2 should include historical trends since pre-industrial revolution 1850 to date.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
614	8	1	8	14	We suggest removing Figure SPM.2 for three reasons: 1. The time range is 1990-2019, rather than 1850-2019 traditionally. The figure is also too complicated to get a straightforward view on cumulative emission trends. 2. The categories of regions and countries are confusing. "Developed countries and developing countries" and "regions of the continents" appear alternatively, and the concept of "developing countries and developed countries" is mixed. The populations and growth trends are different among regions. Thus, this figure will mislead decision-makers. 3. The SPM is lengthy with too many figures, not well displaying the latest and most important assessments. Figure SPM.3 contains the emission information in a wider time range, making Figure SPM.2 redundant.	Government of China, China Meteorological Administration
2196	8	1	8	14	Panel b shows data per country but the main message of figure is perhaps something that could be summarised with a sentence or two in text. Panel b does not seem as relevant as panel a in SPM.2.	Government of Finland, Finnish Meteorological Institute (FMI)
6330	8	1	8	14	Figure SPM.2.b: Removing the filling/shading of these circles and just provide the outer ring would facilitate readability.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6332	8	1	8	14	SPM.Fig.2. This figure could spark longer discussion in the approval session due to the lack of regional groupings. For example, "Asia and Developing Pacific" does this include small island states? If so, this needs to be stated taking into consideration that SIDS do not contribute to such a high level of GHG as Asia (China) does.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6888	8	1	8	14	Picking up on our general comment that there is too little regional information in the SPM, the regional information that is in fact included must be as differentiated as possible. This figure must therefore categorise regions with the same intermediate level as figures SPM.3 and SPM.11. In addition, a category for small island developing states, according to the UNSD scheme, should be added which would allow policymakers to receive this much-needed information.	Government of Jamaica, Meteorological Service Division
9852	8	1	8	14	It is a bit confusing that the scenario categories' numbers are given before these are explained (after table SPM.1 in section C). Perhaps a reference to this table could be included in the text under figure SPM.2 to enhance clarity.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13750	8	1	8	14	Figure SPM.2 contains a lot of useful information. However we have some suggestions that could allow for easier interpretation. Firstly, please consider to replace "emissions" by "net emissions", if this is what the figure shows in the figure and panel titles, caption etc. Secondly, we would appreciate if the caption explicitly refers the reader to where he/she can find an overview of which countries are included within each region category by adding a clear reference to Annex II. Thirdly, please consider in Panel 2b to alter the heading by including "countries and" in front of "region", and replace C3a and C1 on the right hand side of panel b with something like "<2°C" and "<1.5°C", respectively, as many readers are more acquainted with the temperature limits than scenario categories. Additional information can still be included in the legend below the figure, such as stating that "dotted and dashed lines refer to scenarios of global emission change", while the circles represents countries and coloring represents regions. The distinction between regional historic values and global future pathways could also be emphasized more by adding a new circle or line that shows the historic global average emission change. This could avoid possible misinterpretation such as directly inferring future regional reduction pathways. Furthermore, the grey shaded fields linked to the C3a and C1 scenarios might be hard to separate from each other and from the background. Please consider using more distinct colors.	Government of Norway, Norwegian Environment Agency
6062	8	1	8	2	Figure SPM.2: We would like to suggest using the same regional groupings as in Figure SPM.3, as it is much easier to understand. Here, we find it difficult to understand the exact meaning of "Developed Countries".	Government of Belgium, Belgian Science Policy Office - Belspo
6064	8	1	8	2	Figure SPM.2 - panel b: It is hard to understand. It might be useful to repeat the region names under the diagram. We suggest either finding ways to make this diagram clearer (simpler?) or removing it, as most of the information is in the text (B.3.3 for instance).	Government of Belgium, Belgian Science Policy Office - Belspo
14518	8	1	8	2	Define "Developed Countries" in Figure SPM.2. Does this include North America + Western Europe? North America + Western Europe + Japan + South Korea? Why are Asian developed and developing countries combined here but apparently elsewhere they aren't? This is especially confusing given that subsequent figures separately identify North America, etc.	Government of United States of America, U.S. Department of State
14520	8	1	8	2	The Figure SPM.2 title would be clearer if it were reworded to something like: "Emissions have grown in most regions, though some countries have achieved sustained emission reductions in line with what is needed globally in 2°C scenarios."	Government of United States of America, U.S. Department of State
14522	8	1	8	2	Can aviation and shipping be shown in Figure SPM.2b as a separate column, to show trends, even if transport cannot be assigned to a geographic region?	Government of United States of America, U.S. Department of State
6326	8	1	8	5	Figure SPM.2, panel b: please provide a definite scale regarding to the circle sizes.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
914	8	1	8	7	Include CO2 in the figure so that the proportion of CO2 to non CO2 GHGs for the regions can be seen.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
14528	8	1	9	16	Why are there different levels of geographic aggregation between Figures SPM.2 and SPM.3? It would seem simpler if the same regions and color schemes for regions were used throughout the SPM.	Government of United States of America, U.S. Department of State
14530	8	1	9	16	Many reviewers were concerned by the inconsistency of country classifications between Figures SPM.2 and SPM.3, and by the mixing of development and regional categorizations. The authors should revise both figures to use a consistent regional categorization at the 10-region level. If the authors decide to include information on both emissions growth by region and by development level, these breakouts should be shown in separate panels and the development categorization should be based on income levels in order to comprehensively convey the relevant information on emission trends across the spectrum of development to policymakers.	Government of United States of America, U.S. Department of State
6334	8	1	9	19	Please provide an explanation how the regions in figures SPM.2 and SPM.3 relate to each other.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13700	8	1	9	19	Figures refer to different regions, suggest consistency to avoid confusion - as does Figure SPM.11	Government of New Zealand, Ministry for the Environment
13746	8	1	9	19	The figures SPM.2 and SPM.3 contains very valuable regional information on historical emissions and their regional distribution. This is very useful information from a policy-making perspective and the inclusion of this information in the SPM is supported. Please keep.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
1190	8	2	21	3	Figures SPM 2 (p8), SPM 3 (p9), SPM 6 (p21). Captions explain parts a, b. Perhaps include in figure titles as well: * p8 Figure SPM2 Change in regional GHG emissions (a) and rates of change compatible with warming targets (b) p9 Figure SPM3 Distribution of regional GHG emissions per region (2019) (a) and the regional proportion of total cumulative production-based CO2 emissions from 1850–2019 (b) p21 Figure SPM6 Illustrative Mitigation Emissions Pathways (IMPs) (a,b,c) and net zero CO and GHG emissions strategies (d,e)	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
3242	8	2	6	2	Title of the Figure : why only refer to the 2°C scenarios dimension of the figure, which also deals with 1.5°C scenarios?	Government of France, Ministère de la Transition écologique et solidaire
5264	8	2	8	2	Panel b: Scaling size of dot by emissions makes the figure look very cluttered and hard to read. Losing this additional information would be better than a very cluttered figure- so would replace by dots all of the same size. The labels C3a and C1 are difficult to parse at first and, could be replaced by the longer scenario names.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9416	8	2	8	2	The panel b of Figure SPM.2 does not directly show future pathways. In its title, 'and future pathways (2020-2040)' should be rephrased by, for example, 'compared with global reduction rates in future pathways (2020-2040).'	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12492	8	2	8	2	Remove the lines C1 and C3a from Figure SPM.2. Panel b. Actual emissions and changes should not be conflated with model results for the future. The figure misrepresents model results as some sort of benchmark, which it is not. This is policy prescriptive.	Government of India, Ministry of Environment, Forests and Climate Change
12970	8	2	8	2	Fig SPM.2 the right hand panel mixes historical observations with future pathways, presumably modeled. It creates the impression that only developed countries are reducing emissions, at least some of which is due to economies in transition. Two matters should be made clearer: 1) to what extent the range of all countries depends on (recent) history and to what extent on assumed future pathways? 2) disaggregate EIT and non-EIT developed countries.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
14532	8	2	8	2	Figure SPM.2b is too hard to understand and should be deleted. It is inherently biased by not including all GHG, including those covered by the Montreal Protocol, and AFOLU. Bunker fuel emissions can be allocated to regions, but are intentionally not. This treatment is mixing up objective analysis and policy. Delete the figure.	Government of United States of America, U.S. Department of State
14534	8	2	8	2	The Figure SPM.2 title is not consistent with its content. There is nothing in the figure indicating that "some countries have achieved ..." so that part of the title should be deleted.	Government of United States of America, U.S. Department of State
14536	8	2	8	2	Figure SPM.2a should not be a stacked bar chart. Stacking makes it difficult to discern individual regional changes. For example, the late 90s spike in Asia/Developing Pacific country emissions "appears" to occur in all other regions due to the stacking, when that was not the case.	Government of United States of America, U.S. Department of State
14538	8	2	8	2	Delete Figure SPM.2b. It tries to pack too many results into one diagram.	Government of United States of America, U.S. Department of State
2054	8	3			GWP100 AR6 is unnecessary. (change) please delete it.	Government of Republic of Korea, Korea Meteorological Administration
782	8	3	8	3	First of all, not only regions are presented in panel a), because 'International shipping and aviation' obviously is not a region. Secondly, these regions are not of any standard classification. Therefore, they should be described completely and clearly.	Government of Russian Federation, Institute of Global Climate and Ecology
5266	8	3	8	3	As in our comments on section B3, could authors ensure that country groupings are used consistently and transparently across the SPM? Currently they are different in Figures SPM2 and SPM3, as well as in the text, and it leads to the possibly of interpreting these figures differently. A clear explanation of which countries are included in each grouping would be helpful.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5268	8	3	8	3	Panel (b) is quite difficult to read, and makes it hard to identify where the 24 countries that have managed to reduce emissions lie. The large circles make the remainder of the graph difficult to read. Perhaps using horizontal lines, with lengths representing total emissions, would be clearer. The categories could be represented using only the median line rather than the percentile ranges to improve legibility.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
3244	8	4	6	4	Figure SPM2...Panel b: Historical GHG emissions change by region (2010-2019): Referring to the gap between models and state data (see B3.1) the graphs and discussions are based on which data? What does Historical mean with or without CO2-LULUCF? It seems that the data with CO2-LULUCF are not represented? It would be nice to include this gap as an uncertainty in the graphs and/or discussions.	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6336	8	4	8	4	Figure SPM.2, panel b) assigns the recent GHG emissions to the period 2010-2019, while in the caption the same period is referred to as historical. Please improve, e.g. designating them as "recent".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
7018	8	4	8	4	Please, delete the word "historical" from line 4. Usually, the term is used to GHG emissions from 1850, including in this report.	Government of Brazil, Ministry of Foreign Affairs
1170	8	5	8	6	Caption states what circles and horizontal lines in Fig refer to. In the reference to rates of reduction over 2020-2040 after mention what represents this in figure, For example: * "also shown are global rates of reduction over the period 2020-2040 (vertical extent of the aercountries) ..."	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6338	8	9	8	12	Clarification needed on SPM Fig.2. panel b. and SPM Fig.3 panel b. In SPM Fig.2. panel b. caption it is stated that "CO2 LULUCF is excluded due to lack of consistent historical data". However, in SPM Fig.3. panel b "shows the historical net CO2 emissions per region from 1850 to 2019, which includes CO2-LULUCF. The information and captions for these two panels seem to contradict each other or seem to make it unclear why CO2-LULUCF data is used in SPM Fig.3.a and not in SPM.Fig.2. Please clarify.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6340	8	9	8	12	SPM.fig.2 Please clarify how International Shipping and Aviation is included in this figure. The caption states that emissions form these sectors cannot be clearly allocated to regions, then how can they be separated from international emissions?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
784	8	9	8	9	Panel b excludes 'CO2 LULUCF': this should be clearly written in the title of Panel b) above the diagram. It is especially important in the case of Russia	Government of Russian Federation, Institute of Global Climate and Ecology
7020	8	10	8	10	Please, include "in some countries" after the word "data" in line 10, because there is consistent historical national data on CO2 LULUCF in some countries.	Government of Brazil, Ministry of Foreign Affairs
9666	8	10	8	11	We found a possible editorial error in the Chapter 10 sentence stating the foundation for the comment 'International Shipping and Aviation, which cannot be allocated to regions' here. Japan suggests to change the sentence from 'argue that the shipping and aviation industries would prefer emissions to be treated under an international regime rather than a national-oriented regime' to 'and others argued that the shipping and aviation industries would prefer emissions to be treated under an international regime rather than a national-oriented regime' in Chapter 10 P.96 Line 36-39.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
916	8	10	8	14	The term inequalities is not the most useful to be used here. Less pointed terms are preferred.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
3246	8	13	6	13	A reference to Fig. TS.4 could be added (see page TS-18)	Government of France, Ministère de la Transition écologique et solidaire
918	8	15	8	20	provide these data in a table	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2056	8				1. what Panel b countries are? Panel b explanation is not fully descriptive. 2. (present) future pathway -> (change) near future 3. consistent capitalization (present) International Shipping and Aviation ->(change) international shipping and aviation 4. This graph is hard to read since it is hard to know whetere it shows the changes by regions between two periods or not	Government of Republic of Korea, Korea Meteorological Administration
13518	8				Please ensure that Figure SPM.2 makes use of the same intermediate level categories as Figure SPM.3 and SPM.11 so that the figures are comparable. If this information is not available from the literature this must be indicated in the caption. Also, please add a category for "small island developing states" which we understand is a grouping from the UNSD. The current categorisation of small islands within "Latin America and Caribbean" and "Asia and Developing Pacific" does not adequately capture the very unique circumstances of small islands and does not provide the necessary information for policy makers in small island regions.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development

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5260	8		8		It's fairly obvious but in the description for panel a) better to specify that the % figures indicate the % share of each sector in the total for each year	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13380	8		8		Panel b is not clear - the figure need to be made clearer as it is too confusing as is. For example the reference to 'reduction scenarios' which comes with a disclaimer may be confusing - needs revision/better presentation.	Government of Kenya, Kenya Meteorological Service
11206	8		9		SPM.2 & 3: it is odd that "Eastern Europe" is grouped together with "West-Central Asia" (does it mean just Russia, or other countries, too?). It is unclear what "Europe" then includes.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15658	8	8	8	10	It would be very much preferable to present the different scenarios before B3.	Government of Algeria, Ministère de l'Enseignement supérieur et de la Recherche Scientifique
3248	9	0	9	0	We suggest to change the expression "Percentages refer to contribution to total emissions" with "Percentages refer to contribution of each region to total emissions"	Government of France, Ministère de la Transition écologique et solidaire
3250	9	0	9	0	As for SPM.2, it would be useful for the regional categories to be introduced/presented in details in order for readers to understand what they represent.	Government of France, Ministère de la Transition écologique et solidaire
3258	9	0	9	0	Is it possible to consider using the same colors as Figure SPM2 for each big world regions?	Government of France, Ministère de la Transition écologique et solidaire
5270	9	0	9	0	not clear why the bar chart has a section below zero in the left hand figure (North America and in Europe)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13446	9	0	9	0	Figure SPM3. Please delete this figure. It is very difficult to understand and it also overlaps with the Figure SPM2 in terms of messages. This data could be presented in the relevant text where appropriate. Alternatively a small simple table could replace it. If the latter is considered then also the changes in recent cumulative emissions should be presented.	Government of Estonia, Estonian Meteorological & Hydrological Institute
2254	9	0	9	1	Figure SPM.3, Panel b: It is difficult to see the difference between the diagonal and vertical hatching in the circles. Suggest changing the pattern to dots or another pattern to aid in interpretation of the figure. The horizontal shading and lines in panel b are difficult to make out.	Government of Australia, Department of Industry, Science, Energy and Resources
11916	9	1			Figure SPM.3: Despite the fact that this figure comes with a higher regional resolution from the UN classification scheme's "intermediate level" compared to Figure SPM.2, which is useful, the regional categories are still problematic when it comes to SIDS both in the Caribbean and Pacific. Please group all SIDS to be represented in their own category if possible. We understand from the UNSD M49 website that a "SIDS" grouping exists within this framework. And just to reiterate that all SPM regional figures (SPM.2, SPM.3, SPM.11) should have the same categories of regions. Please also add a pointer to the classification scheme in Annex II to the figure caption.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13048	9	1			Figure SPM.3: As highlighted above there is need for consistency in the country groupings in this figure across the SPM.	Government of Gambia, Department of Water Resources
10282	9	1	39	3	Please specify the source for the definition of developed and least developed countries	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transición Ecologica
920	9	1	9	1	SPM3 panel B This diagram is very hard to understand. It would be more accessible as a histogram similar to Panel A. Why have "other GHG" not been included in the Panel B? This would appear to be a major omission given their prominence in the 2019 regional profiles. Is it that cumulative emissions of (short lived) GHGs is not an appropriate indicator of climate impact?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
3252	9	1	9	1	"Regional GHG emission per region" might seem redundant, please consider deleting either "regional" or "per region"	Government of France, Ministère de la Transition écologique et solidaire
5272	9	1	9	1	Figure SPM3: panel a - I think the same comment applies to this figure as Figure SPM2. Why not include the aviation and shipping sector in a category of its own and therefore outside the regions as they do in this figure in panel b.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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6342	9	1	9	1	Figure SPM.3 panel b: Comprehensibility could be improved by making clear (through for example a bracket), which of the three parts of the regional contributions (fully coloured, vertical lines, hatched sections of the diagram) belong to each region.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6344	9	1	9	1	In panel b) the three categories for emissions are not clearly distinguishable. Please improve the selected hatchings. Furthermore, the line showing the Latin America and Caribbean contribution is missing.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13756	9	1	9	1	In figure SPM 3. panel b.), it is difficult to see the borders between the regions, especially since for each region are associated with CO2-FFI and CO2-LULUCF. Please consider adding a solid line between the regions or another way of making it clearer. Also it takes time to see that other GHG emissions are not included in panel b), it would be helpful if other GHG emissions have another coloring/pattern or if it can made more intuitive by moving the legend box.	Government of Norway, Norwegian Environment Agency
13758	9	1	9	1	Figure SPM.3 Please consider clarifying panel a) figure title. E.g. GHG emissions per capita and for total population, per region (2019). Somewhat difficult to see the difference between emissions categories in both panel a and b.	Government of Norway, Norwegian Environment Agency
14540	9	1	9	1	Suggest making the y-axis label as "tCO2-eq per capita" to be consistent with what's in the text.	Government of United States of America, U.S. Department of State
14542	9	1	9	1	In Figure SPM.3b, the shaded areas in the donut figure are not easily distinguished to know which is LULUCF (which is non-CO2). Suggest to consider different ways to visualize the data.	Government of United States of America, U.S. Department of State
14544	9	1	9	1	The role of AFOLU in negative carbon emissions is mostly lost though because the figure only provides net numbers, not gross fluxes. Is there anything that can be done about that?	Government of United States of America, U.S. Department of State
14546	9	1	9	1	Is there an error in Figure SPM.3a? It shows a slight "other GHG emissions" sink in North America, but it seems like this should likely be a sink from LULUCF.	Government of United States of America, U.S. Department of State
14548	9	1	9	1	Why does Figure SPM.3 focus on per capita emissions? The underlying report (Figure 2.9) includes additional panels that would be relevant for the policy audience, particularly emission intensity.	Government of United States of America, U.S. Department of State
14550	9	1	9	1	This figure should be updated to use regions only. Mixing developed countries with a regional breakdown of developing countries reduces the information provided to the reader. Many may wish to know the breakdown between North America and Europe, for example.	Government of United States of America, U.S. Department of State
14552	9	1	9	1	Why is an incomplete picture of emissions (only CO2 without LULUCF) shown in Figure SPM.3b? Include information showing CO2-with LULUCF drawn from Figure 2.10 in Chapter 2. It would also be helpful to explain why this historic assessment does not include non-CO2 GHGs.	Government of United States of America, U.S. Department of State
14554	9	1	9	1	The Figure SPM.3 presentation of only per capita emissions data is a concern. The authors should also include the carbon intensity trends drawn from Chapter 2 to present a fully comprehensive analysis of emission trends to policymakers.	Government of United States of America, U.S. Department of State
6346	9	1	9	14	Figure SPM.2.b: Why is the information provided for scenario C3a while footnote 8 does not mention this scenario group and there is no information available on how C3a is different from C3 which should also imply immediate action. Please use scenario group C3 in this figure as well. Please see also our comment of footnote 8 suggesting a scenario group for "very likely" below 2C.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13754	9	1	9	14	We appreciate Figure SPM. 3, but in our view it would be even more relevant if the role of consumption could be included. This would e.g. show that consumption in other regions is a key driver of industrial emissions in Eastern Asia and LULUCF emissions in the tropics.	Government of Norway, Norwegian Environment Agency
616	9	1	9	16	1. Figures SPM.1, 2 and 3 on emissions are all based on production emissions. There are discussions and figures on emission transfers in the second chapter of the underlying report. It is suggested that the regional emissions in 2019 in Figure SPM3.a be replaced by consumption-based emissions (Figure 2.15 in the second chapter of the underlying report); 2. It is suggested to re-divide regions in SPM.3 into larger groups for simplification sake.	Government of China, China Meteorological Administration
13188	9	1	9	16	B.3 and the associated figures do mix up the assessment entities: B.3. and the title of SPM2 speak of the differentiation between regions. In the text and in the figures, however, the assessment do mix up the assessment per region with other differentiation methods like developing and developed countries (and least developing countries) as well as with household incomes. Please differentiate between assessing the regional differences and the assessment between other entities, like the household income.	Government of Switzerland, Federal Office for the Environment FOEN
13190	9	1	9	16	Title: Inform the reader to which extend the population size and per capita contributions are affecting the total GHG emissions. Make the link to the text, too.	Government of Switzerland, Federal Office for the Environment FOEN



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13752	9	1	9	16	Figure SPM. 3 a) shows negative per capita CO <sub>2</sub> - emissions from North America and Europe's LULUCF-sector. It would be helpful if the text below the figure could comment why these emissions are negative.	Government of Norway, Norwegian Environment Agency
13760	9	1	9	18	In Figure SPM.3, panel a) please check and if needed change the hatching in the part of the North America bar. It seems to be "Other GHG emissions" as the figure reads now. We believe it should be net anthropogenic CO <sub>2</sub> from Land use, land use change and forestry (CO <sub>2</sub> -LULUCF) like it is for Europe. Also consider if the explanation to the asterisk about what the percentages represents could be made as a sub-heading instead, so that the stars could be avoided on all the numbers. In addition we propose to add "global" between total and emissions, so that it reads: Percentages refer to contribution to total global emissions. Please also ensure that it is clearer if this only presents anthropogenic emissions.	Government of Norway, Norwegian Environment Agency
6890	9	1	9	19	To ensure that the SPM has more regional-level information that is relevant to policymakers, please consider adding a category for small island developing states, in accordance with the UNSD scheme.	Government of Jamaica, Meteorological Service Division
6066	9	1	9	2	Figure SPM.3: please improve readability of colors and hatching (it is poorly readable even in color, on inkjet printouts).	Government of Belgium, Belgian Science Policy Office - Belspo
14556	9	1	9	2	Consider revising the x-axis increments to be labeled only as increments (i.e., "1000") versus a cumulative population count moving from left to right. If total population is important here, that number can be labeled at the far right. Otherwise, the chart as presented is treating the x-axis as a scale and should be labeled accordingly -- not as a tally starting with a "north american person 1" and ending with with a "southern asian person 7.8 billion".	Government of United States of America, U.S. Department of State
14558	9	1	9	2	North America has zero change in LULUCF CO <sub>2</sub> emissions? Or is the emission reduction portion (below 0) wrongly marked (vertical lines instead of diagonal)?	Government of United States of America, U.S. Department of State
2070	9	1	9	4	The pie chart of Figure SPM.3 is difficult to read and inconsistencies between the left-side and right-side charts were observed: some CO <sub>2</sub> LULUCF and Other are missing in the pie chart.	Government of Republic of Korea, Korea Meteorological Administration
1172	9	2	9	2	line 2 Add "of" "Distribution of regional"	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5274	9	2	9	2	Panel a & b: Shading for GHG emissions type makes figure hard to read and doesn't add enough value to merit keeping.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14560	9	2	9	2	The striping in the figure and other aspects are not well labeled and should be fixed.	Government of United States of America, U.S. Department of State
13762	9	2	9	3	Editorial: Please check the wording. Would it be correct to rephrase to "Figure SPM.3: Distribution of regional GHG emissions (2019) and ...."?	Government of Norway, Norwegian Environment Agency
14562	9	2	9	3	The Figure SPM.3 title is quite vague. What do authors mean by "distributed unevenly"?	Government of United States of America, U.S. Department of State
9884	9	5	9	14	Please provide a reference where we can find which countries belong to each region in figure SPM.3	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
13628	9	5	9	5	"regional" can be deleted as the sentence goes on to read "...emissions in tonnes CO <sub>2</sub> -eq per capita by region..." It is not necessary to have both "regional" and "by region" in the same sentence.	Government of New Zealand, Ministry of Environment
3256	9	6	9	6	We notice the following error in Panel a: the small negative rectangle for North America should use vertical hatching since it is for LULUCF but it seems that its hatching is oblique. The same error is in Figure TS.5	Government of France, Ministère de la Transition écologique et solidaire
9418	9	6	9	6	The term "Land use, land use change, forestry" should be replaced with "Land use, land use change and forestry", in accordance with the established IPCC terminology. The same applies to the annotation in panel b of Figure SPM.3	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
3254	9	6	9	7	It would be helpful to mention in the text that the different GHG are shown by different hatchings, and make sure that the keys in the table are properly readable (very hard to read the three small circles)	Government of France, Ministère de la Transition écologique et solidaire
14564	9	7	9	7	GWP100 needs to be explained for policymakers and the conversion factors footnoted.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6068	9	10	9	10	The SPM mentions that "Emissions from international aviation and shipping are not included" in Panel a) of Figure SPM.3. It would be helpful to briefly explain why they were excluded (or to include them). By contrast, note that the legend of Figure SPM.2 explains that emissions from International Shipping and Aviation were excluded because they cannot be allocated to regions (which however is not an entirely satisfying explanation: it might be that the data is not available, but from a scientific point of view, rules for the allocation of bunker emissions could potentially be developed, so it is probably not an "absolute" impossibility).	Government of Belgium, Belgian Science Policy Office - Belspo
6348	9	10	9	10	It should be stated that domestic aviation is not included or "international" should be deleted otherwise.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11208	9	10	9	10	Emissions from international aviation and shipping: are these the same exclusion as mentioned on page 6, line 14? In that case shouldn't "biogenic sources" also be mentioned?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11210	9	12	9	12	suggest to use: historical *cumulative* emissions, to contrast to a single year.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5276	9	12	9	14	Figure SPM.1 shows that the LULUCF-CO2 emissions even between 1990 and 2019 are very uncertain. Given this uncertainty, to what extent can we plausibly estimate LULUCF-CO2 emissions back to 1850 in Figure SPM.3 panel b? It's important to retain the information on LULUCF emissions but could authors ensure this uncertainty is captured in the figure caption?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6070	9	13	9	13	Figure SPM.3, Panel b. The caption mentions that "Other GHG emissions are not included". It would be helpful to briefly explain why they were excluded. Is it because cumulative emissions cannot be calculated for many non-CO2 forcings? (Is this panel based on cumulative emissions?)	Government of Belgium, Belgian Science Policy Office - Belspo
6350	9	13	9	13	It should be stated that domestic aviation is not included or "international" should be deleted otherwise.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14566	9	13	9	13	Other GHGs should not be excluded.	Government of United States of America, U.S. Department of State
14568	9	13	9	13	Add an explanation of why "Other GHG emissions are not included".	Government of United States of America, U.S. Department of State
3902	9	13	9	14	The caption indicates that emissions from international aviation and shipping are included in the plot, and so presumably they are somehow allocated to particular regions. But page 8, line 10-11 indicates that international shipping and aviation emissions cannot be allocated to regions. We suggest that they should either be allocated to regions consistently in both plots, or not included in either plot.	Government of Canada, Environment and Climate Change Canada
6352	9	13	9	14	Figure SPM.3: Whereas caption to panel b of Figure SPM.2 states that "International Shipping and Aviation cannot be allocated to regions", caption to panel b of Figure SPM.3 mentions that "Emissions from international aviation and shipping ARE included" even though panel b shows the share of historical CO2 emissions per region. Please verify and correct.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13764	9	13	9	14	It is difficult to understand, or at least might create some confusion, how emissions from international aviation is possible to included in figure SPM.3b. while it is not included in figure SPM.3a. and SPM.2b. Especially, since it is written on page 8, line 10-11, that emissions from international shipping and aviation cannot be allocated to regions. Please consider clarifying.	Government of Norway, Norwegian Environment Agency
3260	9	16	9	16	A reference to Fig. TS.5 could be added (see page TS-22)	Government of France, Ministère de la Transition écologique et solidaire
10284	9	26	9	26	Please specify the source for the definition of developing countries	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climático - Ministerio de la Transición Ecológica
13520	9				As commented before with regards to Figure SPM.2, please add a category along the UNSD grouping "small island developing states" to allow for the unique circumstances of small islands to be captured and for policymakers of those regions to receive this critical information.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2160	9		9		In panel a, I cannot understand some rectangular below 0, at North America and Europe part. Some explanation about it would be more helpful.	Government of Republic of Korea, Korea Meteorological Administration
2428	9		9		Difficult to distinguish between the sector especially in table b.	Government of Denmark, Danish Meteorological Institute
3904	9		9		It is difficult to determine what part of figure SPM 3 is related to the small legend on fossil fuel intensity, LULUCF and other GHG emissions in the lower right hand corner.	Government of Canada, Environment and Climate Change Canada
9896	9		9		Figure SPM.3: Explain the term "production based" for the cumulative emissions, and why that term is relevant here (or: delete it)	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11212	9		9		Panel b) is rather difficult to read because the colors are all so close to each other. This could be fixed quite easily and extended to panel a) for consistency. It is unclear why 'other GHG emissions' are not provided in panel b). Please consider redrawing the figure.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12252	9		9		B:3 Figure SPM.3:Distribution regional GHG emissions per region. In this graph,There is no proportion between distribution regional GHG emissions per region for Europe 8.8% and the regional proportion of total cumulative production-based CO2 emissions 17.5%	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12538	9		9		Figure SPM 3 has to be reworked as follows: Panel a and b should be redone on the same classification of regions as in Figure SPM 2 with developed countries separated.	Government of India, Ministry of Environment, Forests and Climate Change
13612	9		9		GHG emissions per capita and region- aias Europe here taken to be exclusive of Eastern Europe?	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
15660	9	2	9	2	replace regional by of	Government of Algeria, Ministère de l'Enseignement supérieur et de la Recherche Scientifique
130	10	0	10	0	Information on sectoral emissions and patterns should be included back in the SPM. This information was provided in the previous version of SPM (SOD) in page 9 lines 30-37 and Figure SPM 2 of SOD. The entire current SPM lacks important sectoral information and discussion in the (direct and indirect) sectoral emissions. Required Action: Include back the text and the figure as in SPM SOD.	Government of Saudi Arabia, Sustainability Advisor to the Ministry of Petroleum and Mineral Resources
134	10	0	10	0	The high confidence statement from Chapter 16 and included in the Technical Summary Page 127 Lines 2-4 should be added to the paragraph. "Innovation in climate mitigation technologies has seen enormous activity and significant progress in recent years. Innovation has also led to, and exacerbated, trade-offs in relation to sustainable development."	Government of Saudi Arabia, Sustainability Advisor to the Ministry of Petroleum and Mineral Resources
6892	10	1	10	1	What exactly are the low-emission technologies referred to here? How does this term compare to the low-carbon technologies mentioned in B.4.2? Please add clear definitions here and consider using the same terminology consistently throughout the SPM.	Government of Jamaica, Meteorological Service Division
11214	10	1	10	1	"several low-emission technologies": Whilst it is important to highlight the falling cost of these technologies, reference should be made to other energy sources, in particular bioenergy, as that remains by far the biggest source of renewables (albeit not primarily for electricity) and more dominant (and faster growing) than CCS or nuclear.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12998	10	1	10	1	Why do we use 2010 as the reference point?	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13192	10	1	10	1	Add: "adoption AND APPLICATION"	Government of Switzerland, Federal Office for the Environment FOEN
13630	10	1	10	1	It would be helpful to define (perhaps through a footnote?) what is meant by "unit cost". It is clear what this is when looking at figure SPM.4, but not obvious in the headline statement.	Government of New Zealand, Ministry of the Environment

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11216	10	1	10	10	Several elements of headline statement B4 should be re-visited: - Units costs should be described to have "continuously" fallen to represent what is described in B4.1. - Instead of "Innovation policies", say "Mixes of innovation policies" and replace "some countries" by the more specific "in developed countries and emerging economies". - Technological change has led to "lower benefits". It is not clear what exactly this means (presumably that least developed countries have not gained as much as other countries from these technologies). Re-phrase, in particular to make clear what relevance these "benefits" have to climate change mitigation. - "growing impact on mitigation" - what does this mean?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5286	10	1	10	12	"Unit costs" presumably refer to "capital costs" of technologies. The unit cost is the price incurred by a company to produce, store and sell one unit of a particular product (i.e. a turbine or a PV panel). Unit cost is misleading in particular as reductions in the cost per unit of electricity/MW have been achieved by increasing the size of units, and hence the absolute unit cost has actually increased rather than decreased over time while the cost of generating electricity has decreased. "Capital costs" would be a more appropriate term.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11218	10	1	10	16	B.2 talks about "low-emission technologies", but effectively limited to electricity. It should be spelled out in the headline statement or the section should be more balanced.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11918	10	1	10	17	The B.4 headline statement talks of "low-emission technologies" while B.4.2 talks of "low-carbon technologies". It remains unclear what the difference is. It is strongly suggested that each term is clearly defined and included in the glossary and explained in a footnote here. Alternatively (and this would be preferred), one of the two terms is used consistently across the entire SPM (as this comment also refers to later sections), while also being clearly defined in the glossary and explained in a footnote. The definitions provided in Chapter 6, p.8 could be used in a footnote, or used for the new glossary entries: "'Low emissions' is used for energy technologies that produce little CO2 or no CO2 or that remove CO2 from the atmosphere. Similarly, 'low-carbon' transitions is used to describe transitions that limit likely warming to 2°C or below. 'Net-zero' energy systems refer to those that produce very little or no CO2 or may even sequester CO2 from the atmosphere."	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13050	10	1	10	17	Please provide clarity on the difference, if any, between "low-emission technologies" in the headline statement B.4 and "low-carbon technologies" in B.4.2 as this may create confusion. A footnote could be created to explain this. Additionally we suggest only using one of the terms for consistency to avoid any confusion.	Government of Gambia, Department of Water Resources
13334	10	1	10	19	This is very general. For policymakers it would be important to add some substance on what policies have been successful, in what context, under which conditions. Good examples on how this could be done, are found in Section E, e.g., in E4.4 and E4.5.	Government of Switzerland, Federal Office for the Environment FOEN
13766	10	1	10	19	The sentence "Technological change has led to lower benefits, and some adverse effects, in least developed countries" seems not to be supported by text in paragraph B.4.2 (where it would be expected to find an elaboration). Would it be possible to add some text in B.4.2 that explains this better?	Government of Norway, Norwegian Environment Agency
5278	10	1	10	24	This section has some useful information on policy instruments that have been important in reducing technology costs, however could be much clearer on how, to make this section more actionable to policymakers. For example, "where policy has been strong and consistent, technology costs have fallen rapidly" - can any lessons be learnt for the future?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13004	10	1	10	24	Please consistently indicate the CLs across the various statements made.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
922	10	1	10	6	Not increases are from a low base, regions should be included	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
924	10	1	10	6	The statement on technologies should be clarified.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5280	10	1	10	6	The statement 'Technological change has led to lower benefits, and some adverse effects, in least developed countries.', does not appear to be justified, as no further information is given on the adverse effects specific to least developed countries. The underlying chapter discusses the lower benefits to least developed countries due to lower capacity and participation in various programmes, and the lack of ability in 'some developing countries' to avoid trade-offs with developmental objectives, but nowhere does it imply that these trade-offs are specific to those countries categorised as 'least developed countries'. The phrase 'and some adverse effects' should thus be deleted from this paragraph, or otherwise justified.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5282	10	1	10	6	Can this headline make more of the comparison of renewables costs vs fossil fuel? Although fossil fuel costs are shown in the figure, they are not mentioned in the text. It is relevant for the text to make clear that Solar PV and onshore wind are now cheaper than fossil fuels	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5284	10	1	10	6	This headline makes mention of "some adverse effects" in developing countries, but this is not explained further in the B4 bullets below. Is this due to mining for example? The trade-offs with multiple SDGs in B.4.3 could be expanded here to give slightly more detail.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6072	10	1	10	6	Please consider adding a reference to the rebound effect (of reduced costs).	Government of Belgium, Belgian Science Policy Office - Belspo
6354	10	1	10	6	The headline statement should be more substantive: 1) Please reflect the amount of technological change in the first sentence (2-6-34, 2-58-8), mention solar and wind energy" for the clarity for policy makers (Fig. SPM.4, 2-58-8), and join it with the second sentence: "The unit costs of several low-emission technologies, ESPECIALLY SOLAR AND WIND ENERGY, AND BATTERIES have DRASTICALLY fallen since 2010, and their adoption has SIGNIFICANTLY accelerated (high confidence), supported by innovation policies in some countries." 2) Please replace the statement on technological change in least developed countries referring to the delay in deployment due to a lack of governance as well as technological and institutional capacities (see our comment on the respective sentence in B.4.2). 3) Please state the nature of impact of cross-cutting technological change, in particular digitalisation on mitigation, is it positive or negative? Otherwise this information is not helpful. For example, 16.6.4 provides more specific information.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13448	10	1	10	6	B.4 second, third and fourth sentence - what is meant by these statements? Please make clearer and quantify or delete.	Government of Estonia, Estonian Meteorological & Hydrological Institute
6356	10	1	11	16	Previous reports have used the expression "deployment" instead of "adoption". The glossary explains "technology deployment" but not "technology adoption" and we suggest using the first, more familiar expression also in the SPM, if their meanings are identical.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2704	10	2	10	2	if all types of innovation, specify (social, legal, technological, etc.); if only technological and/or technical innovation, indicate.	Government of France, Ministère de la Transition écologique et solidaire
5288	10	2	10	2	Can any indication of the accelerated rate of low-emission technologies be provided? In the following paras, percentage changes in the costs are provided, but not in absolute change in uptake of these technologies, which I think would be useful to know.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13002	10	2	10	2	Qualify or quantify some.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13194	10	2	10	2	What are "innovation policies"? Rephrase, such as "... innovation was supported by policy decisions/instrument ..."	Government of Switzerland, Federal Office for the Environment FOEN
13768	10	2	10	2	Please consider to rephrase this sentence to: "Targeted innovation policies..". The actual policies referred to here, and as described in the underlying chapters, has been technology specific rather than technology neutral. This is a very policy relevant finding. The sustained decreases in unit cost is caused in large part by the large increase in installed capacity, driven by feed in tariffs, mandates, and other such <u>market-pull instruments</u> .	Government of Norway, Norwegian Environment Agency
14570	10	2	10	2	"has accelerated" might be too optimistic; better expressed as "have grown".	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
1154	10	2	10	3	no confidence rating included.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2126	10	2	10	3	Considering B.4.2 sub-paragraph regarding innovation policy, a sentence would be included in the B.4. paragraph.	Government of Republic of Korea, Korea Meteorological Administration
5290	10	2	10	3	Should say deployment & market creation, as well as innovation, policies?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5292	10	2	10	3	What's the assertion that benefits of technological change have been lower in developing countries based on? Adoption has been lower, but that's different, so if that's what it refers to, can this be reworded?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13632	10	2	10	3	It is not clear what the following phrase means: "supported global adoption and cost reduction" . Please rephrase.	Government of New Zealand, Ministry of the Environment
14586	10	3	10	24	Recommend striking "and some adverse effects" and specifying what the "lower benefits" are. Adverse effects are well-covered in Section D, and it seems important to capture the nuance of this point correctly and completely because to a policymaker the language as it stands may read that "R&D investments are not a priority and in some cases can do harm."	Government of United States of America, U.S. Department of State
786	10	3	10	3	Suggestion: to replace ' has led to' with 'in some cases has led to', because it is not the case for all technologies	Government of Russian Federation, Institute of Global Climate and Ecology
1236	10	3	10	3	The "some adverse effects" is not discussed in the B.4.x paragraphs below. Relevant information would be useful to include.	Government of Sweden, Swedish Meteorological and Hydrological Institute
2128	10	3	10	3	There is no corresponding sub-paragraph to the "Technological change has led to lower benefits, and some adverse effects". So, it is necessary to make a sub-paragraph to cover that key sentence.	Government of Republic of Korea, Korea Meteorological Administration
2706	10	3	10	3	We suggest to explain what mean "lower benefits"	Government of France, Ministère de la Transition écologique et solidaire
5294	10	3	10	3	some adverse effects' - the paras that follow don't really bear this out, unless these are somehow folded in to 'distributional effects' mentioned in para B.4.2. If the adverse effects are relatively low, it would be good to make this clearer, otherwise the opening para could come across as unfairly negative.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5298	10	3	10	3	An explanation of the "lower benefits, and some adverse effects" needs to be provided in B.4.2, building on this reference in B.4. B.4.2 only mentions slower adoption, but does not actively mention adverse effects or benefits (at least not the word).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13000	10	3	10	3	Indicate the CL in the sentence, if any.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
618	10	3	10	4	The "lower benefits, and some adverse effects" mentioned in this framework text refers to the insufficient benefits of technological innovation in the least developed countries, but the corresponding text in B4.2 below only emphasizes application of low-carbon technologies, and cannot support the view of insufficient benefits. It is recommended to be consistent with the original meaning in B4.2.	Government of China, China Meteorological Administration
926	10	3	10	4	The statement regards ".lower benefits and some adverse effects.." is too vague and potentially easy to misunderstand. There is little (or nothing) in the subsequent paragraphs in this section to support or clarify this statement.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
1156	10	3	10	4	no confidence rating included.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2210	10	3	10	4	Third sentence of the headline statement B.4 is not clear. What kind of technological change? Lower benefits for what and measured how? Adverse effects on what? Please reformulate the sentence to read more clearly and make a clearer statement.	Government of Finland, Finnish Meteorological Institute (FMI)
2256	10	3	10	4	Suggest clarifying the sentence beginning 'technological change' as it is slightly unclear. When referencing lower benefits is this in terms of emissions reductions, socio-economic interactions or cost implications?	Government of Australia, Department of Industry, Science, Energy and Resources
2430	10	3	10	4	Suggest elaborating on the the lower and adverse effects in delveloping countries ie blow B4	Government of Denmark, Danish Meteorological Institute
3906	10	3	10	4	As written, this sentence is very general and could easily be misunderstood. Should the type of technological change be specified here (e.g. low-emission technologies)? When the word 'lower' is used, a reader automatically asks 'lower than what'? Is the intended comparison here to benefits from technological change in least developed countries to those in developed countries? Why would benefits of technological change be lower in least developed countries than elsewhere? This conclusion is not expanded on, or supported by any of the following paragraphs. Instead, para B.4.2 speaks to the lower adoption of low carbon technologies in last developed countries. There is no mention in the supporting paragraphs of what kind of adverse effects have occurred in least developed countries in association with deployment of low-carbon technologies. As a statement of fact, this conclusion should be better supported.	Government of Canada, Environment and Climate Change Canada
3908	10	3	10	4	The sentence related to least developed countries in Line 3 is unclear when it refers to technological change. It seems that sentence is establishing either a weak or an adverse relation between technological changes and its benefits in least developed regions/countries.	Government of Canada, Environment and Climate Change Canada
5296	10	3	10	4	The line around technological change leading to lower benefits and adverse impacts in least developed countries is misleading I think. In the current form it makes it sound like new technology is damaging least developed countries but the fuller paragraph below is clearer that this is about least developed countries not accessing the benefits of technology improvement at the same rate as other countries. This line should be clarified accordingly in the summary.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5300	10	3	10	4	"Technological change has led to...some adverse effects, in least developed countries". Please explain what these adverse effects are in section B.4.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5302	10	3	10	4	Technological change...' this sentence doesn't seem to reflect B.4.2, which does not discuss adverse effects, and says simply that adoption of low-carbon technologies is lower in developing countries. The relevant headline statement on the other hand seems to imply that the same magnitude of change led to lower benefits/adverse effects in LDCs, which seems incorrect. Please could you rephrase?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6074	10	3	10	4	The sentence "Technological change (...) in least developed countries" is not clear as it stands now. We think that it is important to either make it clearer or to provide information that clarifies the topic within the next paragraphs.	Government of Belgium, Belgian Science Policy Office - Belspo
6358	10	3	10	4	Please clarify what is actually meant by "Technological change has led to lower benefits, and some adverse effects, in least developed countries." This sentence has no underlying para in subsection B.4 and is misleading with respect to the previous sentence. In addition, we could not find supporting evidence in chapters 13 and 16. The latter states that LDCs are lagging behind due to a lack of governance as well as technological and institutional capacities, which not inherently associated with low-emissions technologies itself. Please consolidate/clarify.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9420	10	3	10	4	The sentence "Technological change has led to lower benefits, and some adverse effects, in least developed countries." seems to point out that the technological change itself has a nature to bring a negative impact, thus this might be misleading, but the corresponding part in the page 82, L36-39 of Chapter 16 describes that this happens in countries below the technological frontier and without appropriate technological capabilities. It is better to reflect the original description, e.g. "Technological change in least developed countries below the technological frontier can lead to lower benefits and some adverse effects without appropriate technological capabilities."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9886	10	3	10	4	The bold printed statement mentions 'some adverse effects' for LDCs but there is no explanation of those adverse effects in the underlying tekst. So either delete 'adverse effects' or explain in the text	Government of Netherlands, Ministry of Economic Affairs and Climate Policy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9898	10	3	10	4	(B.4): The sentence "Technological change...least developed countries" is totally unclear. What are "Lower benefits" compared against? What are (examples of) "some adverse effects"? Where do these occur and what causes them? The sub-items under B.4 do not offer any clues or clarification, which makes this sentence obsolete, suggest to delete it.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
10300	10	3	10	4	The statement "Technological change has led to lower benefits and and adverse effects in least developed countries" should be explained an elaborated.	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
11220	10	3	10	4	This is mainly an issue of how you write it but this reads as if technological change itself has led to lower benefits. The statement on adverse effects seems too strongly worded.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11222	10	3	10	4	Could it be explained/examples provided on the adverse effects of technological change in least developed countries (this is not mentioned anywhere in the underlying text).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11920	10	3	10	4	B.4: The sentence "Technological change has led to lower benefits..." is confusing. It implies that technological change has caused a lowering in benefits. Please reword (perhaps "fewer benefits"?)	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12540	10	3	10	4	Replace "some adverse effects....least developed countries." with the following "including higher cost for goods and services, loss of employment, increase the import dependence affecting energy security and other such adverse effects in developing countries".	Government of India, Ministry of Environment, Forests and Climate Change
13196	10	3	10	4	"Technological change has led to lower benefits, and some adverse effects, in least developed countries". Assess if this is message corresponds to the main findings from the literature for the lead paragraph? Also, why are we highlighting a subset of the actors (developed countries)? In addition it corresponds to a medium confidence level. SEE ALSO general comment on the use of findings of low and medium confidence level findings in lead paras.	Government of Switzerland, Federal Office for the Environment FOEN
13770	10	3	10	4	Please consider rephrasing the sentence beginning with "Technological change has led to lower benefits..". It is difficult to understand what this means, and what it refers to (which benefits are reduced by technological progress, and compared to what?)	Government of Norway, Norwegian Environment Agency
14572	10	3	10	4	This sentence mentions adverse affects, but does not offer any explanation either in this paragraph or the rest of the page. While it is likely covered in greater detail in the report, this is a strong enough statement that additional information should accompany it in the SPM.	Government of United States of America, U.S. Department of State
14574	10	3	10	4	"Technological change has led to lower benefits, and some adverse effects, in least developed countries." This sentence is poorly worded and seems to imply that technological change is the cause of lower benefits in the least developed countries. Presumably the intent is to convey that the distribution of benefits from technological change is unequal. Perhaps reword to: "The benefits of technological change have been unevenly distributed with the least developed countries receiving lower benefits and experiencing higher adverse effects."	Government of United States of America, U.S. Department of State
14576	10	3	10	4	This is a provocative and counter-intuitive statement and needs some elucidation or context. The subsequent three paragraphs provide no or hazy support or explanation for the statement. It should be noted that the suggestion or possibility of some adverse effects should not be weighted in the narrative to seem equal to the concrete, demonstrated and potentially very positive effects. Suggest adjusting wording in this sentence to clarify the meaning and where the true confidence is and what is more speculative.	Government of United States of America, U.S. Department of State
14578	10	3	10	4	If sentence is kept on lines 3-4, authors need to explain "some adverse effects" in B.4.2 below.	Government of United States of America, U.S. Department of State
14580	10	3	10	4	The statement that technological change has led to adverse effects in least developed countries is not supported by the explanatory text in B.4.2, which only states that adoption is lagging in developing and least developed countries. Provide some explanation of the type and scale of adverse effects in least developed countries.	Government of United States of America, U.S. Department of State
14582	10	3	10	4	What does this sentence mean? What are lower benefits and adverse effects in this sense?	Government of United States of America, U.S. Department of State
14584	10	3	10	4	This sentence is not supported by the text in the section, and is otherwise difficult to understand (which benefits? net of all possible benefits) and so should be deleted.	Government of United States of America, U.S. Department of State



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
788	10	4	10	4	The adverse effects are possible not only in 'in least developed countries', but also in other countries. Suggestion: replace 'in least developed countries' with ' in particular, in least developed countries'	Government of Russian Federation, Institute of Global Climate and Ecology
13198	10	4	10	4	What is "cross-cutting technological change"? Avoid buuszwords, collocated words, simplify and rephrase.	Government of Switzerland, Federal Office for the Environment FOEN
620	10	4	10	5	The meaning of this expression is unclear, and it is suggested that this sentence "Whether the digital revolution will be an enabler or a barrier for decarbonization will ultimately depend on the governance of both digital decarbonization pathways and digitalization more in general" from the underlying report (line 14, page 21, Chapter 16) be added to the SPM to avoid misleading.	Government of China, China Meteorological Administration
2258	10	4	10	5	Please clarify whether the 'growing impact' supports greater emissions reductions, or has mixed effects as suggested in B.4.3.	Government of Australia, Department of Industry, Science, Energy and Resources
2708	10	4	10	5	The phrase "growing impact" is somewhat misleading and is more asertive than what paragraphe B.4.3 which is more balanced ("can contribute to energy conservation and efficiency improvements, but can also increase energy demand and involve trade-offs with multiple Sustainable Development Goals") the sentence could be more precise on the type of impacts, based on B4.3, we suggest to precise that "a growing both positive and negative impact on mitigation"	Government of France, Ministère de la Transition écologique et solidaire
6076	10	4	10	5	It is not clear whether the impact of growth is positive or negative. Is it actually clear and well substantiated? We feel that this might be debatable, so a clear explanation is needed.	Government of Belgium, Belgian Science Policy Office - Belspo
11224	10	4	10	5	"digitalisation ... Having a growing impact": the HS should spell out whether it is a positive or negative impact on mitigation. If it is unknown (lines 22 and 23 seem inconclusive), then the "impact" should perhaps not be mentioned in the HS (as it may be close to neutral) or it should be emphasized that the impact cannot be estimated at this stage.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2260	10	4	10	6	Consider including a footnote to define and provide examples of 'cross-cutting technological change'.	Government of Australia, Department of Industry, Science, Energy and Resources
14588	10	4	10	6	The Chapter 5 introduction and Section 5.3.4 alternately conclude the impact of digitalisation has made limited contributions AND may lead to more energy consumption from demand for more devices and their related production, shifts in transportation, etc. Remove "in particular digitalisation" since it is captured in B.4.3.	Government of United States of America, U.S. Department of State
12542	10	4	10	5	Remove sentence. Reason: Unclear and also overemphasizes digitalization.	Government of India, Ministry of Environment, Forests and Climate Change
2130	10	5	10	5	Based on the B.4.3, at the last part of the sentence, "through energy conservation and efficiency improvement" would be added.	Government of Republic of Korea, Korea Meteorological Administration
2470	10	5	10	5	please indicate direction for 'growing impact'	Government of Denmark, Danish Meteorological Institute
5304	10	5	10	5	Could authors clarify what is meant by "impact"? Is it lowering costs?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13634	10	5	10	5	It would be useful to know if the "growing impact on mitigation" is positive or negative.	Government of New Zealand, Ministry%20for%20the%20Environment
14590	10	5	10	5	"a growing impact" is not specific enough and is misleading given the detail presented later in B.4.3. Replace with a brief statement about the trade-offs presented by digitalization which are summarized in B.4.3.	Government of United States of America, U.S. Department of State
14592	10	5	10	5	In B.4 and B.4.3 (SPM-10, line 30) "digitalization" is not defined. Suggest creating a glossary of terms for the SPM and defining digitalization there.	Government of United States of America, U.S. Department of State
2714	10	7	10	10	The majority of institutional firms work with the EROI parameter. However, the latest reports show that oil and gas extraction, and particularly shale gas, remain much more profitable than renewable energies. Of course, the investment prices of these renewable energies have fallen, but their current uses should be put into perspective, in particular in the industrial sector, by introducing the percentage of use of these energies in national production. Therefore we recommend to remind in thi paragraph that the share of oil and gas in the energy production has not yet significantly decrease.	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2716	10	7	10	11	It should be better highlighted that renewable energy sources are actually added to fossil fuel and are not replacing them (cf Fig.6.5, showing no decrease in the use of coal, oil and gas for world total energy supply).	Government of France, Ministère de la Transition écologique et solidaire
14234	10	7	10	11	The explanations of slower growth of CO2 capture and storage (CCS) and nuclear power is different in each case as the underlying report shows, so it is the level from which they further evolve. It is misleading to put them together under the same category.	Government of Romania, National Meteorological Administration
14236	10	7	10	11	As for the public acceptance as a barrier for nuclear power, this evaluation does not fit for all countries - as the underlying report shows, and should not be mentioned as a general remark.	Government of Romania, National Meteorological Administration
14238	10	7	10	11	In terms of economic barrier for nuclear, again this is disputable and it is not stated in the underlying report since nuclear life time extension projects provided the cheapest source of electricity across the board.	Government of Romania, National Meteorological Administration
2734	10	7	10	12	Intermittent renewable energies are diffuse which require much resources and space than thermal power plants. Public acceptance is also a problem.	Government of France, Ministère de la Transition écologique et solidaire
12254	10	7	10	12	B.4.1:According to Clean Air law in Iran, it is necessary to provide at least 30% annual increase in the required electricity capacity of the country from renewable energy sources. Unfortunately, due to sanctions and lack of international technical and financial support, only about 7% of it has been achieved. In this paragraph, it is necessary to point out that, unfortunately, due to oppressive sanctions and lack of international supports in some countries (like Iran), despite useful laws and diligent efforts, the goals in the field of renewable energies have not yet been achieved.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
2710	10	7	10	7	We suggest to give time unit ("between 2010 and 2019" is more precise than "since 2010")	Government of France, Ministère de la Transition écologique et solidaire
9422	10	7	10	7	Though the cost of PV has been declining since 2010, the cost has jumped up by 30% in 2021 because of the energy crisis particularly in China, where more than 80% of solar grade silicon and solar panels are produced. This may raise the question of lifecycle carbon impact of PVs and competitive cost assumption of the electricity if China switch the electricity to produce silicon and panels from coal power to other more expensive electricity sources.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
13008	10	7	10	7	Again 2010 is used as the reference year. Why is this?	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
2062	10	7	10	8	(Basis) consistent with p.3 of executive summary of chapter 6(energy) (present) "Since 2010, there have been sustained decreases in the unit costs of solar energy(85%), wind energy(55%), and lithium-ion batteries(85%)" to (change) "From 2015 to 2020, the unit costs of solar energy(56%), wind energy(45%), and lithium-ion batteries (64%)"	Government of Republic of Korea, Korea Meteorological Administration
2712	10	7	10	8	Does this cover both onshore and offshore (the latter had a different profile)?	Government of France, Ministère de la Transition écologique et solidaire
2720	10	7	10	8	Add a comment to clarify that the LCOE is a partial indicator. We must consider the full costs of the system (network reinforcement, additional cost for balancing, flexibility, demand management and storage). Cf. ch6 p48 L31, p53 L10&11,p24 L18 to 30	Government of France, Ministère de la Transition écologique et solidaire
5306	10	7	10	8	Preferable to indicate the exact time period the changes relate to (probably 2010-2020?) rather than just "since"	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5308	10	7	10	8	What is the end year value for these numbers? Needs to be included.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6360	10	7	10	8	The statement should be amended by a statement on the low market shares as shown in figure SPM.4 to frame this development correctly. Also, it should be said in the text that the decrease has led to costs that are competitive with fossil fuel (coal and gas) LCOE.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
10302	10	7	10	8	Please provide the reference year for the decreases in unit costs (it is stated that these decreases occurred since 2010 but it is no specified in relation to what final year).	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11226	10	7	10	8	Not "solar and wind energy" but "solar and wind electricity" is more precise wording, and clearer.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14594	10	7	10	8	This statement should make it clear that the percentages in parentheses are for reductions. For example, solar energy has decreased by 85%, so it makes more sense to write (-85%) with the negative sign in front to denote a decrease.	Government of United States of America, U.S. Department of State
14596	10	7	10	8	There are several technologies mentioned in this sentence that have experienced significant cost declines, but one example that is often included as part of this group has been left out, which is LEDs. Given the other references to energy efficiency in this section and the importance of energy efficiency in reducing GHG emissions, it should be considered for inclusion here.	Government of United States of America, U.S. Department of State
12544	10	8	10		Insert after "...capacities" the following: ", however, issues surrounding recycling or waste management of solar panels or batteries, and availability of critical minerals used in these technologies also need to be analyzed to get the true costs especially given the timescales considered in climate modeling. (Alonso et al., 2012; Li et al., 2020)" Alonso, E., Sherman, A. M., Wallington, T. J., Everson, M. P., Field, F. R., Roth, R., & Kirchain, R. E. (2012). Evaluating Rare Earth Element Availability: A Case with Revolutionary Demand from Clean Technologies. <i>Environmental Science &amp; Technology</i> , 46(6), 3406–3414. <a href="https://doi.org/10.1021/es203518d">https://doi.org/10.1021/es203518d</a> I, J., Peng, K., Wang, P., Zhang, N., Feng, K., Guan, D., Meng, J., Wei, W., & Yang, Q. (2020). Critical Rare-Earth Elements Mismatch Global Wind-Power Ambitions. <i>One Earth</i> , 3(1), 116–125. <a href="https://doi.org/10.1016/j.oneear.2020.06.009">https://doi.org/10.1016/j.oneear.2020.06.009</a>	Government of India, Ministry of Environment, Forests and Climate Change
2718	10	8	10	10	We suggest to add "compared to X% in 2010"	Government of France, Ministère de la Transition écologique et solidaire
13614	10	8	10	9	would be good to give an indication of what the contribution of solar and wind was before for comparison	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13406	10	9	10	10	Decompose 8% into % for wind and that for solar respectively, since potential for exploitation and investment costs for the two forms of renewable energy differ.	Government of Kenya, Kenya Meteorological Service
2722	10	9	10	9	After "supply" we suggest to add ",while hydropower and nuclear power provided respectively about 16% and 10%,"  Sources : lines 13 to 15 page TS-53, line 46 page 6-3 and line 1 page 6-4	Government of France, Ministère de la Transition écologique et solidaire
2730	10	10	10	10	We suggest to add "energy" after "nuclear"	Government of France, Ministère de la Transition écologique et solidaire
11228	10	10	10	10	Growth of CCS: compared to what period? It was zero only very recently, which could posit an infinitely high growth rate. However, compared to recent years it is likely to be much lower. A concrete indication (of share and/or growth rate) could be informative.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14598	10	10	10	10	"slower growth of CO2 capture and storage (CCS)" phrasing gives a misleadingly positive impression of the scale of the limited pilots to date. The current cost of CCS is \$100-\$600/tCO2e and the cost is projected to be \$50-\$150/tCO2e in 2030 (Patrick Burgi 2021, Southpole.com). Lack of awareness of these costs results in policymakers' over-optimism about the prospects for this technology through 2030.	Government of United States of America, U.S. Department of State
132	10	10	10	11	B.4.1: It was mentioned that the slower growth of CO2 capture and storage (CCS) and nuclear is due to economic and institutional barriers and limited public acceptance. There was no reference to political barriers for both technologies which is a very critical aspect. To be able to address the issue at highest effectiveness, we have to employ all technologies. Political pressure is one the reasons. There is a need for inclusive investment which allows all types of technologies to be employed. Additionally, CCS has been presented in the most of the reviewed literature as a proven solution and this should be highlighted here.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
622	10	10	10	11	The statement is incomplete. According to the original text in Section 11.3 of the underlying report, CCS also addresses a key challenge of the technical aspect of "building a gathering and transport network". Therefore, it is suggested to change it to: ".....is due to economic, technological and institutional barriers and limited public acceptance."	Government of China, China Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
928	10	10	10	11	The statement implies CCS is now a mature technology, and proven at scale. This should be stated explicitly if indeed a findings from the assessment.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1238	10	10	10	11	The reference to "economic barriers" when it comes to nuclear sounds a bit surprising, given the price development of renewable energy (cost competitive in the markets). Is "barrier" the appropriate term here viz. cost of nuclear?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2724	10	10	10	11	Technological issues and trade-off of CCS should be added to this list.	Government of France, Ministère de la Transition écologique et solidaire
2726	10	10	10	11	There is an issue of balance here : the focus on economic and institutional barriers and public acceptance is inconsistent with elements presented below regarding technical and other feasibility barriers (in particular for CCS). This makes it seem like CCS and nuclear are solely to be considered from a reputational perspective. Add that the slower growth of CCS and nuclear is also due to the fact that there are large-scale technologies, therefore it is more complex to initiate them. See Technical summary p. 25 lines 19 to 21 : "Emerging evidence since AR5 indicates that small-scale technologies (e.g., solar, batteries) tend to improve faster and be adopted more quickly than large-scale technologies (nuclear, CCS) (medium confidence)."	Government of France, Ministère de la Transition écologique et solidaire
2728	10	10	10	11	Unclear why CCS is compared to energy sources, in particular nuclear energy, in this sentence. Although the challenges faced by the two are the same, CCS is a mitigation measure and thus should be differentiated in a different sentence.	Government of France, Ministère de la Transition écologique et solidaire
3910	10	10	10	11	We wonder whether the phrase 'economic and institutional barriers' is appropriate here. It does seem to imply a value judgement that the technologies described are desirable, and these 'barriers' are things which policymakers might seek to remove. Consider replacing 'barriers' with 'reasons'. For example if solar power is less expensive than CCS, is this really an 'economic barrier' to adoption of CCS?	Government of Canada, Environment and Climate Change Canada
3912	10	10	10	11	Is this conclusion about the slower growth in CCS and nuclear intended to be about their deployment in the electricity sector? If so, it would be helpful to specify this, especially as CCS on its own is not an energy supply technology, so comparing its growth in deployment to various sources of energy supply is somewhat confusing.	Government of Canada, Environment and Climate Change Canada
5310	10	10	10	11	My understanding is that the slower growth of CCS and nuclear compared with solar, wind and batteries is mainly due to their size. Small-scale technologies tend to evolve much more rapidly than large-scale technologies, because the latter have a fewer opportunities for learning.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5312	10	10	10	11	What metric is the 'slower' evaluated here in relation too? It is % of electricity generation? Needs to be clear - and relevant number for CCS and nuclear given too to allow quantification of how much slower.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6078	10	10	10	11	CCS and nuclear face really different barriers, hence we do not have the impression that it is appropriate to consider these together. Could you please rephrase, and possibly split the sentence?	Government of Belgium, Belgian Science Policy Office - Belspo
6362	10	10	10	11	_CCS: Without any further explanation, the SPM merely conveys the message that CCS is growing at a "slower" rate than solar, wind and Li-batteries. Because of its high relevance in the context of negative emissions, more specific information is needed on CCS in particular about its deployment rate and reasons for the smaller growth rate. Technical and sustainable potentials as well as risks should also be provided either here or in C11.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6364	10	10	10	11	The formulation in the SPM that suggests the slow deployment of nuclear is only associated with soft barriers ignores the fact that nuclear accidents, radioactive waste and proliferation of nuclear material that can be misused for military purposes are barriers that expose humanity to extreme risks that are not acceptable in many countries. In addition, RD-investments and deployment rates of nuclear energy has decreased or was much slower than that for renewables in many countries. Please reflect these facts in the SPM, drawing on the information in the underlying report including in chapters 16 and 6.4.2.4 (the latter mentions the challenge of higher costs of nuclear and its risks, not only "economic and institutional barriers"). In addition, we do not support addressing CCS and nuclear with very different characteristics and risks in the same sentence.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6366	10	10	10	11	The potentially large amounts of negative emissions assumed in scenarios compatible with the Paris Agreement are associated with CCS. This SPM, therefore, needs to inform about its technological and sustainable potential included associated risks and additional costs as well as on the installed capacity. The slow growth of CCS is especially due to fundamental techno-physical barriers (i.e. the inherently unreducible, very high energy demand), as detailed in chapter 12, which refers to the medium to low technology reference level of DACCS and enhanced weathering. Please also add here "The high energy demand of CCS, DACCS and enhanced weathering is inherent in these technologies." In addition, the amount of CO2 captured and stored by CCS was a few magnitudes smaller than the emission reduction due to PV and wind (and nuclear) and this should also be mentioned in the SPM.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
10304	10	10	10	11	The inclusion of nuclear energy should be at least qualified to take into account its environmental impact and security concerns.	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
11230	10	10	10	11	The slower growth rate of CCS is attributed not only to economic and institutional barriers but also to technological uncertainty which does not guarantee the permanence of storage.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11232	10	10	10	11	In the case of nuclear it better to state clearly the very high construction costs, which make this technology not affordable compared to renewable technologies, instead of defining it as an economic barriers. In addition there is also some limited political acceptance in some jurisdictions.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11234	10	10	10	11	It is not convincing to suggest that CCS and nuclear are not growing as fast as a range of other low-carbon options (solar, wind, EV-batteries) because of "economic and institutional barriers and limited public acceptance". In fact, while there has been resistance, nuclear power has had much more time and both financial and political support than any of the other options. And CCS has also been promoted to the utmost degree possible but still has not been able to deliver sufficient cost-efficiency to be scaled up. Furthermore, CCS is fundamentally different to the other technologies since it can never 'compete' on cost alone but requires a robust carbon pricing and regulatory framework (it will always be cheaper to use the same combustion technologies without capturing the CO2). Therefore it can never reach cost parity with unabated fossil fuel technologies in the way that solar, wind and nuclear might.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13010	10	10	10	11	There are several other barriers associated with these technologies, including environmental barriers/issues. This sentence also seems policy prescriptive. All new technologies, including solar, wind and hydro have barriers, but these are not mentioned. I suggest we remove the sentence on barriers.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13200	10	10	10	11	"The slower growth of CO2 capture and storage (CCS) and nuclear is due to economic and institutional barriers and limited public acceptance." In comparison to the assessment of other technologies, this sentence is the only situation where the authors do assess the acceptance in the public and reference barriers. It would be worthwhile to also assess the acceptance and barriers for the other technologies. Also add a notion with respect to the costs. That would also make a direct link to the figure SPM4.	Government of Switzerland, Federal Office for the Environment FOEN
13636	10	10	10	11	It would be useful to know if the phrase "economic and institutional barriers and limited public acceptance" applies equally to CCS and nuclear. Are the barriers to these options the same or, for example, are the barriers to CCS weighted more to "economic and institutional" than to "limited public acceptance"? It is particularly necessary to clarify this point here given that section C.11 is dedicated to the necessity of CDR, of which CCS is a component.	Government of New Zealand, Ministry of the Environment
13772	10	10	10	11	Please consider to include "lack of policy support" to the list factors causing slower growth, if appropriate. In our understanding the main point of B4 is that strong, targeted, innovation and deployment policies in some countries has been effective in driving down the cost of solar PV, batteries etc. CCS has not seen comparable incentives for deployment. IEAs 2021 World Energy Outlook states that one of four key short term priorities for holding 1,5 alive is to drastically increase the support for CCS, and other climate mitigation technologies not currently technological mature or competitive in the market.	Government of Norway, Norwegian Environment Agency
14600	10	10	10	11	The statement on the cost and deployment of CCS does not seem to consider or reference recent reports by the GCCSI and others showing that costs of CO2 capture have been reduced by over 30% and deployments have picked up by 32% over the past year. <a href="https://www.globalccsinstitute.com/resources/global-status-report/">https://www.globalccsinstitute.com/resources/global-status-report/</a>	Government of United States of America, U.S. Department of State
14602	10	10	10	11	What is the difference between high cost and an economic barrier? CCS isn't expensive because it is taxed heavily.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
538	10	10	10	12	We note the authors have attributed the slower growth of both CCS and nuclear to economic and institutional barriers, and limited public acceptance. We would suggest splitting the reasons for slower growth for CCS and Nuclear because they face different challenges, as noted in Figure SPM.10 (which elaborates on the barriers and enablers for these technologies). It would be useful to refer to Figure SPM.10 as a line of evidence as well. In addition, the authors may wish to consider including hydrogen and the associated reasons for lower growth here as well.	Government of Singapore, Ministry of Environment and Natural Resources
930	10	10	10	12	mention of enabling environments and resources needed as well as barriers e.g. lock ins.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
11236	10	10	10	12	Do institutional barriers include a missing economic perspective and access to market financing?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11238	10	10	10	12	The causes of slower growth of CCS compared to other technologies are not discussed in Chapter 11.3, which is listed as reference.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13450	10	10	10	12	Please quantify the increase in nuclear and CCS.	Government of Estonia, Estonian Meteorological & Hydrological Institute
14604	10	10	10	12	The statement about CCS in this sentence is not supported by the FGD. As is detailed in Section 6.4, the slower growth of CCS is also, even primarily, due to a lack of commercializable technology development to date. Unlike nuclear technology, modern forms of which are available at some describable cost if institutions and the public were to choose to invest (thus meriting the "high confidence" rating), it is not clear that today's CCS technology would function as a mitigation solution at any cost. Authors can certainly not say with "high confidence" that the barriers to CCS deployment are primarily due to "economic and institutional barriers, and limited public acceptance." Even if these barriers were removed, Section 6.4 makes it clear that CCS has yet to be proven at scale from a technological standpoint. Recommend removing it from this sub-point, or adding an additional sentence that addresses the technological barriers to CCS deployment more directly.	Government of United States of America, U.S. Department of State
2732	10	11	10	12	A reference to TS.3 could be added (see page TS-25 lines 12-26)	Government of France, Ministère de la Transition écologique et solidaire
14606	10	12	10	12	In general, Chapter 16 discusses innovation, evidence for supporting innovation, and barriers to innovation. However, it does not clearly address the specific issue here (growth of CCS and nuclear energy). Including the sections from Chapter 16 as supporting evidence within curly brackets seems misplaced.	Government of United States of America, U.S. Department of State
12338	10	13	10	19	In defining indirect incentives, little attention has been paid to legal incentives that influence policy	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
13202	10	13	10	13	Abbreviations do only make sense if they are use later in the text, in a frequent matter. This argument does not hold true for "(R&D)", please delete.	Government of Switzerland, Federal Office for the Environment FOEN
11240	10	13	10	15	Here the effects of competition in a market are missing. Yes, policy instruments can create a market, but the competition of market players is a major factor in reducing the costs.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
540	10	13	10	17	Suggest to include "international collaboration" to emphasise the importance of international climate cooperation, particularly for more alternative energy disadvantaged countries. The sentence could read: "Policy mixes have enhanced innovation capacity and competitiveness in developed countries and emerging economies, with effectiveness depending on national context, international collaboration, policy design and technology complexity.	Government of Singapore, Ministry of Environment and Natural Resources
13336	10	13	10	19	The formulation does not make clear that context-dependent does also importantly apply to differences WITHIN developed or WITHIN developing countries. For example, the very same or similar policy mixes had diverse effects in the different developed countries.	Government of Switzerland, Federal Office for the Environment FOEN
14608	10	13	10	19	Replace "deployment incentives" with "mandates". Context is not just national, but also subnational. What about costs, institutional perspectives, incentives for FDI investments in fossil, etc.? innovation systems? What is adoption capacities?	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13452	10	13	10	24	Please join these two qualitative subsections together and please quantify the statements where possible.	Government of Estonia, Estonian Meteorological & Hydrological Institute
14610	10	14	10	15	The evidence that R&D and policy incentives have addressed "distributional effects" (a vague term) is weak and contradictory; in many cases, it is largely the wealthier countries and segments of populations that have benefitted the most from, for example, incentives for renewable energy or CCUS technologies. Indeed, it is contradicted by the last sentence of this paragraph. Delete the phrase "address distributional effects" or, at minimum, assign it low confidence if there are actually widespread data to suggest that this is correct.	Government of United States of America, U.S. Department of State
10306	10	15	10	15	Please explain the concept of "distributional effects"	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
14612	10	15	10	15	"addressing distributional effects" of what? Recommend greater precision, e.g., "improving access".	Government of United States of America, U.S. Department of State
14614	10	15	10	16	"Policy mixes have enhanced innovation capacity and competitiveness" is too vague to be useful. What policies? What examples of innovation and competitiveness?	Government of United States of America, U.S. Department of State
14616	10	15	10	16	Add "of low-emission technologies" to the sentence that ends with "distributional effects".	Government of United States of America, U.S. Department of State
624	10	15	10	19	1. It is suggested to change "emerging economies" in line 16 to "some developing countries" in accordance with the rules of the IPCC and UNFCCC on country classification. 2. According to Chapter 2 of the underlying report, the lag in adoption of new technologies in developing countries is due to the lack of financial and capacity building support. It is suggested that the sentence be followed by a statement that "developing countries are lagging due to the lack of financial and capacity building support from developed countries".	Government of China, China Meteorological Administration
790	10	16	10	16	Please, clarify, which definitions for developed countries and emerging economies are used here. In the UNFCCC (key platform for policy makers) 'emerging economies' is not used at all, while 'developed' means 'of Annex 1 Parties'	Government of Russian Federation, Institute of Global Climate and Ecology
7022	10	16	10	16	Please, change "emerging economies" by "some developing countries" due to the lack of definition of "emerging economies".	Government of Brazil, Ministry of Foreign Affairs
7024	10	17	10	17	Please, include the word "some" before "developing countries" in line 17. Adoption of low-carbon technologies does not lag in all developing countries.	Government of Brazil, Ministry of Foreign Affairs
932	10	17	10	18	This statement begs the question of whether carbon intensive technologies being deployed in developing countries instead? Otherwise, it may be a reflection on the impacts of barriers to investment in least developed economies in general.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6894	10	17	10	19	Could the explanation why adoption of low-carbon technologies is lagging in developing countries be expanded on a bit more beyond the two reasons that are currently given? There surely are many more and diverse reasons, e.g. barriers related to cost and a lack of fiscal space, lack of capacity overall, lack of (access to) finance, governance or policy issues, etc...?	Government of Jamaica, Meteorological Service Division
11242	10	17	10	19	What are "weaker innovation systems and adoption capacities"? Clearer reference to limited means of implementation (financial, technical, human) and weaker governance and institutions would be more appropriate. Is it also because renewable technologies, although can be cheaper overall, tend to rely more on things like financial capital, infrastructure, governance and financial models (e.g. power grids, charging stations)? Whereas fossil-based systems rely more on solid or liquid fuels which are easier to store and transport?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12494	10	17	10	19	Rewrite the statement as follows as it appears in the literature in the context of the least developed countries. Specifically, "Adoption of low-carbon technologies lags particularly in the least developed countries, due in part to weaker adoption capacities".	Government of India, Ministry of Environment, Forests and Climate Change
13052	10	17	10	19	B.4.2: It would be great to add some information on the state of adoption for low-carbon technologies by the developing countries. This is important for LDCs as it will enable the policymakers have a clearer picture of the nuances around this and thus enhance the clarity of the SPM.	Government of Gambia, Department of Water Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13522	10	17	10	19	The reasons currently given, explaining why "adoption of low-carbon technologies lags in developing countries" are insufficient and need to be broadened and elaborated. Furthermore, the precise meaning of "low-carbon technologies" is unclear, also since the term "low-emission technologies" is also used in other parts of the section. Please ensure consistent use of terminology and explain these terms in the glossary.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
14618	10	17	10	19	Two omissions in this sentence that should be addressed: (1) What about AFOLU? (2) On differences, what about basic governance in developing countries?	Government of United States of America, U.S. Department of State
2738	10	18	10	18	We suggest to replace "adoption capacities" by "adoption and financial capacities"	Government of France, Ministère de la Transition écologique et solidaire
13204	10	18	10	18	What are "innovation systems"? Avoid busszwords, collocated words, simplify and rephrase.	Government of Switzerland, Federal Office for the Environment FOEN
2736	10	18	10	19	We suggest to add "lags in capacity buiding" to the list.	Government of France, Ministère de la Transition écologique et solidaire
13408	10	18	10	19	"weaker innovation systems" has the potential to promote adoption of available low-carbon technologies, but not impede. Low uptake capacity would limit adoption of the technologies.	Government of Kenya, Kenya Meteorological Service
2740	10	19	10	19	A reference to TS.3 could be added (see page TS-26 lines 14-22)	Government of France, Ministère de la Transition écologique et solidaire
11244	10	19	10	19	It is recommended to add also 9.9 among the relevant chapter discussing this issue and providing supporting evidence for this SPM statement.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5316	10	20	10	20	Text says 'Digitalisation, enhanced by electrification.....'. It might be more accurate to say 'Digitalisation, including its application to electrification...'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14620	10	20	10	20	Be more specific about the technologies in "Digitalisation, enhanced by electrification, ..."	Government of United States of America, U.S. Department of State
2742	10	20	10	24	This mention of the environmental effects of the development of information and communication technologies is not very precise and would undoubtedly deserve longer developments, both concerning positive effects (smart grids, smart cities, ...) and negative effects (massive deployment of data centres, consumption of critical minerals, and associated waste ...). As this issue is becoming increasingly acute, and has been the subject of a strongly growing literature in recent years, there is reason to alert policymakers more precisely	Government of France, Ministère de la Transition écologique et solidaire
5314	10	20	10	24	This paragraph would benefit a lot from a brief conclusion. For example, it could be said that the overall effect on emissions is not possible to isolate but digitalisation is only marginally used to design mitigation measures and growing demand from digitalisation is poorly controlled (if broadly supported by evidence in chapters).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6080	10	20	10	24	B.4.3: Please clarify the possible impact of digitalisation. The phrase is very generic and too synthetic. To clarify the message, we suggest separating the 2 roles of digitalisation: innovation support (consuming low to moderate energy levels) on one side and social and communication development on the other (consuming high energy levels). Relevant text is provided in Chapter 16, Cross-chapter Box 11 and in particular Table 1 within that box, which also indicates the importance of governance to increase the benefits of digital technologies for decarbonization as compared to the energy and material consumption of these technologies.	Government of Belgium, Belgian Science Policy Office - Belspo
6368	10	20	10	24	Please provide more specific information on digitalisation drawing on Cross Chapter Box 11 in chapter 16, the current information is rather trivial.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11246	10	20	10	24	Apart from increased energy demand (rebound effect) what are the trade-offs between digitalisation and SDGs?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11248	10	20	10	24	It is unclear why digitalisation is mentioned in this section. The relations to electrification appear to be entirely inconclusive (no indication whether it helps or hurts mitigation overall), and the considerations mentioned apply to other sectors and measures as much as to this one. Consider deleting the paragraph or making it more relevant to mitigation.	Philippe Tulkens, European Union (EU) - DG Research & Innovation



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13006	10	20	10	24	Para B4.3 is policy prescriptive since it clearly states that there are several cross-cutting technological developments, however only digitalisation is highlighted and emphasized. Please include the other forms of cross-cutting technological developments as well for policymakers.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
14622	10	20	10	24	Should include energy access with low carbon solutions.	Government of United States of America, U.S. Department of State
2746	10	21	10	21	Is it possible to indicate an overall direction in the trend of this impact? This seems important as this medium confidence statement is referred to in the headline of the section.	Government of France, Ministère de la Transition écologique et solidaire
934	10	21	10	22	This statement regarding the role of digital technologies is too vague. Would need to provide more substantial insights into what are the benefits and potential trade-off and the relevant context.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2140	10	21	10	23	There is also the view that digitization may lead to an increase in energy demand due to the rebound effect in terms of energy consumption. However, since digitization aims to reduce energy demand by optimizing energy use and improving efficiency, it is necessary to revise the content that digitization affects energy demand increase.	Government of Republic of Korea, Korea Meteorological Administration
626	10	21	10	24	The confidence level is not consistent with the underlying report (lines 24-27, page 6, Chapter 16) in which it is reported as high confidence. The authors are requested to check and keep the confidence consistent with the underlying report.	Government of China, China Meteorological Administration
2098	10	21	10	24	(Basis) The current statement that digital technologies can involve trade-offs with multiple SDGs is not sufficient in explaining potential adverse side-effects of digitalisation. Please consider adding some examples showing how digitalisation may affect negatively in meeting SDGs. A brief solution addressing the trade-offs would also be welcome. •(Present) "Digital technologies and associated innovation ... can also increase energy demand and involve trade-offs with multiple Sustainable Development Goals (SDGs)." •(Change) "...and involve trade-offs with multiple Sustainable Development Goals (SDGs), including harsh working conditions and unregulated disposal of electronic waste, which triggers the necessity of adequate governance"	Government of Republic of Korea, Korea Meteorological Administration
2744	10	21	10	24	the sentence suggests a balanced outcome. Digitalisation is generating more energy consumption than it contributed to energy conservation. Therefore, digitalisation is not a mitigation solution as a whole. Digital technologies dedicated to energy saving contribute to energy conservation but the overall usages of digital tech are not dedicated to energy savings, therefore, they increase energy consumption.	Government of France, Ministère de la Transition écologique et solidaire
11250	10	21	10	24	It is important that the rebound effect (increased energy and material demand caused by efficiency gains) is not ignored. Nevertheless, digitalisation is only one example of a much more general phenomenon. The text should reflect this.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2748	10	22	10	22	What does conservation mean? is it behavioral? It should maybe be a bit explicated.	Government of France, Ministère de la Transition écologique et solidaire
14624	10	23	10	23	Suggest explaining the following as the cross-chapter box is not immediately accessible: "involve trade-offs with multiple Sustainable Development Goals (SDGs)"	Government of United States of America, U.S. Department of State
2750	10	24	10	24	A reference to TS.5 could be added (see pTS-102 lines 9-16)	Government of France, Ministère de la Transition écologique et solidaire
15628	11	0			To extend this excellent figure, panels for the amounts of subsidies for the different dynamic energy technologies should be added. A grey shading representing fossil fuel (coal, oil, gas) subsidies should then also be included in these panels as is done in the current upper panel. Overall, the subsidies spent on fossil fuels and their relation to renewable energy subsidies should be covered more in the SPM.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
136	11	0	11	0	B.4: The statement "Technological changes has led to lower benefits and some adverse effects in least developed countries" is misleading and does not attribute the lag of technological advancements in the least developed countries as stated in lines 17-19 in the same page is due to weaker innovation systems and adoption capacities.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
138	11	0	11	0	Expand on figure SPM.4 to show other renewable/storage technologies that are mentioned in the text (e.g., CCS, CDR).	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
140	11	0	11	0	The discussion on technology adoption and cost does not provide indication of the levels required to achieve the different GWLs. Expand text on technology adoption and cost in B.4 to show expected levels in regards to GWLs. If literature does not exist, this should be clearly stated in the SPM as to ensure a balanced and inclusive report	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
142	11	0	11	0	Title of Figure SPM.4 does not reflect the figure caption. Re-write the title to be consistent with the caption and inclusive to all "energy technologies" and specifically the ones in the text	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
3262	11	0	11	0	The main text says 'fallen' (B.4), whereas the figure heading says 'fallen significantly'. Regarding the variety of response, 'fallen' might be the most appropriate wording in the title of the figure (in grey)	Government of France, Ministère de la Transition écologique et solidaire
3264	11	0	11	0	Figure SPM.4 is very informative and quite clear. Regarding the range of fossil fuel (grey area), we suggest to display the range between the 5th and 95th percentiles in each year instead of a constant range averaged over the period 2000-2020. It would deliver an important message about the very variable and unpredictable evolution of the cost of fossil fuel (coal and gas). It is a very policy-relevant information.	Government of France, Ministère de la Transition écologique et solidaire
5328	11	0	11	0	The evolution of coal, oil, gas is also needed in a figure (SPM.4, SPM.1 or elsewhere) to fully capture the scale of their current use (and the future challenge of reducing them) and their trends. Such elements would show that lots of progress has been made in reducing the use of coal (or at least stopping its growth), but that the use of oil and gas remains unabated.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13454	11	0	11	0	Figure SPM4 - the main messages of that figure are already covered in the text on page 10. This type of figure belongs to the Technical Summary. Please delete.	Government of Estonia, Estonian Meteorological & Hydrological Institute
2262	11	0	11	1	Suggest that, for consistency, it would be good to include the standard deviation (as a shaded band) of cost in the batteries and electric vehicles (EVs) panel in SPM figure 4. The bottom set of graphs should state in the axis label what point in time the Market Shares (on the bottom of the Adoption graphs) represent, e.g. 2020. It would be useful to clarify what each 'market share' represents' e.g. is the market share the percentage of total electricity generation for wind and solar? For batteries and EVs, is the market share the percentage of vehicles? Does the stated number adoption in GW already account for capacity factors?	Government of Australia, Department of Industry, Science, Energy and Resources
11922	11	1			Figure SPM.4: This is an excellent figure, which is very informative and clear. Could two panels (on cost and adoption) be added for fossil fuels, with time series for the combined total estimates (potentially even for coal, gas as well as oil separately)? The grey shading from the existing cost panels could be superimposed in order to show where this shading in the other panels is derived from. The market shares in % could also be added as was done for the existing panels. In addition, could an explanation be added to the caption on why oil is not included? It would be very useful to include quantitative information on oil, also to allow for comparison with the later statements on the use of coal, gas and oil in pathways that limit warming, e.g. C.3.2. Would including information on the amount of subsidies (on average globally) for each renewable energy technology, and for (the newly to be added panels on) fossil fuels be possible? For fossil fuel subsidies, this information could be elevated from 13.6.3.6 and especially from Figure 13.5, as well as from Box 6.3 Energy Subsidies p.21.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
3914	11	1	11	1	Figure for Adoption of EVs - unclear whether it is millions of new EVs sold in each year or is cumulative (i.e. reflects the full stock of EVs on the road)	Government of Canada, Environment and Climate Change Canada
5318	11	1	11	1	Really important to highlight figure SPM.4. Probably want to spell out PV and CSP in the text (not just above the figures)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5320	11	1	11	1	good to specify in the notes that these are global benchmark LCOEs (assuming that is correct), given the wide ranges between countries and regions	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5322	11	1	11	1	Title says 'Unit cost reduction and adoption in dynamic energy technology', it might be more informative to say 'Levelised unit cost and adoption of renewable generation technologies and electric vehicles'.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5324	11	1	11	1	Upper panel graph on right is titled 'Batteries and electric vehicles (EVs)', should rather be 'Electric vehicles (EV)'. Batteries are used for many things, of which one is EV.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5326	11	1	11	1	Upper panel graph on right for EV lacks a 'light blue shaded area showing range' as stated in the text.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6370	11	1	11	1	Figure SPM.4 lower panel: "Market share x%" reads like a label for the x-axis. Please move elsewhere and amended to "2020 market share".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6372	11	1	11	1	Figure SPM.4, lower panel ("Adoption (GW)"): The y-axis of the plots for "Offshore Wind" and "CSP" should use the same scale / maximum value as those for "PV" and "Onshore Wind" plots. In the current draft, the y-axis of the former two have considerably smaller maximum values (40 GW) than the latter (800 GW). This limits the informative value of the whole figure SPM.4 because the different, very small figures cannot be compared easily and the adoption of "offshore wind" and "CSP" appears to be larger than it is. In addition, the upper panel the y-axes of all plots have always the same max value. <u>Please improve.</u>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9424	11	1	11	1	In the lower panel, adoptions for photovoltaics and onshore wind are similar for 2020, but the 2020 market shares below the graphs are different by a factor of two. This apparent inconsistency may have something to do with the capacity factor issue stated in the figure caption, but for many of the readers the notion of the capacity factor is not quite familiar.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9426	11	1	11	1	"Market share 1%" is not accurate. As the total number of automobiles in the world exceeds 15 billions in 2020, 7million is less than 1%. "Market share < 1%" is correct.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11252	11	1	11	1	Change in title: Replace "renewable energy" with "renewable electricity"	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11254	11	1	11	1	The title "battery and electric vehicle" on the right sounds weird. Please indicate whether you refer to automotive batteries, stationary batteries, both or to the cost of the whole electric vehicle and in that case indicate whether you refer to a car, van, bus, etc	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11256	11	1	11	1	Top right panel: The Y axis label is inconsistent with the title (the latter has Evs, the former only batteries).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11258	11	1	11	1	Top right panel: Please add uncertainty range or explain why it is missing.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12496	11	1	11	1	The Figure heading refers to batteries alone while the figure shows results of all technologies. This should be changed as follows: "The unit cost of some forms of renewable energy and storage have fallen significantly and their adoption continues to rise".	Government of India, Ministry of Environment, Forests and Climate Change
14626	11	1	11	1	In Figure SPM.4 title, replace "batteries and some forms of renewable energy" with "solar and wind power and lithium-ion batteries and plug-in electric vehicles".	Government of United States of America, U.S. Department of State
14628	11	1	11	1	The meaning of the dashed lines needs to be somehow emphasized. It's barely enough to explain them in the legend and they are pretty easy to miss/ignore if you don't read the legend.	Government of United States of America, U.S. Department of State
14630	11	1	11	1	Can an analogous plot or set of plots for key aspects of AFOLU be generated?	Government of United States of America, U.S. Department of State
2180	11	1	11	15	PV and onshore wind seem to have the same cumulative adoption (ca. 700 GW in 2020), yet their market share is different. Why is this? If one should interpret that cumulative adoption indicates growth of market share, that should be explained in the caption.	Government of Finland, Finnish Meteorological Institute (FMI)
6374	11	1	11	15	Please improve the illustration of the AR5 values. The vertical dashed looks like an auxiliary line to the x-axis. We suggest using a circle on the respective value at the time of the AR5. In addition, the dashed line is only explained in the caption of the lower panel.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13774	11	1	11	15	Figure SPM. 4 indicates in a very good way how renewable technologies are gaining market share. The figure should absolutely be kept, but we wonder if it is other innovative technologies like electrification in shipping that could be included? Since important renewable energy sources like bioenergy and hydropower are not included, we recommend to add the notion of innovation in the figure title and reverse the formulation since batteries are shown to the right in the figure. Also, we think that "implementation" is a better word to use than "adoption" in the heading and the figure caption. We therefore suggest to reformulate the figure title to: "The unit cost of more recent forms of renewable energy and batteries have fallen significantly and their implementation continues to rise.". Please also consider to clarify the two last sentences in the caption, since they are currently somewhat hard to grasp for a non-expert reader.	Government of Norway, Norwegian Environment Agency
13776	11	1	11	15	Figure SPM.4: In order for the reader to better understand the trend in costs for off-shore wind we recommend to add to the caption if this is only fixed shallow-water installations or also includes floating installations, or otherwise please consider including information that explains the increasing costs until approx. 2015. Furthermore, the implementation of off-shore wind is very low. Could it be explained in the caption as well? It would also help the readability if it was clearly stated if other vehicles than personal cars (PC) are included in the lower rightmost panel. If it is only PC, a quick fix could be to write "Batteries and electric personal cars" instead of EVs.	Government of Norway, Norwegian Environment Agency
14638	11	1	11	16	Figure SPM.4 would be more helpful if the y-axis units were shown in terms of "energy shares". This would better link with statements in B.4.1.	Government of United States of America, U.S. Department of State
14640	11	1	11	16	Figure SPM.4 contains the first mention of electric vehicles (EVs). The EV storyline should be brought up in the headline statements leading up to this figure.	Government of United States of America, U.S. Department of State
6896	11	1	11	18	The authors and design team have done an excellent job in presenting this figure. The information and message can be easily understood. We propose that for an even stronger message, the figure is expanded to provide the same type of information also for the fossil fuels coal, gas and oil, as well as to provide information on subsidies for each source of energy.	Government of Jamaica, Meteorological Service Division
6082	11	1	11	2	Figure SPM.4: It is confusing to have electricity production and storage under the same title. If LCOE also applies to batteries, could you clarify what is meant, i.e. is it levelised cost of storage? We did not find a definition of LCOE in the glossary. We would like to suggest providing this definition in a footnote.	Government of Belgium, Belgian Science Policy Office - Belspo
6084	11	1	11	2	Figure SPM.4: The title of the rightmost column is confusing: the upper panel likely applies to batteries and the lower panel (adoption) to electric vehicles. This is confusing, please consider providing a separate title for each line or find another way to clarify the scope of this last column. Another way to provide more clarity would be to add vertical lines to separate panels which have a different vertical axis (for example, between onshore and offshore wind in the lower panel). This figure would also benefit from getting more contrasted colours, especially for the blue shade, which is poorly visible with some printers.	Government of Belgium, Belgian Science Policy Office - Belspo
11260	11	1	11	2	The market shares of RES electricity generation technologies is not in terms of installed capacity, but in terms of the generated electricity. This is not clear from the figure. Nevertheless, the capacity increase is important to explain the falling costs, following the industrial experience curve.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14632	11	1	11	2	In Figure SPM.4 title, add "since 2010" or "from 2010-2020".	Government of United States of America, U.S. Department of State
14634	11	1	11	2	Showing what the deployment trend/rate of conventional technologies is would be a useful contrast/comparison.	Government of United States of America, U.S. Department of State
14636	11	1	11	2	If PV and onshore wind are both at about 700GW in 2020, why is PV only 3% of market share of total electricity production while onshore wind is 6%? If this is because of capacity factor, it would be clearer to state this directly in the last sentence of the caption.	Government of United States of America, U.S. Department of State
3266	11	2	11	2	Market share could be mentioned in the title	Government of France, Ministère de la Transition écologique et solidaire
5330	11	2	11	2	Change of scale in offshore wind and CSP panels is very misleading, particularly as they are the same variable as panels to the left. These should be set on the same y-axis scale to allow a meaningful visual comparison. The market share figures should be for the same variables shown in the timeseries panels - it is odd to shift from generation capacity to generation share and sales to share to the total fleet as is currently the case.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5332	11	2	11	2	Definition of EVs in this figure needs to be given somewhere in the caption. E.g. BEVs only or BEVs + PHEVs?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14642	11	2	11	2	Replace "dynamic energy" with "low-emission" in the Figure SPM.4 caption. This section is about low-emission technologies. "Dynamic energy" can be interpreted to mean these technologies provide dynamic operating benefits to the electrical grid which most of them do not (batteries being the exception).	Government of United States of America, U.S. Department of State
13778	11	2	11	9	The information given in line 7-9 ("LCOE ... it does not include environmental externalities and does not reflect variation in the value of electricity over time and space") is important when interpreting figure SPM.4. The question is whether this information could be provided more explicitly in the caption title (line 2), for example by rephrasing this to "Figure SPM.4: Unit private cost reductions and adoption in dynamic energy technologies".	Government of Norway, Norwegian Environment Agency
13780	11	3	11	15	To what extent is 2020 a useful baseline year for fossil fuel costs with regards to the impact of the covid-crisis on the global economy (and effects on fossil fuel prices)? Would it be better to use a pre-covid year as baseline scenario?	Government of Norway, Norwegian Environment Agency
628	11	3	11	3	It is not appropriate to use LCOE to describe the cost of lithium-ion batteries. So it is suggested to replace "levelised costs of electricity (LCOE)" with "unit cost" here.	Government of China, China Meteorological Administration
5334	11	3	11	3	The first sentence does not apply to batteries in the fifth graph, for which capital costs rather than LCOE are shown. Could the authors please amend?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5336	11	3	11	3	Text says 'The upper panel show levelised cost of electricity'. I'd suggest deleting 'of electricity', since the cost for batteries is not a cost of electricity.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14644	11	3	11	3	In a footnote, explain the differences between "levelized cost of energy" and "levelized avoided cost of energy" and why the latter is a preferable measure for grid costs.	Government of United States of America, U.S. Department of State
1174	11	3	11	4	Add s to include, "This figure includes"	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
13206	11	3	11	5	Abbreviations do only make sense if they are use later in the text, in a frequent matter. This argument does not hold true for "(PV)", "(CSP)", "(Evs)", please delete.	Government of Switzerland, Federal Office for the Environment FOEN
6376	11	3	11	9	The explanation of LCOE is not understandable for non-experts, i.e. those who would need it. Please improve.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9428	11	3	11	9	It should be appropriate that it mentions the Integration cost associated with variable renewable energy, although it mentions that the LCOE of renewable energy has decreased significantly. Reference should be made to the following text in the SOD to include a reference to Integration cost.  The costs of integrating large amounts of PV in electric grids are becoming an increasing share of total costs of PV intensive energy systems. (SOD chapter6, Page:26,line:12-13) The full costs of PV includes grid integration, which varies tremendously due in part to PV's share of electricity, other supply options like wind, availability of storage, transmission capacity and demand flexibility (SOD chapter6, Page:26, line14-16) Wind and PV generation is growing rapidly, but their potential future contribution will depend on their levelized costs, integration costs and the ability to integrate variable generation technologies into tge grid (SOD chapter6, Page:107,line:3-5)	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12432	11	3	11	9	The statement is not entirely true. Just by looking at the technology cost does not gives the right picture of true cost in supply energy. For example, although PV technology cost went down, it comes with other risk that need to be mitigated due to its intermityency, which eventually leads to the deployment of other technology such as gas/battery to support intermityency issues. This evidently clear with the event. Thus, these statement is misleading because the end user price doesn't reflect the true cost that has been paid by consumer	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
11262	11	4	11	4	Replace "include" with "includes"	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
630	11	5	11	5	As stated in the underlying report (page 24, Chapter 6), "solid blue lines" refers to "utility-scale installation". It is suggested to change this sentence to "Solid blue lines indicate average unit cost of utility-scale installation in each year."	Government of China, China Meteorological Administration
6898	11	6	11	6	Why are only coal and gas included? Unless oil is included, the grey shading that is included for reference in the renewable energy panels would be misleading?	Government of Jamaica, Meteorological Service Division
632	11	6	11	7	"... USD55-148 per MWh)." is not consistent with the underlying report (page 24, Chapter 6) "Range of fossil fuel LCOE indicated as dashed lines USD 50-177 MWh". The authors are requested to check and give the exact cost range.	Government of China, China Meteorological Administration
5338	11	6	11	7	This may not be something fixable for this Report, but the use of a grey bar for the price of fossil fuels is not necessarily a helpful theoretical comparator for the price of renewables. As we have seen over the last period, there has been extremely marked fluctuations in the price of fossil fuels and the market design and reality in many countries for Electricity and of course fossil fuels directly, takes price from the fossil fuel - it may be worth noting this in a footnote or similar so readers are aware the grey bar doesn't represent a consistent price. As the fossil fuel price goes up and down there is little debate on what this does to the viability or costs of renewables, and this is something which WG III could seek to address in the future. Does a high gas price strengthen, or weaken, the likely trajectory for zero carbon alternatives?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11264	11	6	11	7	It is not clear from the explanation whether the bandwidth of cost in the grey band is for new fossil fuel plants, or for written off ones (marginal costs).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
792	11	7	11	7	Clarify which year USD. E.g. UDS 2019 = in USD prices of 2019	Government of Russian Federation, Institute of Global Climate and Ecology
13208	11	7	11	7	Assess if the information in the brackets is needed. It is a rather technical information for the SPM.	Government of Switzerland, Federal Office for the Environment FOEN
3268	11	8	11	8	It could be useful to add a sentence to indicate the order of magnitude of these environmental externalities	Government of France, Ministère de la Transition écologique et solidaire
14646	11	8	11	8	Delete "does not reflect".	Government of United States of America, U.S. Department of State
11266	11	11	11	11	"millions of vehicles": is it millions of vehicles on the road, or the number sold any given year? The conflation with "installed capacity" would suggest the former, but "market share" points to annual sale. Is it only full electric vehicles or also hybrids? Are they all cars (and larger), or all electric vehicles, including scooters and bicycles?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
3916	11	11	11	12	Why is the dashed line for AR5 shown in 2010? The AR5 WGIII report was published in 2014.	Government of Canada, Environment and Climate Change Canada
9430	11	12	11	12	In the lower panel of Figure SPM.4, the market share percentages are explained as the 2020 shares based on provisional data. SPM, which will be referred for years in the future, should avoid showing number based on provisional data. As stated in line 8-9 of page 10, using the 2019 shares could be an option to show the market share.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11268	11	14	11	14	An indication of the market share and/or capacity factor would be useful.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5340	11	14	11	15	Suggest to replace "lower capacity factors" with "low capacity factors" or to replace the whole sentence with "These renewable technologies have substantially lower capacity factors than baseload fossil and nuclear power plants".	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6086	11	14	11	15	This notion of capacity factors is very important, and geographically dependent. It is generally not clear in people's minds, so please explain in a few words (possibly in a footnote).	Government of Belgium, Belgian Science Policy Office - Belspo
6378	11	14	11	15	The last sentence is enigmatic, why is it needed here? What are "capacity factors" (not explained in the glossary)? Please improve so that it becomes understandable for non-experts, i.e. those who need this explanation.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
5342	11	15	11	15	The final sentence says '...for these renewable technologies', to which could be added 'in comparison with thermal electricity generation technologies such as fossil fuels or nuclear'.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3270	11	16	11	16	A reference to Fig. TS.7 could be added (see page TS-25)	Government of France, Ministère de la Transition écologique et solidaire
13524	11				In line with our comment regarding further information needs on fossil fuels, this figure would strongly benefit in its message from additionally including panels on adoption and cost of fossil fuels, separately for coal, oil, and gas. Please consider adding this information. Also, it remains unclear as to why, according to the figure caption, the grey shading only indicates the range of coal and gas but not of oil. This sends an incomplete message.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
9900	11		11		Figure SPM.4: Putting production costs of primary sources (wind, solar) in one graph with storage costs (batteries) may lead to confusion. Suggest to adjust the figure by adding a clear delineator between the leftmost three graphs and the fourth graph. And adjust the text in the caption to stress the different nature of the two categories.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
9902	11		11		Figure SPM.4: Putting the "market shares" directly under the graphs showing production figures may be confusing, as these are not directly comparable as mentioned in the caption. Suggest to adjust the figure to avoid possible confusion.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12342	12	1	12	6	According to Chapter 14 - Page 50 - Line 25 to 30 and Page 51 - Line 1 to 5: Is there a process for providing financial and technical assistance to adapt to climate change for countries under global sanctions?	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
936	12	1	12	1	Would suggest a different word here as "coverage" implies media and political fora, but I think the insight here is that climate policy has been expanded to include (cover) more emission sources and sinks.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
13456	12	1	12	1	Here and elsewhere - what is meant by finance and financial flows? It is confusing. Is it public and private investment? Is it redirection of investment? R&D investment? Or investment to new infrastructure? Please be precise and avoid general terms that can include several meanings.	Government of Estonia, Estonian Meteorological & Hydrological Institute
14648	12	1	12	1	Recommend rephrasing as "A growing share of emissions are covered by climate policy and innovation support", even if slightly duplicative to B.5.2. Though understood that the authors intended on paraphrasing that language, the language in B.5 as it currently reads is imprecise and hard to understand. Policy "coverage" of what? Total emissions, but this could read as gases, industries, etc. What are "associated institutional arrangements"? The authors should be precise if referring specifically to innovation support, even if these words are used a few paragraphs down.	Government of United States of America, U.S. Department of State
6088	12	1	12	2	The expression "associated institutional arrangements" is not usual: please consider replacing it with something clearer.	Government of Belgium, Belgian Science Policy Office - Belspo
5346	12	1	12	26	Two elements are missing here: 1) An analysis of the greenness of Covid-related economic stimulus would be very useful in this section, to show that the short-term perturbation from Covid is unlikely to substantially change the background trends, or alter the conclusions based on those trends. 2) An explanation as to why we are not on track to reduce global emissions rapidly given the progress detailed in this section. Is it because there are still many countries that don't have climate policies, or because climate policies (and associated actions) are too weak in those countries that do have it, or both?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5348	12	1	12	26	A bit more could be said about the emissions that have been avoided through climate policies so far, and the corresponding temperature scenarios that are no longer likely. This information is important to show, as we have already made progress towards tackling climate change, even though action needs to greatly scale up. This section could also highlight where the biggest wins have been and why, for example, where policy has been strong and consistent.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14654	12	1	12	26	B.5 states, "Policy coverage remains weaker for non-CO2 gases and emissions outside the energy sector" but the detailed statements below do not discuss policy coverage for non-CO2 emissions, which in practice vary considerably by gas and source. Global action on HFCs under the Kigali Amendment to the Montreal Protocol has led to significant policy coverage, and methane emissions from the oil and gas sector are beginning to draw more policy attention with actions such as the Global Methane Pledge, while N2O emissions and methane emissions from enteric fermentation have generally received little policy coverage. If this assertion remains in the headline statement, it should be elaborated upon in the supporting statements below.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11270	12	1	12	3	These lines seem to give a misleadingly positive impression compared to the underlying report. For example, TS 6.1 states that "The share of global GHG emissions subject to mitigation policy has increased rapidly in recent years, but big gaps remain in policy coverage, and the stringency of many policies falls short of what is needed to achieve the desired mitigation outcomes."	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14650	12	1	12	4	Unclear what "policy coverage" means.	Government of United States of America, U.S. Department of State
14652	12	1	12	4	The use of the term "coverage" needs to be defined in this context or replaced. The use of "covered" and "coverage" is problematic throughout B.5 because this usage does not reflect standard English. For example, one could ask: "What kind of coverage? News coverage?"	Government of United States of America, U.S. Department of State
5344	12	1	12	6	The report should be clearer about up to which date policy commitments are being included and modelled, and strive to ensure the most up-to-date analyses and data are used where possible. For example does this summary of the current policy commitments and their expected effects include those commitments made in the run-up to and during the Glasgow COP 26? For example there is no mention of the number of countries or share of emissions covered by net zero commitments which has gone up substantially in the last 12 months. Recognising the literature cut-off date, there will be many policymakers who are keen to understand the difference which COP26 may have made in terms of policy commitments and there were several high-profile analyses including by the IEA which implied that the commitments had brought down warming estimates. At the very least, it would be helpful if B5 could acknowledge that further commitments have been made, or make clear whether there are further commitments not included in this analysis.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6900	12	1	12	6	Findings from B.5.4 (that are to be further quantified) should be elevated to B.5, which must make clear that despite the positive developments that are described here, there are still major impediments to aligning financial flows with the Paris Agreement, specifically the still large sums of both public and private fossil fuel financing.	Government of Jamaica, Meteorological Service Division
13526	12	1	12	6	Could the authors be more precise regarding what type of coverage they are referring to? Also, it would be very helpful to explicitly refer to the effect of the UNFCCC/Paris Agreement as the most central element of global climate policy.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
15630	12	1	12	6	This is an important headline statement which must include the findings on the lack of ambition in climate policy and lack of alignment of financial flows with the Paris Agreement. Otherwise, this statement that reflects on recent developments across a range of climate policy and finance spheres would be incomplete and imbalanced.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
13782	12	1	13	23	Could section B.5 and B.6 also include reference to the main AFOLU policies that are presented in the Special report on climate change and land? Especially from section B in the special report (such as sustainable land management in section B.5) and section C. Please consider adding.	Government of Norway, Norwegian Environment Agency
12	12	2	12	2	"avoided emissions" is a technical term used by various communities in different context (e.g. ISO has prepared a draft annex to explain this term in a frequently used ISO standard). It is suggested to either avoid that language (the text in line 17 uses the language "avoiding emissions .." or to provide in the glossary a definition of "avoided emissions".	Government of Austria, Federal Ministry of Agriculture, Forestry
6380	12	2	12	2	Please quantify the amount of "avoided emissions" and its trend.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
634	12	3	12	3	The confidence level is not consistent with "medium evidence, medium agreement" in the underlying report (lines 14-15, pages 13-14). The authors are requested to check and keep the confidence consistent with the underlying report.	Government of China, China Meteorological Administration
2754	12	3	12	3	Replace "expanded financial flows" by "expanded financial flows for climate change mitigation": otherwise one could think that financial flows in general (irrespective to their goal) are increasing.	Government of France, Ministère de la Transition écologique et solidaire
5350	12	3	12	3	Does likely 2 degrees here also mean low / no overshoot? Useful to say	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6382	12	3	12	3	"Financial flows" is too generic. Please add for example "for climate adaptation and mitigation" after "... and expanded financial flows" to clarify what type of financial flows you are referring to. Please see also our comment on B.5.4.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11924	12	3	12	3	B.5: While the developments described in this section are welcome and encouraging, it is also our understanding from Chapter 15, p.27 that "... the insufficient level of ambition and coherence of public policies at national and international level remains the root cause of the still significant misalignment of investment and financing compared to pathways compatible with the Paris Agreement temperature goal". Similarly, we understand from the underlying chapters, e.g. 15.3.1 p.22, that there is still a "relatively small size of current climate finance flows and relatively larger size of remaining fossil fuel-related finance flows ... as well as, more generally, the significant overall scale of financial flows and stocks that have to be made consistent with climate goals". It is imperative that this mismatch is clearly and explicitly represented at this headline statement level. Please rephrase accordingly!	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13528	12	3	12	3	The headline statement B.5 must reflect what is already indicated in B.5.4 (but also not clear enough there): That current financial flows for climate mitigation and adaptation are far outweighed by both public and private fossil fuel financing, which stands in the way of climate action.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
14656	12	3	12	3	Policy coverage has increased substantially for non-co2 gases (i.e., CH4), making this statement outdated.	Government of United States of America, U.S. Department of State
2752	12	3	12	4	Policy coverage may not be weaker for F-gases covered by the Kigali amendment of the Montreal Protocol	Government of France, Ministère de la Transition écologique et solidaire
14658	12	3	12	5	Does the science provide any additional guidance on what is actually needed? How could this framing lead to the wrong set of investments / unwise resource allocation?	Government of United States of America, U.S. Department of State
9854	12	4	12	4	Suggest to include the words "have grown, but" after "finance flows".	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
13012	12	4	12	4	Qualify/quantify the word "weaker". Does this mean lower?	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
15632	12	4	12	4	As this statement covers the crucial topic of finance flows, this headline statement must also explicitly cover the international climate finance goal of USD100bn/year (which is also not part of B.5.4, where it should at least be mentioned). It is central to international climate policy discussions and including information here is relevant for policymakers. Furthermore, the headline statement does not reflect the important conclusions made in B.5.4 that "the growth of climate finance flows has slowed down" and that "both public and private fossil fuel financing remains at high levels". These are highly relevant findings that must be part of the headline statement.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
14660	12	5	12	5	The SPM needs to reflect the underlying text with greater fidelity. Section 5.6 (cited in this line) argues that places with higher social trust and inclusive participatory processes reduce inequality AND reductions in inequality and broad participation and cooperation enable successful actions to reduce GHGs (more flexible policymaking and less lock-ins). In Section 5.6 the concept "and finance flows are distributed unevenly across regions and sectors" refers specifically to the informal economy -- described as primarily dominated by women, and developing countries. Broaden the language as follows: "... unevenly across, regions, sectors and formal and informal economies."	Government of United States of America, U.S. Department of State
794	12	7	12	7	The Kyoto Protocol led to reduced emissions' is not correct for 100%. Suggestions: to replace with "The Kyoto Protocol led to reduced emissions in some countries"	Government of Russian Federation, Institute of Global Climate and Ecology
796	12	7	12	7	Suggestion: to replace 'building national capacity' with 'building of international and national capacity'	Government of Russian Federation, Institute of Global Climate and Ecology
938	12	7	12	7	It is not true that the Kyoto Protocol reduced emissions at least not at a global scale. Nor was this the objective of the protocol. Need to be precise in language here.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
3918	12	7	12	7	"The Kyoto Protocol led to reduced emissions" is a simple statement, but without qualifiers is not really correct. Global emissions did not decline as a result of the Protocol although they may have been reduced for some participating countries. Perhaps change "led to reduce" to "aimed to reduce" or "led to reduced emissions for many countries".	Government of Canada, Environment and Climate Change Canada

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9432	12	7	12	7	This statement sounds somewhat strange because global GHG emissions have continued to increase during the Kyoto Protocol period. It would be better to say "The Kyoto Protocol had the impact of reducing emissions."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9856	12	7	12	7	Unclear what is meant with "led to reduced emissions". It implies global emissions have gone down during this period. Add: "of most developed countries"	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11926	12	7	12	7	B.5.1: This statement on the effects of the Kyoto Protocol is very important, yet further information is needed to provide supporting evidence, with quantitative information where available. Also, a confidence statement should be added here. For example, this statement from 14.3.3.1 could be rephrased/simplified and elevated to the SPM: "Overall, countries with emission reduction obligations emit on average less CO2 than similar countries without emission reduction obligations – with estimates ranging from 3-50%".	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
3920	12	7	12	8	The first sentence may need a separate confidence statement.	Government of Canada, Environment and Climate Change Canada
11272	12	7	12	8	Overall emissions are still on the rise, see Fig. SPM1. Please clarify.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14662	12	7	12	8	This is a remarkable statement that applies high confidence to attributing emissions reductions to the Kyoto Protocol. There is no issue with the claim on improving national capacity for GHG accounting and carbon markets; however, the first half of the statement (unequivocally attributing emissions reductions) both hints at a bigger impact than might warrant high confidence and elides an important driving factor, which is that the real drivers of policies were not the KP but were instead national or region-wide policies like the EU ETS. It is disingenuous to claim that the KP delivered these reductions without also mentioning the critical and central role of national/regional policies. This sentence needs to be revisited and revised to either make clear that the KP role in emissions reductions, along with national policies, realized emissions reductions; or the KP itself is seen (on its own) as contributing to a small amount of hard-to-attribute emissions reductions.	Government of United States of America, U.S. Department of State
2264	12	7	12	9	Suggest that this paragraph is expanded to include more detail regarding building national capacity. For example, the transparency arrangements designed under the Convention and the Kyoto Protocol for use by developed countries provide the basis for significant capacity building in developing countries, providing them with a model for greenhouse gas reporting that was adopted under the Paris Agreement, as well as providing opportunities for the building of developing country expertise via the review process under the Kyoto Protocol and the Convention.	Government of Australia, Department of Industry, Science, Energy and Resources
2756	12	7	12	9	Is there a way to give a sense of the magnitude of the emission reductions mentioned here for the Kyoto Protocol, in particular as compared to emission reductions achieved outside of carbon markets (in a similar way as what is proposed in B.5.2 with carbon pricing)? This is important for balance purposes, as the current statement could mislead readers in thinking that carbon markets are the only tool and that it is at the scale of the global emission reductions undertaken so far.	Government of France, Ministère de la Transition écologique et solidaire
3922	12	7	12	9	This sub-bullet raises many questions about the attribution of GHG reductions and national and sub-national policy developments to the Kyoto and Paris Agreements. More clarity on the attribution (e.g. is it off of a baseline?) and the types of observed policy developments would be helpful.	Government of Canada, Environment and Climate Change Canada
9434	12	7	12	9	In the SPM of AR5 WG3, the effect of Kyoto protocol was found limited as "The Kyoto Protocol offers lessons towards achieving the ultimate objective of the UNFCCC, particularly with respect to participation, implementation, flexibility mechanisms and environmental effectiveness (medium evidence, low agreement)." in SPM5.2. But this paragraph (lin7-9 in page 12) sets out "The Kyoto Protocol led to reduced emissions and was instrumental in building national capacity for GHG accounting and carbon markets". The reason for this clear change of evaluation on Kyoto Protocol from AR5 to AR6 should be clarified.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
13530	12	7	12	9	Could this encouraging information on the effects of the Kyoto Protocol for reduced emissions (as well as national capacity for GHG accounting and carbon markets if possible) be specified with a quantitative statement on the emission reductions? The following sentence regarding the Paris Agreement needs to be made more concrete and strengthened.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
14664	12	7	12	9	These two sentences do not appear to be connected and it is not clear how they reinforce the bolded introductory paragraph without additional contextual information.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
152	12	7	14	12	The use of the term 'pathways that limit warming to 1.5' is not accurate and is inconsistent with other working groups reports and with the rest of this report. Replace pathway with 'scenario' for consistency.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
13638	12	8	12	8	The Kyoto Protocol was also instrumental in building national capacity for GHG reporting, not only accounting (these are two separate, but related activities). Suggest the sentence be changed to read: "...for GHG reporting and accounting, and for carbon markets."	Government of New Zealand, Ministry%20for%20the%20Environment
1158	12	8	12	9	Countries all sign up to these commitments - under the Paris Agreement, this sentence could be clearer.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2266	12	8	12	9	Policy development' is too general to be useful. Suggest specifying what policy areas are being referred to.	Government of Australia, Department of Industry, Science, Energy and Resources
5352	12	8	12	9	Is the link between Paris Agreement and policy causal? Would be useful to bring out if so. If not, is this important enough to make SPM?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6902	12	8	12	9	The entire sentence on the Paris Agreement is unfortunately somewhat vague and imprecise. Please add concrete numbers on ratification and NDC submission rate, which would be the type of information this sentence seems to imply.	Government of Jamaica, Meteorological Service Division
11274	12	8	12	9	"Many countries' participation in the Paris Agreement is associated with policy development and enhanced transparency". This formulation ('is associated with') is not really saying anything at all. Suggest replacing it with more useful material from the underlying report. For example, "the commitments under the Paris Agreement are primarily procedural, extend to all parties, and are designed to trigger domestic policies and measures, enhance transparency, and stimulate climate investments" (Ch 14, p 3, I.30-32). However, this is a positive development because of the Agreement's near-universal ratification, combined with the fact that "Participation in international agreements and transboundary networks is associated with the adoption of climate policies at the national and sub-national levels," (Ch14 ,p3, I.19-20).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11928	12	8	12	9	B.5.1: The statement on the Paris Agreement appears to be too weak given the unprecedented role of the agreement, and needs to be strengthened. It is unclear what "many countries' participation" refers to, as ratification is near-universal, as is submission of first NDCs by parties. This should be reflected in this statement. Also it is unclear what exactly "associated with" means. Could "policy development and transparency" be specified, e.g. with a statement on the levels at which this is taking place (global, national, ...), and information on NDCs or reporting?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13014	12	8	12	9	This sentence needs to be clarified for policymakers, i.e., "Many countries' participation in the Paris Agreement is associated with policy development and enhanced transparency". In it's current form it's a bit confusing and to me it seems as if it means that countries mainly participate in the Paris Agreement to develop policy and for enhanced transparency and not necessarily to mitigate and adapt to climate change.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13054	12	8	12	9	B.5.1: Include here perhaps the number of countries that have ratified the Paris Agreement and also submitted first and probably also second NDCs as this helps to give an idea about the momentum towards addressing climate change. Maybe important to note here the role the Paris Agreement has played in 'opening' up the space for countries to commit to addressing climate action based on their circumstances and capacities.	Government of Gambia, Department of Water Resources
13640	12	8	12	9	It is not clear what point is trying to be made in this sentence. The Paris Agreement asks for enhanced transparency from all Parties (not many Parties), and each Party needs to demonstrate progress towards meeting its NDC. Article 4.2 of the Paris Agreement states that "Parties shall pursue domestic mitigation measures" and under the enhanced transparency framework each Party shall provide information on actions, policies and measures that support implementation and achievement of its NDC (refer to para 80 of the annex to decision 18/CMA.1). The way the sentence is currently drafted suggests that policy development and enhanced transparency might be optional	Government of New Zealand, Ministry%20for%20the%20Environment

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14666	12	8	12	9	While the Kyoto Protocol language is arguably overstated, this sentence errs in the opposite direction and may well understate the level of impact of the Paris Agreement. The literature understandably may not be fully caught up "in attributing emissions reductions impacts" but the net impact of these two sentences together somewhat strangely gives the impression that the KP was effective and the PA has been less so, when there is strong reason supported by literature to believe that the opposite is true. The PA has in fact driven not just "policy development" but significantly ambitious increases in policy targets; it has centered the locus of policy action in national commitments with subnational/all-of-society approaches, which is already proving to be a more robust and effective approach; and it has also, importantly, driven implementation of commitments and a ratcheting up of ambition. This section should be reworked to underscore these points.	Government of United States of America, U.S. Department of State
2758	12	9	12	9	We suggest to add "cooperation and collaboration" after "Paris agreement is associated with" since there are also key features of the Paris Agreement in making further and faster action possible.	Government of France, Ministère de la Transition écologique et solidaire
3924	12	9	12	9	Clarification on enhanced transparency is needed. Transparency of GHG accounting, GHG policy and reduction estimates, both?	Government of Canada, Environment and Climate Change Canada
144	12	10	12	10	B.5.2: "a growing share of emissions is covered...." is not clear as it is not set by percentage or growth. Provide numerical values.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
636	12	10	12	10	The percentage of emissions covered by the carbon pricing policy is changing with time and should be indicated here with the corresponding time. According to the underlying report (page 44, Chapter 13), it is suggested to add "In 2020" at the beginning of the sentence.	Government of China, China Meteorological Administration
6384	12	10	12	10	Please specify what "innovation support" means in this context (e. g. is innovation related to technological development and/or also consumer demand)? How this can be directly be associated with a certain share of emissions?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9436	12	10	12	10	The first sentence of B.5.2 seems a little confusing. We suggest stating "A share of emissions covered by regulation and innovation support is growing" instead of the current one.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
14668	12	10	12	10	The Kyoto Protocol did not reduce emissions at all.	Government of United States of America, U.S. Department of State
146	12	10	12	11	B.5.2: Carbon pricing is one option of climate policy, should be no specification for such policy especially linking it to innovation support and regulation. Remove this policy perspective statement.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
5354	12	10	12	11	In what year is the 20%?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11276	12	10	12	11	Provide a time reference for the first sentence	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12498	12	10	12	11	Replace "A growing share of emissions is covered by regulation and innovation support, and over 20% of the emissions are covered by carbon pricing (medium confidence)." with "A growing share of emissions is covered by regulation and innovation support, and over 20% of the emissions are covered by carbon pricing mechanisms including carbon taxes and emissions trading systems (medium confidence)." Reason: Chapter 11 which is the source chapter contains the following statement: "In the absence of a coordinated effort, individual countries, regions and cities have implemented carbon pricing schemes. As of August 23rd, 2021, 64 carbon schemes have been implemented or are scheduled by law for implementation, covering 22.5% of global GHG emissions (World Bank 2020), 35 of which are carbon taxes, primarily implemented on a national level and of which are emissions trading schemes, spread across national and subnational jurisdictions" (Source Chapter 11, page 85, lines 10-13). Therefore, mention of the term "carbon pricing" in the SPM should also include what carbon pricing mechanisms are included for more clarity on the term.	Government of India, Ministry of Environment, Forests and Climate Change

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13642	12	10	12	11	Need to insert "global" before "emissions" in both line 10 and line 11.	Government of New Zealand, Ministry%20for%20the%20Environment
14670	12	10	12	11	Recommend noting that the carbon prices covering a large portion of these emissions are much lower than most social cost of carbon estimates would deem sufficient to account for the full cost of emissions.	Government of United States of America, U.S. Department of State
14672	12	10	12	11	Needs clarification: "growing share of emissions is covered by regulation and innovation support, and over 20% of emissions is covered by carbon pricing"	Government of United States of America, U.S. Department of State
3926	12	10	12	15	Improve clarity of this sub-bullet. "A growing share of emissions" since what date.	Government of Canada, Environment and Climate Change Canada
5356	12	10	12	15	B5.2 currently does not distinguish between direct and indirect climate laws as defined in the underlying chapter. The 53% figure could be made clearer by using the following text from the underlying chapter: "By 2020, 'direct' climate laws primarily focused on GHG reductions were present in 56 countries covering 53% of global emissions"	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11278	12	10	12	15	Demand-side mitigation strategies are not described anywhere in the SPM. Hence, it is proposed to introduce a brief explanation of the key categories of demand-side strategies by revising the last sentence of the paragraph, as follows: 'Demand-side mitigation strategies and actions can be classified as Avoid-Shift-Improve (ASI) options, that reflect opportunities for socio-cultural, infrastructural and technological change. Demand side management strategies and materials efficiency are not widely addressed by policy'	Philippe Tulkens, European Union (EU) - DG Research & Innovation
1240	12	11	12	11	Does the "emissions" refer to GHG emissions of emissions of carbon dioxide?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6904	12	11	12	11	Instead of or in addition to mentioning laws here, the number of countries that have submitted NDCs and the emissions covered by them, as well as the emissions covered by net zero targets (90%) should be added.	Government of Jamaica, Meteorological Service Division
834	12	11	12	12	Chapter 13, Page 9, lines 9-17 says: Direct climate laws – with greenhouse gas limitation as a direct objective -- had been passed in 56 countries (of 194 studied) covering 53% of emissions in 2020, with most of that rise happening between 2010 and 2015 (see Figure 13.1). Suggestion: to change respective wording in SPM as " In total, 56 countries had laws targeting reduction of GHG net-emissions covering 53% of global GHG emissions in 2020 (medium confidence)."	Government of Russian Federation, Institute of Global Climate and Ecology
3928	12	11	12	12	Please clarify if the 53% of global GHG emissions is based on the total current emissions of the 56 countries or based on the laws targeting climate change mitigation in these countries. As written, this is unclear.	Government of Canada, Environment and Climate Change Canada
3930	12	11	12	12	What is the medium confidence for in the second sentence - the # of countries with laws or the coverage of 53%? If it is the latter, can there an standard deviation or range for the 53%? This is otherwise a very precise number for medium confidence.	Government of Canada, Environment and Climate Change Canada
11280	12	11	12	12	The sentence reads: "In total, 56 countries had laws targeting climate change mitigation covering 53% of global GHG emissions in 2020 (medium confidence)". Unclear what the 53% refers to here. The statement can be misread to say that due to laws implemented in 56 countries, 53% of global GHG emissions have already been mitigated in 2020. What you wanted to say is probably that "In total by 2020, 56 countries had laws targeting climate change mitigation, which address 53% of global GHG emissions." Ideally, the sentence should also mention that some policies are much stronger than others in terms of disincentivising emissions.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11930	12	11	12	12	B.5.2: This statement should not only refer to laws but also NDCs. Almost all parties to the Paris Agreement have submitted their first NDC. This should also include a statement on the % of emissions that are covered by NDCs.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12500	12	11	12	12	Replace "In total, 56 countries had laws in the form of legislations that directly address climate change mitigation, covering 53% of global GHG emissions in 2020. (medium confidence)" with "In total, 56 countries had laws in the form of legislations or executive orders that directly address climate change mitigation, covering 53% of global GHG emissions in 2020. These laws differ widely in their relative significance to mitigation. (medium confidence) " Reason: It is important to qualify the meaning of the term "climate law" in the context of the 56 countries mentioned. "Direct climate laws – with greenhouse gas limitation as a direct objective -- had been passed in 56 countries (of 194 studied) covering 53% of emissions in 2020, with most of that rise happening between 2010 and 2015." This excludes laws which contribute to climate change mitigation indirectly, or which do not have textual mentions of climate change mitigation. Further, the source chapter provides a qualifier that the relative importance of different climate laws could not be assessed due to differences across studies in what defines a "climate law": "The prevalence of both direct and indirect climate laws has increased considerably since 2007, although definitional differences across studies complicate a clear assessment of their relative importance (Nachmany and Setzer 2018; Iacobuta et al. 2018) (medium evidence, high agreement)." (Chapter 13, page 9, lines 7-11)	Government of India, Ministry of Environment, Forests and Climate Change
12502	12	11	12	12	Replace "targeted" with "directly addressed".	Government of India, Ministry of Environment, Forests and Climate Change
10286	12	12	12	12	It might be relevant to include "global" in the following sentence "However, global financial flows, for both adaptation and mitigation, have increased only modestly, from USD 343-385 billion annually in 2010-2012 to approximately USD 546 billion in 2018..."	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
9438	12	12	12	14	"The coverage of sectoral policies has also increased (high confidence) although coverage of emissions from the production of industrial materials and feedstocks, and agriculture, remains limited."  It would be better to delete "and agriculture" because agriculture sector is not mentioned in chapter 13, sub-section 13.6.1.2, outlining the coverage of mitigation policies, as a sector with potential gaps in mitigation policies. On the other hand, as indicated in Chapter 7.6 and other sections, agriculture is covered in countries' NDCs, offset programmes, and agro-environmental policies.  cf. The main gaps in current mitigation policy coverage are non-CO2 emissions and CO2 emissions associated with production of industrial materials and chemical feedstocks, which are connected to broader questions of shifting to cleaner production systems (Chapter 13, page 39, line 25 to 27.)	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
13410	12	12	12	14	Consider rewriting the sentence to read " Although the coverage of sectoral policies has increased (High confidence), coverage of emissions from production of industrial materials and feedstocks, and agriculture remain limited"	Government of Kenya, Kenya Meteorological Service
14674	12	12	12	15	It is helpful to know that sectoral policies on emissions from industrial materials production (which includes inputs for agriculture and food systems), feedstock production, and agriculture are limited at this time.	Government of United States of America, U.S. Department of State
3932	12	13	12	15	Last two sentences require confidence statements.	Government of Canada, Environment and Climate Change Canada
14676	12	13	12	15	Worded as an afterthought when it might be the game-changer. Also worded as though it is separate from sectors, which it is not.	Government of United States of America, U.S. Department of State
2760	12	14	12	15	This seems like an untapped lever of action which could be better reflected in the headline given its policy relevance. Is it normal that there are no confidence levels for this sentence?	Government of France, Ministère de la Transition écologique et solidaire
12504	12	14	12	15	Remove "Demand management and materials efficiency are also not widely addressed by policy". Reason: The meaning of "widely" is vague, and DSM policies differ substantially across countries.	Government of India, Ministry of Environment, Forests and Climate Change
542	12	15	12	15	The Line of Sight evidence for B.5.2 refer to {6.8}, which is not included in Chapter 6. Suggest to remove or correct it with a valid chapter reference.	Government of Singapore, Ministry of Environment and Natural Resources
2762	12	15	12	15	We suggest to specify what means "materials efficiency"	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3934	12	15	12	15	the phrase "Material efficiency" has not yet defined clearly in SPM or in the glossary pdf document. We suggest clarifying this phrase.	Government of Canada, Environment and Climate Change Canada
5358	12	15	12	15	It's not clear what is meant by 'materials efficiency' in this context. Could this be unpacked?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6386	12	15	12	15	Please check and correct reference to Chapter 6.8 as Chapter 6 only includes sub-chapters up to 6.7.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12506	12	15	12	15	Chapter 6.8 referenced. Source chapter runs till 6.7, has no 6.8.	Government of India, Ministry of Environment, Forests and Climate Change
13016	12	16	12	16	Quantify/qualify the words "discernible impact". It is not scientifically clear what it means.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
14678	12	16	12	16	"Policies have had a discernible impact" is unclear and vague.	Government of United States of America, U.S. Department of State
14680	12	16	12	16	This statement is not accurate. Globally, deforestation has continued and, at global scales, no policies have been effective.	Government of United States of America, U.S. Department of State
3936	12	16	12	17	Sub-bullet B.5.3 is very vague when it could be more quantitative: "discernible", "several Gt". Are there ranges? "Several" does not convey a shared impression of how successful these policies are.	Government of Canada, Environment and Climate Change Canada
13458	12	16	12	17	What is several? Please quantify.	Government of Estonia, Estonian Meteorological & Hydrological Institute
14682	12	16	12	17	Difficult to interpret whether "discernible impact" implies some threshold or whether this is a qualitative statement; recommend rephrasing.	Government of United States of America, U.S. Department of State
14684	12	16	12	17	The impact of policies is of such interest to policymakers and their advisors that more detail on how the influences of these policies were quantified would be a very helpful addition.	Government of United States of America, U.S. Department of State
5360	12	16	12	20	It would be really useful for policymakers to understand the evidence available on the relative effectiveness of different types of policies. Would it be possible to comment on this in B.5?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5362	12	16	12	20	The phrase 'several GtCO <sub>2</sub> eq-1' is not very helpful, as it could be interpreted very differently by different readers. It would be helpful if the authors could attempt to quantify this, providing a range of estimates, which would be an essential piece of information for assessing the success of mitigation efforts to date.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
940	12	17	12	17	Need more nuance here with respect to discussion of avoided emissions. Avoiding emissions is not the objective. Reducing emissions is the objective. There is the potential poorly constructed climate policy if these ideas are conflated. For example, the building of a natural gas power plant avoids the higher emissions of a coal power plant, but neither reduces emissions.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2268	12	17	12	17	Suggest providing a more specific quantitative estimate of how much emissions were avoided by policies, rather than 'several GT CO <sub>2</sub> '.	Government of Australia, Department of Industry, Science, Energy and Resources
2764	12	17	12	17	is it not possible to give a number with a range of uncertainty? "several" seems somewhat blurry, in particular next to a specific unit like Gt CO <sub>2</sub> eq.yr-1	Government of France, Ministère de la Transition écologique et solidaire
10308	12	17	12	17	Please provide a range of figures instead of "several Gt CO <sub>2</sub> -eq per year"	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transición Ecológica
11282	12	17	12	17	avoiding emissions of several Gt CO <sub>2</sub> -e q yr-1 globally ' it would be really good if 'several' could be quantified.	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13018	12	17	12	17	Quantify what "several Gt CO <sub>2</sub> -eq yr <sup>-1</sup> " means.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13056	12	17	12	17	B.5.3: please quantify "several" - a range could also be provided here for clarity.	Government of Gambia, Department of Water Resources
13532	12	17	12	17	Can "several" be specified with a number/range?	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
2766	12	18	12	18	We suggest to add "in most countries" after "reduced rates of deforestation"	Government of France, Ministère de la Transition écologique et solidaire
11284	12	18	12	18	'reduced rates of deforestation' is this certain? Can it be generalised? For what period? It could be noted that certain renewable energies (like biofuels or hydropower) can also drive deforestation.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5364	12	18	12	19	Add "In some countries" before "Policies have enhanced..." to make clear that the impacts referred to are not universal	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12508	12	18	12	19	Between the words "enhanced" and "energy", insert "inter alia" so that the first part of the sentence reads: "Policies have enhanced, inter alia,...." Reason: List of enhanced outcomes is not complete but only indicative.	Government of India, Ministry of Environment, Forests and Climate Change
13534	12	18	12	19	This is quite a general statement, would it be possible to specify it?	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13784	12	18	12	20	Please consider to quantify or add some specificity to the various improvements/examples mentioned, if possible.	Government of Norway, Norwegian Environment Agency
13786	12	18	12	20	Please consider to insert ", where implemented," after policies in this sentence. In this way it will clarify that these policies mostly reduce emissions in countries where they are implemented.	Government of Norway, Norwegian Environment Agency
14686	12	18	12	20	To improve accuracy, add caveat "(although not close to desired rates to achieve 1.5 or 2°C warming targets or other zero deforestation pledges)" after "reduced rates of deforestation".	Government of United States of America, U.S. Department of State
2270	12	19	12	19	The focus on heating systems seems skewed towards a northern hemisphere or higher latitude audience. Consider replacing 'heating systems' with 'heating and cooling systems'.	Government of Australia, Department of Industry, Science, Energy and Resources
5368	12	21	12	26	"Annual financial flows for climate adaptation and mitigation were USD632bn in 2019/20". Source isn't explicitly cited but data appears at odds with OECD estimates for a similar timespan. Would be helpful to be explicit on what is measured here - public flows or public+private? If the former, worth providing some additional context on private flows, which will offer additional nuance - drawing on e.g. the Climate Policy Initiatives Global Landscape data. Sources: OECD <a href="https://www.oecd.org/newsroom/statement-by-the-oecd-secretary-general-on-future-levels-of-climate-finance.htm">https://www.oecd.org/newsroom/statement-by-the-oecd-secretary-general-on-future-levels-of-climate-finance.htm</a> CPI <a href="https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2021/">https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2021/</a>	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5366	12	21	12	21	The "USD632 billion" doesn't seem to be in the underlying chapter, and is different to that found in the chapters FAQ section. Does "2019/2020" indicate the financial year or an average across the two years? Would be useful to add annual GLOBAL financial flows, given continued confusion over climate finance definitions.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6388	12	21	12	21	Please provide a definition for financial flows. Does it refer to Article 2.1.c of the Paris Agreement? Does this apply to global finance pattern, to private or public money? Has it been provided through the finance architecture related to the UNFCCC, through MDB, or otherwise? Does fossil-fuel-finance refer to subsidies? Please clarify.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6390	12	21	12	21	Please provide the uncertainty range for the 632 billion US\$.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14688	12	21	12	21	Replace "Annual financial flows for climate adaptation and mitigation" with "Average annual, public and private financing for climate mitigation and adaptation".	Government of United States of America, U.S. Department of State
148	12	21	12	22	B.5.4: The sentence provides information on Annual financial flows for climate adaptation and mitigation with exact numbers even though that there are uncertainty involved as indicated in the footnote attached. Requested Action: Information provided in Footnote 11 "Estimates of financial flows are based on a single series of reports which assemble data from multiple sources, and which were adjusted based on other data sources where available and appropriate. Such data can suggest broad trends but is subject to uncertainties." should be included in the text.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
640	12	21	12	22	It is inconsistent with the underlying Report. The average increase in financial flows in 2019/20 compared to 2015/16 is approximately 36% rather than 50%, based on the data in Table 15.1 on page 23 of Chapter 15 of the underlying Report (472, 456, 623, 640 for 2015, 2016, 2019, 2020, respectively), which exaggerates increases in scales of climate finance. It is suggested to be revised to 36% according to the data in the underlying report.	Government of China, China Meteorological Administration
2768	12	21	12	22	This sentence is highly relevant from a policy perspective. It may be useful to introduce in more details in footnote 11 what scope is used in these annual financial flows (national, regional, international, local, worldwide..)	Government of France, Ministère de la Transition écologique et solidaire
2770	12	21	12	22	In this set of data on climate finance, it would be necessary to isolate the weight of the flows relating to the Paris Agreement green fund ( $\pm$ 80 billion dollars according to last OECD data, for 2019), since this is one of the essential elements for making this institutional framework credible.	Government of France, Ministère de la Transition écologique et solidaire
7040	12	21	12	22	Finance is a high political theme, especially for developing countries, and it is not ideal to have a medium confidence sentence like this one regarding finance. We would like to see more details on how the authors achieve this amount of finance flow.	Government of Brazil, Ministry of Foreign Affairs
11932	12	21	12	22	B.5.4: It is our understanding that the numbers provided here stem from the CPI and reflect financial flows from multiple sources as indicated in the footnote. There needs to be information added however on international climate finance as assessed by the OECD and progress towards achieving the 100bn goal. This number, "USD 79.6 billion in 2019, up 2% from 78.3 billion in 2018" is very widely used and highly policy-relevant and must be added to this statement. Chapter 15, Box 15.4 p.25 states: "For 2018, the OECD analysis resulted in a total of 78.9 billion USD, out of which 62.2 billion USD of public finance, 2.1 billion USD of export credits and 14.5 billion USD of private finance mobilised. Mitigation represented 73% of the total, adaptation 19% and cross-cutting activities 8%." Furthermore, information from grants vs. loans should be added, e.g. from Box 15.4: "The difference with OECD figures stems from the high share represented by loans, both concessional and non-concessional, in public climate finance, i.e. 74% in 2018 (OECD 2020b)."	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
14690	12	21	12	22	Specify whether "USD632 billion" is in nominal or real dollars (and which year if real), especially as that figure is likely to be widely cited in the future. Also clarify whether that 50% higher is based on real or nominal dollars.	Government of United States of America, U.S. Department of State
13020	12	21	12	23	Is it possible to quantify what the split of the USD632 billion is between mitigation and adaptation?	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
6906	12	21	12	24	Please add concrete numbers here on the 100 billion climate finance goal and the latest assessment of progress towards achieving it, including the respective number on mitigation and adaptation finance. This would provide important additional policy-relevant information.	Government of Jamaica, Meteorological Service Division
11286	12	21	12	24	The section identifies financial flows, but is there an estimation of the total needs (mitigation +adaptation) ==> to frame the issue in the bigger picture? ; "The growth of climate finance has slowed down" - in which period and what could be the reasons for that?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
638	12	21	12	26	Since there is no common definition of "climate finance" (e.g., page 25, Chapter 15 of the underlying report), it is suggested to add a footnote as an explanation.	Government of China, China Meteorological Administration
2432	12	21	12	26	How does the sentence "the growth in climate finance flows has slowed down" relates to "Annual financial flows in 2019/2020 were roughly 50% higher than in 2015/2016"?	Government of Denmark, Danish Meteorological Institute
9440	12	21	12	26	This paragraph is referring finance for climate mitigation and adaptation. But the description of "The growth of climate finance flows has slowed down (medium confidence) and both public and private fossil-fuel financing remains at high levels (high confidence)" may give a wrong message by an arbitrary and inappropriate comparison.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs

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12510	12	21	12	26	Delete first sentence. Reason: No estimate based on a single series of reports is acceptable and the footnote only suggests broad trends and subject to uncertainties. Hence indication of specific numbers is unwarranted.	Government of India, Ministry of Environment, Forests and Climate Change
13460	12	21	12	26	Please quantify. E.g. how much is 'heavily focused'?	Government of Estonia, Estonian Meteorological & Hydrological Institute
13536	12	21	12	26	The information given in this bullet is welcome and needs to be expanded further by additionally giving information and concrete numbers on (1) the state of current financial flows as they relate to the USD 100 billion goal, (2) the shares of mitigation and adaptation finance (and loss and damage where available), (3) the shares of fossil fuel vs climate finance, (4) the share of green bonds and sustainable finance products vs their non-green and non-sustainable counterparts.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13538	12	21	12	26	Information on energy subsidies, specifically separated for both fossil fuels and renewable energy should be added to this bullet.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
14692	12	21	12	26	The discussion of financial flows seems only to speak to funds devoted to climate aligned finance. Would it not also be useful to speak to flows that are NON-aligned? Have those gone down (likely not); isn't that as much of a problem? Also, is the increase of the bond market reflected in the overall balance of flows?	Government of United States of America, U.S. Department of State
14694	12	21	12	26	Section B.5.4. makes clear that the financial flows to climate change adaptation have increased by 50% since 2015/2016, which begs the question of whether increased flow has had a corresponding impact on adaptation or mitigation?	Government of United States of America, U.S. Department of State
1160	12	22	12	22	Need to link to where multiple sources that used to estimate financial flows, lacking detail or reference to where this information is located	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2774	12	22	12	22	Please, consider clarify the alternative to avoid ambiguity: instead of adaptation	Government of France, Ministère de la Transition écologique et solidaire
6392	12	22	12	22	Please add references to these reports.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11934	12	22	12	22	B.5.4: "heavily focussed on mitigation" should be stated with a percentage value. Information from 15.3.2 can be used, i.e. p.24: "Mitigation continues to represent the lion's share of global climate finance (between 90% and 95% between 2017 and 2020), and in particular renewable energy, followed by energy efficiency and transport (UNFCCC 2018a; Buchner et al. 2019) (high confidence)."	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13058	12	22	12	22	B.5.4: It is important especially for LDCs to provide a number/percentage here when referring to the tilt in balance towards mitigation financing. With a lot of LDCs and developing countries having to adapt to climate change this would reflect that there is need to enhance adaptation finance to ensure that the most vulnerabel are not left behind.	Government of Gambia, Department of Water Resources
2272	12	22	12	23	Suggest re-wording. This sentence implies that there should be balance across regions and sectors. In reality larger regions, or regions with great climate finance needs usually attract larger shares of climate finance. Similarly, a balance of flows to sectors is not a reflection of efficient or effective climate finance. Suggest 'with some regions and sectors receiving larger flows than others'	Government of Australia, Department of Industry, Science, Energy and Resources
2772	12	22	12	23	The relative share between adaptation and mitigation financial flows could be presented with more precision in this sentence.	Government of France, Ministère de la Transition écologique et solidaire
6908	12	22	12	23	Please replace "heavily focused" with a concrete number/percentage.	Government of Jamaica, Meteorological Service Division
11862	12	22	12	23	Could you specify how focused are the flows on mitigation rather than adaptation? (ratios or percentages) In addition, could you specify the distribution of the flows between regions and sectors? Thanks for the consideration.	Government of Chile, Ministry of Environment
15634	12	22	12	26	These statements must be given with quantitative values. For statements on such crucial issues, the merely descriptive wording used to present these findings rather state what one already assumes, and may even suggest that quantitative assessments are not available, which is of course not the case. Quantitative statements would be much more meaningful.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
544	12	23	12	24	Suggest to include the time frame which indicates that the growth of climate finance has slowed down, as noted in Table 15.1 in Section 15.3.2.	Government of Singapore, Ministry of Environment and Natural Resources
3938	12	23	12	24	Slowed down since when? Since 2015?	Government of Canada, Environment and Climate Change Canada
5370	12	23	12	24	Again, useful to add GLOBAL before climate finance	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5372	12	23	12	24	"The growth of climate finance flows has slowed down (medium confidence)" - needs to have dates/figures to add value as a statement	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12322	12	23	12	24	This sentence: " The growth of climate finance flows has slowed down" seems to be the opposite of what the previous sentence says: " Annual financial flows for climate adaptation and mitigation were USD632 billion in 2019/2020, roughly 50% higher than in 2015/16"	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
14696	12	23	12	24	Incorrect statement about climate finance slowing down. Growth was about the same between 2015/2016 and 2017/2018 and between 2017/2018 and 2018/2019. See graphs in <a href="https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2021/">https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2021/</a>	Government of United States of America, U.S. Department of State
14698	12	23	12	24	Specify over what time period climate finance flow growth has "slowed down". Implied 2015/2016 --> 2019/2020, but what's actually being compared is the year-on-year growth 2015-2016 vs. 2019-2020, or something else?	Government of United States of America, U.S. Department of State
150	12	23	12	25	B.5.4: The text "The growth of climate finance flows has slowed down (medium confidence) and both public and private fossil-fuel financing remains at high levels (high confidence)" is misleading as it implies scientific correlation of the two paths of financing. In addition, it is not clear in the statement if financing to fossil fuel has slowed down at all and if the rate of financing to fossil fuel is higher or lower than climate financing. Overall, The focus should not be fossil-fuel financing or any sources rather, it should be on the emission intensity financing. Finance flows should be directed to low-emissions pathways as per PA, regardless of the source. Re-write the statement.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2146	12	23	12	25	An undate is needed on the climate finance market in 2021. Unlike until 2020, the climate finance market in 2021 is growing rapidly as ESG becomes a social issue. (Basis) Also in Korea, spread of coal-free declarations by financial institutions, increasing number of green bonds and reduction in the proportion of fossil fuel investment compared to 2020 take place.	Government of Republic of Korea, Korea Meteorological Administration
6394	12	23	12	25	Could you be more specific about the trend of public/private fossil-fuel financing? Did it increase, or did it stay the same? How much is the difference between climate finance and fossil-fuel finance?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
10310	12	23	12	25	It is stated " The growth of climate finance flows has slowed down (medium confidence) and both public and private fossil -fuel financing remains at high levels", please provide the extent of such slowing down as well as timeframe for it.	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
2776	12	23	12	26	Adding some figures on the % of increase or amount of USD would be useful.	Government of France, Ministère de la Transition écologique et solidaire
5374	12	23	12	26	These two sentences would make much more sense if their order was reversed. Please start with "Markets for green bonds...have expanded..." and then follow with "The growth...has slowed...fossil-fuel financing remains high."	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11288	12	24	12	24	redraft 'fossil-fuel' to 'fossil fuel'	Philippe Tulkens, European Union (EU) - DG Research & Innovation
942	12	24	12	25	Is there evidence that this high level of financing for Fossil Fuel is leading to lack of action on mitigation. Seems obvious, but would need to be stated,	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
3940	12	24	12	25	This second clause on" financing for fossil-fuel remains at high levels" should be separated and elaborated. For example, highlevels relative to what? Can it be split between private and public?	Government of Canada, Environment and Climate Change Canada

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5376	12	24	12	25	Might be useful to include a comparator when talking about high levels - historically or compared to climate finance levels?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5378	12	24	12	25	"high levels" of fossil fuel financing is not clear. Some context needed, e.g. "historically high levels" or "levels inconsistent with meeting climate and sustainable development goals"	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6910	12	24	12	25	For such critical information as on fossil fuel financing, please replace "high levels" with a concrete absolute number and set this in relation to climate finance.	Government of Jamaica, Meteorological Service Division
11936	12	24	12	25	B.5.4: An absolute number should be added to the statement on fossil fuel financing, instead of just saying "high levels". This information is highly relevant for policymakers. Information on investments should also be added. The following information from 15.3.3, p.27 could be elevated to the SPM: "In the power sector, fossil fuel-related investments reached an estimated 120 billion USD yr-1 on average over 2019–2020"; and "... supply side new investments: in 2019-2020 on average yr-1, an estimated 650 billion USD were invested in oil supply and close to 100 billion USD in coal supply. These estimates also result in fossil fuel investments remaining larger in aggregate than the total tracked climate finance worldwide".	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12324	12	24	12	25	According to various sources, investment in the world oil and gas industry has decreased in the last two years. As instance: "Oil and gas companies have cut their capex by a combined 34% in 2020" Source: By Joseph McMonigle, Alan Thomson, Christof van Agt, Rebecca Fitz, and Jamie Webster, "Oil and Gas Investment in the New Risk Environment", BCG, December 10, 2020. Or IEA says " The initial reductions in capital expenditure average around 25% compared with the plans that had previously been outlined for the year" Source: International Energy Agency, World Energy Investment 2020.  Furthermore In recent years, investment in the world oil and gas sector has been lower than the average of the last decade. See International Energy Agency World Energy Investment 2020 Page 11	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
5380	12	24	12	26	Are there data that would enable a comparison of climate finance to fossil fuel financing? At the moment it says climate finance growth has slowed and FF financing remains at high levels. Presumably this is based on some data - quantification here would be helpful.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2778	12	25	12	25	is it possible to give an order of magnitude for "high level"?	Government of France, Ministère de la Transition écologique et solidaire
6912	12	25	12	26	Could a number (absolute or percentage) be added to this statement, instead of just saying "have expanded significantly", which is too vague in this context? Also, it is our understanding from 15.3.1 p.22 that the share of bonds earmarked for climate action is still very low, so this information should be added to the SPM: "... since AR5, an increasing number and volume of bonds have been earmarked for climate action but these still only represent less than 1% of the total bond market."	Government of Jamaica, Meteorological Service Division
6914	12	25	12	26	Please add a sentence to this bullet point reflecting information on fossil fuel subsidies and renewable energy subsidies that is available from chapter 6.	Government of Jamaica, Meteorological Service Division
11290	12	25	12	26	Shouldn't the integrity concerns around the green bonds and sustainable finance products be spelled out? (need for more harmonised rules, better disclosure and governance). Messages here could be more targetted to inform concrete actions by policy makers	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13788	12	25	12	26	Please consider to add a quantification if possible, or some examples of green bonds and sustainable finance products that have expanded.	Government of Norway, Norwegian Environment Agency

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11938	12	26	12	26	B.5.4: This section must also include information on energy subsidies. The following information could be rephrased/shortened and elevated to SPM level, from 15.3.3, p.28, on fossil fuel subsidies: "... a rise to USD 340 billion in 2017, a 5% increase compared to 2016"; from Box 6.3 p.21: "For the year 2017, the IEA estimated fossil fuel subsidies of USD 300 billion using IEA's pre-tax, price-gap method (IEA 2018b), while the IMF included unpriced externalities in calculating subsidies of USD 5.2 trillion or 6.5% of global GDP (World Bank 2019; Coady et al. 2017, 2019). It has been estimated that the amount spent on fossil fuel subsidies was around double the amount of subsidies spent on renewables (IEA 2018b)."; "Global fossil fuel subsidies represent more than half of total energy subsidies with predominantly adverse environmental, economic, and social effects"; "the subsidies have proven to be regressive in most cases, with little benefit reaching the poor".	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
15636	12	26	12	26	This important paragraph on financial flows should feature findings regarding energy subsidies more consequently, findings that are contained in the underlying chapters. These findings should put fossil fuel subsidies in relation to renewable subsidies.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
5382	12	43	12	43	What does "The coverage of climate policy" mean? Suggest clarifying.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
	12		12		It would be relevant to be specific to specific gases ; which fraction of CO2 emissions, which fraction of CH4 emissions, N2O emissions, F gases etc are covered by regulation. WGI has stressed the importance of methane regarding its weight in today's warming and near term changes, there have been new methane pledges at COP26, so an emphasis here could make sense.	WGI Bureau,
2828	13	0	13	0	The meaning of the footnote 14 is not clear. Is this meant to be a definition of "substantially overshoot"? Or is it meant to refer to by how much warming with current NDCs risks overshooting 1.5°C - in which case the figure should be a great deal higher?	Government of France, Ministère de la Transition écologique et solidaire
798	13	1	13	1	In view of coming NDC-2035, it is desirable to specify that NDC-2030 are implied here.	Government of Russian Federation, Institute of Global Climate and Ecology
2782	13	1	13	1	We have a serious concern with the fact that the difference between the 2019 global emissions reference as assumed in underlying studies (54 (52-56) GtCO <sub>2</sub> -eq) and the actual 2019 emissions as presented in B1.1 (59±6.6 GtCO <sub>2</sub> -eq) is not mentioned in B6. Though we fully understand the assumption made in the studies, most readers might be misled and, as an example, deduce from B6.1 that current policies result in global 2030 emissions 2 GtCO <sub>2</sub> -eq lower (57 (52-60) GtCO <sub>2</sub> -eq) than the actual 2019 emissions, which is not the case. This critical issue deserves a detailed explanation in the SPM. We hope that this big difference is due to methodological approaches for processing the scenarios or to the not-accounting of some LULUCF/AFOLU emissions in the assumption. If it is the case, please mention it in B1.1 clearly . However, we found no explanation in Chapter 4. Should there not be a difference in the scope of the global emissions considered in B.6 and B1.1 (which would be very surprising), the main scientific question would be : since there is a 5 GtCO <sub>2</sub> -eq difference between the assumed and the actual 2019 baseline, how this difference should be reflected in the "projected" 2030 emissions resulting from NDC or current policies? In such a case, the authors should provide provide 2 different numbers for every result in B6.1, B6.2 and B6.3, reflecting a potential difference of about 5 GtCO <sub>2</sub> -eq in the 2030 projected emissions.	Government of France, Ministère de la Transition écologique et solidaire
5384	13	1	13	1	This introductory text is very clear and powerful. However, there is too much overlap between B.6 and C.1. The former presents recent trends in the context of the projections, the latter presents projections and contrasts them with recent trends. A merge of those two sections would benefit understanding.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6396	13	1	13	1	<u>NDC UPDATE</u> : Footnote 12: We are very concerned that this report only considers NDCs that have been submitted by mid-October 2021. This means that the report would already be outdated at the time of its publication. While we fully support that new literature can only be considered in a given report until a specific cut-off date, previous reports and their SPMs have included most recent data, e.g. from model simulations, if the methods to assess this data had already been described in literature published before the cut-off date and referred to in the underlying report. In this case, the methodology for the assessment of NDCs is already included in the underlying report and updating their values with more recent data would not be new, but would follow precedent, e.g. for updated model results in WG I. We, therefore, strongly urge the authors to include the most recent NDCs including those updated in the context of the UNFCCC COP26 in November last year. In any case, referring to NDCs from last year with "current" is not useful, please use "2021-NDCs" or something similar.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6916	13	1	13	1	Footnote 12 explains the caveat with regards to "current NDCs" well, yet it remains unclear what NDCs submitted after this deadline could mean for the assessment presented and to what extent new submissions could change the picture. Could at least a very broad/general/uncertain statement on the possible magnitude be added here?	Government of Jamaica, Meteorological Service Division
11940	13	1	13	1	B.6: Given that "current" NDCs are changing with the new submissions, could a statement be added to footnote 12 on what the new NDCs since the cutoff date would mean for 1.5°C feasibility?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13790	13	1	13	1	Please consider the possibility of including more recent NDCs in the SPM, either directly or by assessing the opportunity space of those NDCs assessed up to the deadline for literature and at the same time bearing in mind that some of those have been strengthened after the deadline. Also please consider rephrase "current NDCs" and "current policies" by indicating the relevant date throughout the SPM.	Government of Norway, Norwegian Environment Agency
14700	13	1	13	1	NDCs are political documents that are not necessarily the most accurate sources of information on projected emissions in 2030 in a country.	Government of United States of America, U.S. Department of State
9442	13	1	13	14	As stated in FOOTNOTE 12, revised NDCs submitted or announced after 11 October 2021 are not included. In order to be consistent with the NDC Synthesis Report by UNFCCC and other reports, it should reflect NDCs after 12 October 2021 and new ambition statements at COP26, such as India's 2070 carbon neutrality.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
944	13	1	13	23	The currency of the data may be questioned. Either date statements or update text if this is possible. or note that further updates in 2021 were not included.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
946	13	1	13	23	The word here should perhaps be 'more' rather than "higher". Are emissions high or is mitigation high? High is confusing here.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5390	13	1	13	23	The SPM currently does not give policymakers an estimate of what trajectory current NDCs put the world on, which is a key policy-relevant question. The following text from Cross Chapter Box 4 should be included to answer it: "GHG emissions of NDCs are broadly consistent with 2030 emission levels of cost-effective long-term pathways staying below 2.5°C."	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5392	13	1	13	23	The analysis in B6 and its sub-paragraphs is unfortunately already out-of-date, as it only includes NDCs submitted or announced up to 11 October, significantly before COP26 where a number of other countries submitted updated NDCs. As a result, assessments by other organisations including WRI and UNEP provide a more up-to-date picture. Recognising the difficult job the authors have in a constantly-moving environment, we request that authors make best efforts to ensure that the SPM is as up-to-date as possible. Where it is not possible to update these figures due to the literature cut-off date and we would request that the gap in updated commitments is acknowledged and addressed more clearly in section B6. However, we also note that previous SPMs, for example updated model results in AR6 WGI, have included most recent data if the methodology to assess the data was published prior to the cutoff date and referred to in the underlying report.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5394	13	1	13	23	The analysis in B6 focusses specifically on the near-term 2030 NDC horizon. However, this does not give policymakers the required information about the long-term pictures. There is some limited analysis in Chapter 4 on mid-century low-emission strategies at the national level (section 4.2.4) which could be elevated into the SPM. The report should also acknowledge that many net-zero targets have been announced since the literature cut-off date, either in the text or by updating footnote 12, or otherwise amended in line with updates in B6.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6400	13	1	13	23	Please state the time reference (e. g. "throughout / during the 21st century"). Even though it may seem self-evident and defined in footnote 8, this paragraph only delivers an explicit specification at the end, in the last sentence ("by 2100").	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14704	13	1	13	23	This should all come at the front (including Figure SPM.5).	Government of United States of America, U.S. Department of State
14706	13	1	13	23	Footnote 12 notes that the cutoff date for studies referred to in this section as 11 October 2021. Because of the timing of COP-26 in Glasgow, multiple NDCs were updated after this cutoff date and several important studies were published (e.g., Ou et al., Can updated climate pledges limit warming well below 2°C? DOI: 10.1126/science.abl8976). If possible, it would be beneficial for this section to reflect the most up-to-date science that attempts to assess the full impact of updated pledges Parties made in Glasgow.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14708	13	1	13	23	It would be more valuable if this section actually described the modeled emission and temperature paths implied rather than trying to tie NDCs to the two highly cited temperature benchmarks of 1.5 and 2°C and discussing "limited overshoot". Authors should just say that scenarios rise to 1.6°C and let policymakers and other analysts decide what is "limited". Provide the numbers in the most factual and appropriately qualified way.	Government of United States of America, U.S. Department of State
11292	13	1	13	25	This is an essential point, consider moving it to the beginning of the report, like becoming B1?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
156	13	1	13	3	In B.6. the text states, "Global emissions in 2030 implied by current nationally determined contributions (NDCs) would put limiting warming to 1.5°C with no or limited overshoot out of reach, and would require an abrupt acceleration of mitigation efforts after 2030 to make limiting warming to 2°C likely." This headline-statement demonstrates policy-prescriptive language and does not reflect the IPCC principles and procedures in ensuring policy-neutral language. Similarly, the text should depict all degree target levels, not only focusing on 1.5°C or 2°C scenarios. Include all degree target levels and ensure policy-driven timeframes are removed.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
5386	13	1	13	3	There are mixed messages overall on feasibility of out of reach / overshoot, here and in Section C. Technically right, but: <input type="checkbox"/> It could be much stronger on risks of negative emissions needed and pace of reduction on overshoot 1.5 from NDCs - didn't 1.5 SR rule out negative emissions on this scale? <input type="checkbox"/> Needs to be stronger on risks of achieving those rates with the NDCs	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6090	13	1	13	3	Why is the range of temperatures associated to NDCs "in absence of abrupt reduction after 2030" not mentioned here, given that it is done in C.1? It might be more logical to state what would happen in the absence of a strengthening of current policies already in section B, given its title ("(...) where are we headed?").	Government of Belgium, Belgian Science Policy Office - Belspo
9784	13	1	13	3	There is a need to attach a likelihood qualification to 1.5C as well; if not in the text than by adding a footnote	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
14702	13	1	13	3	This sentence gives an incomplete narrative and conveys a more negative framing around 1.5°C than warranted. As written, the first part puts the most stringent requirements forward: (i) implied by current NDCs; (ii) excluded conditional commitments; and (iii) no or limited overshoot. The framing text here is silent on whether 1.5°C with some overshoot might be possible, or under what circumstances 1.5°C is actually viable. This omission implies (though does not state) that 1.5°C is in fact out of reach. A better framing is to include additional language drawn from B.6.3 that discusses circumstances in which 1.5°C is attainable, and only then transition to the 2°C piece.	Government of United States of America, U.S. Department of State
5396	13	1	13	4	As in our comments on B6.3 and C1.1, the association of 2030 NDCs with overshoot pathways is quite confusing given that the underlying report in Chapter 3 is clear that emissions in 2030 implied by NDCs make even limiting warming to 2C extremely challenging. This is also inconsistent with footnote 8 which sets out the definitions of overshoot as used in the report. Perhaps reference to overshoot pathways could be removed. Could you please also address the feasibility of limiting warming to 1.5C with a high overshoot whilst following the NDCs to 2030, and not just low/limited overshoot/likely 2C as this is a key policy-relevant message. Please also see our comments on B.6.3 - together these statements convey a confusing a message about where NDCs are taking us, which needs to be put into context. Also, how does this framing fit with UNEP analysis, which suggests that NDCs are expected to take us to ~2.4C by 2100? Can a similar assessment of where NDCs will take us be included somewhere?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2780	13	1	13	5	This headline is clear and an highly relevant input to inform the global stocktake. On the last sentence, it may be interesting to indicate an order of magnitude of the gap between current policies and NDCs based on B.6.1.	Government of France, Ministère de la Transition écologique et solidaire
5398	13	1	13	5	Define "current policies", and clarify what this sentence is trying to imply - is it that NDCs have not been implemented as promised, or that emission reductions from implementing NDCs have been lower than expected, or something else? The headline statement should also emphasise the key message from B6.2 that greater action is needed this decade to close the 2030 emissions gap. Currently this is mentioned in line 4, but could be made clearer.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6398	13	1	13	5	For clarity reasons, please specify that these statements refer to "GHG" emissions.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13214	13	1	13	5	The reference to the important findings with respect to the emission gap (B6.2) and emission reduction (B6.3) is entirely missing in the lead paragraph. With the rationale that the lead paragraph is highlighting/summarizing the most important findings from the following paras, the results from B6.2 und B6.3 need to be included in the lead para.	Government of Switzerland, Federal Office for the Environment FOEN
14710	13	1	14	14	Section B.6 could be a candidate for cutting. (1) It is already out of date by not including all NDCs available by COP-26, and will be obsolete within the year most likely (by COP-27), so it will not have the persistent value of other sections. In fact, it already is out-of-date. "Current" policies were no longer current by the opening of COP-26 so it is also mislabeled. There is no explanation as to why it would include political announcements made but not submitted as NDCs, and on an analytical level it should not as they are just political statements. (2) The section's analysis is poorly documented and therefore difficult to interpret. For example, which countries' pledges are included or not, and which countries are included that did not submit new NDCs? Which countries were not included because they didn't provide sufficient authoritative information for quantification? (3) Unlike the rest of an authoritative IPCC report, this section has not been through peer review. The information is not unique to an IPCC report and the easily available, authoritative, and more frequently updated source for that information is and will be the UNFCCC Secretariat's synthesis and analysis of NDCs. (4) It does not provide new information that is not already widely available. To trim the SPM, omit this section. If it stays, it should be balanced with discussion of the modeled GHG effects of policies that are enacted into law or otherwise being implemented, as it is more concrete than nonbinding political pledges some of which are not even embodied in official NDCs.	Government of United States of America, U.S. Department of State
14712	13	1	14	17	This whole section seems to equate NDCs with "policies" or actions/incentives in place. At a minimum, the difference between paper pledges and having policies and incentives in place to achieve the targets therein must be identified for policymakers and the public. Not doing so displaces analysis of realities with analysis of notions. This is not to fully demean the value of political intentions, but recognizes that pledges are not the fundamental factors that result in GHG reductions. The former cannot succeed without the latter, but the latter can succeed without the former.	Government of United States of America, U.S. Department of State
5388	13	2	13	2	Why is there no uncertainty language used on what probability to keep warming to 1.5C? This is technically covered by footnote 8 in the definition of 'scenarios limiting warming to 1.5°C with no or limited overshoot' as referring to a 50% probability in 2100 and 50% probability of keeping peak warming to 1.6C, but as this is such a critical point for the SPM extreme clarity is required here. This should mean moving the uncertainty language on the 50% probability in 2100 into the text for this headline statement.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5400	13	2	13	2	Please define "out of reach" in terms of the assessed likelihood and confidence level. The uncertainty in ECS and the emissions budget means that "out of reach" requires high emissions, unless we assume that no policies will follow NDCs. The NDCs + <2 degree C line in Figure SPM.5 overlaps the 1.5 degree C line, suggesting that it would be possible to get back on track (while acknowledging the higher emissions in the intervening period).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14714	13	2	13	2	This language is unnecessarily complicated and tied to a limited set and structure of scenarios. Replace "would put limiting warming to 1.5°C with no or limited overshoot out of reach" with "is inconsistent with holding the global temperature increase to 1.5°C". Consider replacing "and would require an abrupt acceleration of mitigation efforts after 2030 to make limiting warming to 2°C likely" with (starting a new sentence) "For holding the temperature increase to 2°C or below would likely require an abrupt acceleration of mitigation efforts after 2030." Try to make the language easier for an average person to understand.	Government of United States of America, U.S. Department of State
11294	13	3	13	3	Can we expand on what 'abrupt acceleration of mitigation efforts' entail? And why we would be confident it would be possible? Maybe also introduce when that is not possible and what impacts that has on biodiversity loss, tipping points, adaptation limits - thus making the link with WG I and II reports.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
154	13	4	13	4	B.6: "current policies exceed those implied" Clarify the implied policies that are referenced as having been exceeded.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
5402	13	6	13	12	This paragraph is quite difficult to follow and should be redrafted to aid reader understanding. How does "as assumed in underlying studies" relate to "Current policies are projected to result in"? Similarly the ranges presented are confusing for unconditional and conditional savings [4.1 (3.6–7.1) and 4.7 (3–6.4)] since if unconditional savings can only be as low as 3.6Gt, how can conditional savings be lower (at 3.0 Gt)? Please re-write the paragraph for clarity.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6092	13	6	13	12	In B.6.1, it is not easy to compare the provided numbers and the gaps. It would probably be easier to understand if it was provided in a table format.	Government of Belgium, Belgian Science Policy Office - Belspo
6094	13	6	13	12	Emissions in 2030 consistent with NDCs (53 GtCO <sub>2</sub> ) are reported "relative to emissions of 54 (52-56) GtCO <sub>2</sub> -eq in 2019 as assumed in underlying studies", while section B.1.1 says that GHG emissions in 2019 were 59±6.6 GtCO <sub>2</sub> -eq. This makes it difficult for policymakers to understand the change in emissions between now and the 2030 NDCs (does the text mean that these emissions would be roughly constant, i.e. that in reality the expected emissions in 2030, given unconditional NDCs, would be about 58 GtCO <sub>2</sub> instead of 53?). We would like to ask for 2030 emissions that are consistent with the NDCs given the actual recent emissions. If that is not possible, we would suggest adding an explanation about why the 2015 and 2019 emissions are different in the "underlying studies" and in this report, and how one could interpret the text in terms of emission changes between 2019 and 2030 (with NDCs).	Government of Belgium, Belgian Science Policy Office - Belspo
9904	13	6	13	12	(B6.1): Very hard to read-let alone comprehend- overkill of numbers and ranges for different sets of assumptions. For example: about conditional vs. unconditional NDCs (ll. 6-8), or unexplained differences between "current" and "original NDCs/INDCs. Suggest to rewrite and reorganize so as to make clear what the different sets represent, and add policy relevant messages arising from the observed differences. Note that Figure SPM.5 provides a very clear and illustrative overview, that could serve to reorganise the text in B6.1.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11864	13	6	13	12	Please edit this paragraph to make it easier to read.	Government of Chile, Ministry of Environment
13792	13	6	13	12	It is somewhat difficult to read this para due to many numbers and abbreviations. Please consider to make it more reader-friendly.	Government of Norway, Norwegian Environment Agency
14720	13	6	13	12	Emissions implied by NDCs and current policies are relative to 54 GtCO <sub>2</sub> eq in 2019, but B.1.1 states that emissions in 2019 were approximately 59 GtCO <sub>2</sub> eq. How should these findings for 2030 be interpreted given discrepancy in the 2019 emissions?	Government of United States of America, U.S. Department of State
14722	13	6	13	12	The draft states that limiting warming to 1.5°C without overshoot is "out of reach" based on the assessment of "current" NDCs. While setting a cut-off date for the consideration of NDCs is understandable, the draft is insufficiently clear about which announcements are included in this finding, as most readers will not know when major emitters announced their NDCs. It is also unclear to the extent that important non-NDC pledges and announcements (such as the Global Methane Pledge) are included. Given other recent analyses of mitigation announcements at and after COP26, it is extremely important to have full clarity about what is included within the results presented here. At minimum, the footnote in B.6.1 should be strengthened to be more explicit about which NDCs are included beyond simply providing the cut-off date.	Government of United States of America, U.S. Department of State
14724	13	6	13	12	This finding inappropriately implies that NDCs will not be updated. This is inconsistent with the use of a literature cut-off date, after which major emitters have strengthened their commitments, and the outcomes of COP26 where Parties were requested to revisit and strengthen the 2030 targets in their NDCs as necessary to align with the Paris Agreement temperature goal. The text should be updated to emphasize that the implementation of current commitments and the scaling up of additional commitments prior to 2030 would keep the 1.5°C temperature goal within reach rather than declaring that the goal is out of reach based on an assessment of already outdated commitments.	Government of United States of America, U.S. Department of State
13646	13	6	13	23	While fully understanding and appreciating the cut-off date for considering updated NDCs (as per footnote 12) there is a risk that this SPM is quite out of date in this respect (i.e.regarding updated NDCs and other national pledges) even before publication. With the additional pledges made at the Glasgow Climate Change meeting in November 2021, the IEA has estimated a reduced gap: "Our updated analysis of these new targets – on top of all of those made previously – shows that if they are met in full and on time, they would be enough to hold the rise in global temperatures to 1.8 °C by the end of the century. This is a landmark moment: it is the first time that governments have come forward with targets of sufficient ambition to hold global warming to below 2 °C".	Government of New Zealand, Ministry of the Environment
26	13	6	13	6	Add FOOTNOTE to NDCs as written here: "Ahead of COP26 meeting".	Government of Czech Republic, Czech Hydrometeorological Institute
800	13	6	13	6	Please, clarify that 'Unconditional elements' means 'elements of NDC, which do not depend on external support'	Government of Russian Federation, Institute of Global Climate and Ecology
2784	13	6	13	6	A footnote or addition in the glossary about the difference between conditional and unconditional NDCs might be useful, as it might not be clear to an unspecialized audience.	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2786	13	6	13	6	The unit should be GtCO2-eq per year	Government of France, Ministère de la Transition écologique et solidaire
14716	13	6	13	6	What is meant by "unconditional elements"?	Government of United States of America, U.S. Department of State
1162	13	6	13	7	Not clear what is meant by conditional and unconditional when describing elements of NDCs	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6402	13	6	13	7	Please rephrase " global ANNUAL GHG emissions of 53...", because the time frame "BY 2030" does not deliver an exact time reference (as opposed to the phrasing "IN year xxxx" used in the rest of the paragraph).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6404	13	6	13	7	unconditional elements... conditional elements: please provide definition for "unconditional elements" and "conditional elements" in the glossary, or use a working that is understandable for non-experts.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
3942	13	6	13	8	It would be helpful to have a statement added here (at a minimum in a footnote) to explain the implications of lower assumed GHG emissions in 2019 in underlying studies (54 (52-56 GtCO2eq) than those observed (59 (52-66) – Figure SPM.1 chart).	Government of Canada, Environment and Climate Change Canada
14718	13	6	13	8	A quick note about what constitutes unconditional versus conditional elements would help. Perhaps in a footnote?	Government of United States of America, U.S. Department of State
2274	13	6	13	9	Footnote states that analysis is based on NDCs and other pledges submitted up to 11 October 2021. There were a number of significant NDC resubmissions made in the context of COP26. The omission of these NDCs will mean that the analysis is out of date before the report is released and will reduce its relevance to policy makers. Suggest that the cut-off date for government policies and NDC submissions is updated to 12 November 2021.	Government of Australia, Department of Industry, Science, Energy and Resources
2788	13	7	13	7	The unit should be GtCO2-eq per year	Government of France, Ministère de la Transition écologique et solidaire
28	13	7	13	8	Here the 2019 emissions are 54 (52-56) GtCO2eq, but in Fig.SPM.1a the emission for 2019 are 59 Gt. Why such difference?	Government of Czech Republic, Czech Hydrometeorological Institute
642	13	7	13	8	"relative to emissions of 54 (52-56) GtCO2-eq in 2019" is inconsistent with "B.1, Page 6": "GHG emission were 59±6.6GtCO2-eq in 2019". The authors are requested to check and modify.	Government of China, China Meteorological Administration
1242	13	7	13	8	It would be good to comment on the difference in the 2019 emissions between B1.1. (59 Gt) and here (54 Gt). The "as assumed in underlying studies" is probably not immediately clear for many. (Refers to new methods?)	Government of Sweden, Swedish Meteorological and Hydrological Institute
6406	13	7	13	8	... relative to emissions of 54 (52- 56) GtCO2-eq in 2019 as assumed in underlying studies: the value (54 GtCO2-eq) differs from the value 59 GtCO2-eq in section B1.1. Please correct.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12326	13	7	13	8	The emissions of 54 GtCO2-eq in 2019 does not correspond to (or match) the number stated on page 4 of the SPM (Global net anthropogenic GHG emissions were 59±6.6 GtCO2-eq in 2019).	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
13794	13	7	13	8	There seems to be a discrepancy in the 2019-emissions stated here when compared to the numbers given on page 4, line 6-7. Please consider to explain more clearly why these discrepancies occur, and if possible it would be easier for the readers to follow if they were given only one number for 2019 emissions.	Government of Norway, Norwegian Environment Agency
2790	13	8	13	8	Slightly different numbers are provided page TS-30 line 2 than "4.7 (3-6.4)	Government of France, Ministère de la Transition écologique et solidaire
12406	13	9	13	12	Rewrite the Sentence to read " Under the current policies, Global GHG emissions are projected to reach 57.....	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
13210	13	9	13	12	B6.2. is the paragraph that addresses the emission gaps. This B6.1 paragraph does speak to total GHG emissions. Move the sentence "current policies ... to achieve current NDCs (medium confidence)." to B6.2 as it also speaks - among others - to the emission gap.	Government of Switzerland, Federal Office for the Environment FOEN
2156	13	9	13	9	It would be better if there are some explanation that INDC means Intended nationally Determined Contributions, in that paragraph.	Government of Republic of Korea, Korea Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2158	13	9	13	9	It's about footnote 12. It would be better if NDC data is updated after COP 26, since many countries submitted revised NDC after COP 26. Eventhough there are not valid or meaningful research result, some qualitative mentioning might be helpful.	Government of Republic of Korea, Korea Meteorological Administration
2792	13	9	13	9	The unit should be GtCO <sub>2</sub> -eq per year	Government of France, Ministère de la Transition écologique et solidaire
13644	13	9	13	9	Suggest that "INDCs and" be deleted. INDCs have been replaced by NDCs and are no longer relevant (except in an historical context)	Government of New Zealand, Ministry%20for%20the%20Environment
2796	13	11	13	11	The unit should be GtCO <sub>2</sub> -eq per year	Government of France, Ministère de la Transition écologique et solidaire
5404	13	11	13	11	This is the gap between NDCs and current policies - what about the gap between current policies, NDCs and where we need to be? That said, it may be covered partially by para B.6.2. Also, where it says 'scenarios that limit warming to 1.5 C with no or limited overshoot - definitely or 50/50 or 66% likelihood?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2794	13	12	13	12	A reference to TS.4 could be added (see page TS-28 lines 15-19 and TS-30 lines 1-7)	Government of France, Ministère de la Transition écologique et solidaire
6918	13	13	13	15	Are the emissions gaps to 1.5°C and 2°C as described here the same as emissions gaps to achieving the Paris Agreement temperature goal? Please clarify, or adjust the information presented accordingly.	Government of Jamaica, Meteorological Service Division
11942	13	13	13	15	B.6.2.: In line with our overarching comment regarding the Paris Agreement-compatibility of information provided, it is questionable whether gaps to "likely below 2°C" would be PA-compatible. This should be rephrased.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12514	13	13	13	15	Insert the words "illustrative model" before the word "scenarios". Reason: The comparisons are with outcomes of model projections which include many assumptions that are not, or cannot be tested.	Government of India, Ministry of Environment, Forests and Climate Change
160	13	13	13	17	B.6.2: The naming of limiting warming to 1.5°C scenarios is misleading as the likelihood is missing, the names should reflect the likelihood of "more likely than not". Second, as indicated in the footnote in page 5, limiting warming to 1.6 is included in scenarios limiting to 1.5, this is confusing for the decision makers as it is not clear the case of other levels such as 1.7 for example. Required action: The authors should carefully verify the range of the scenario or category of scenarios and provide the likelihood in the name consistently.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
644	13	13	13	17	The confidence level is not consistent with the underlying report (lines 32-35, page 72, Chapter 3) in which no confidence level is given. The authors are requested to check and keep consistent with the underlying report.	Government of China, China Meteorological Administration
646	13	13	13	17	Since the NDCs of each country have been updated, it is suggested to amend "current NDCs" in line 16 to "NDCs by 11 October 2021" to clarify the cut-off date of SPM references.	Government of China, China Meteorological Administration
13212	13	13	13	17	The reference to the important findings with respect to the emission gaps is entirely missing in the lead paragraph. With the rationale that the lead paragraph is highlighting/summarizing the most important findings from the following paras, the result from the emission gap needs to be included in the lead para.	Government of Switzerland, Federal Office for the Environment FOEN
13462	13	13	13	17	How is this gap calculated? From which reference scenario? B6.1 says that the studies used 54GtCO <sub>2</sub> e as 2019 emissions. B1.1 sates that the actual emissions were 59GtCO <sub>2</sub> e in 2019. How does it change the results? Also the various overshoot definitions/scenarios are confusing. It might be better to stick to previously defined scenarios from WGI and SR1.5.	Government of Estonia, Estonian Meteorological & Hydrological Institute
2798	13	14	13	14	Relative to 59 GtCO <sub>2</sub> eq (or 54 whatever figure is correct), is a huge reduction. For the reader that is not used to these figures, it's not sure that he will realize that it's equivalent to almost halve our emissions in less than 10 years.	Government of France, Ministère de la Transition écologique et solidaire
2800	13	14	13	14	The unit should be GtCO <sub>2</sub> -eq per year	Government of France, Ministère de la Transition écologique et solidaire
9444	13	14	13	14	There is no need to limit to no or limited overshoot scenarios. If emissions remain in line with current measures or NDCs, overshoot scenarios will be necessary to achieve the temperature target. It would be useful for policy maker to have information related to overshoot scenarios.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
14726	13	14	14	12	"scenarios that limit warming to 1.5°C": With what probability? Suggest using probability-based statements to clarify which scenarios these are, as should the next clause referring to "scenarios that are likely to limit warming to 2°C ..." (same comment for SPM-14, line 12).	Government of United States of America, U.S. Department of State

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2802	13	15	13	15	The unit should be GtCO2-eq per year	Government of France, Ministère de la Transition écologique et solidaire
2804	13	16	13	17	The unit should be GtCO2-eq per year	Government of France, Ministère de la Transition écologique et solidaire
2806	13	16	13	17	Different numbers are provided in TS4.1 (page TS 28 lines 19-21) but the reference date is ambiguous in the TS	Government of France, Ministère de la Transition écologique et solidaire
2808	13	17	13	17	A reference to TS.4 could be added (see page TS-28 lines 15-21)	Government of France, Ministère de la Transition écologique et solidaire
12512	13	17	13	17	Add a sentence after this line "Model scenarios include assumptions that are not tested for feasibility in terms of finance or technology transfer among other assumptions."	Government of India, Ministry of Environment, Forests and Climate Change
11296	13	18	12	22	B6.3 seems to understate how difficult it would be to achieve a likely below 2°C scenario from the 2030 emissions level implied by the NDCs. For example, saying that "the acceleration would be particularly challenging" is a very euphemistic way of describing the stranded assets issues discussed at the beginning of Section C. Please provide some more specific illustration of why this post-2030 reduction would be so hard; e.g. how much of the global fossil-powered power supply or vehicle fleet would need to shut down each year from 2030. Such illustrations are necessary - otherwise the immediate action and post-2030 pathways appear too much like alternative choices on a menu.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5418	13	18	12	23	As previous comment - and could say here what NDCs are estimated as consistent with (around 2.4 degrees, and rising). As well as emphasising carbon intensive investments, it could also state the flip side, e.g. lack of progress on low carbon role out and changes needed	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
162	13	18	13	18	The text in B.6.3 states, "Limiting warming to likely below 2°C would require the rate of global emission reductions to accelerate abruptly after 2030 to an average 1.3–2.1 GtCO2-eq per year during 2030-2050, around 70% higher than in pathways that assume immediate action to limit warming to the same level." The text should depict all degree target levels, not only focusing on 2°C scenarios, given that the B.6.3 is of high confidence level. <u>Required action: Include all degree target levels and ensure policy-driven timeframes are removed.</u>	Government of Saudi Arabia, Sustainability Advisor to the Minister of Ministry of Petroleum and Mineral Resources
2810	13	18	13	18	This statement would require a confidence assessment	Government of France, Ministère de la Transition écologique et solidaire
2812	13	18	13	18	The sentence is too vague. Clarify by adding directly in the main text the global warming level in 2030 according to NDCs.	Government of France, Ministère de la Transition écologique et solidaire
2814	13	18	13	18	The phrasing : an overshoot of 1.5°C higher than 0.1°C sounds weaker than limiting warming to 1.5°C out of reach as above (page SPM-13 lines 1-2) and elsewhere in the report (for example page TS-29 lines 16-17, TS-39 lines 19-15, TS-43 lines 52-53 etc.)	Government of France, Ministère de la Transition écologique et solidaire
3944	13	18	13	18	Footnote 14: As written, this footnote could be misinterpreted to mean that emissions implied by current NDCs lead to an overshoot of 1.5C as little as anything above 0.1C, whereas WGIII shows that current NDCs imply a much larger overshoot than that. The current text in the footnote is just a definition of how 'high overshoot' scenarios are defined and is not a statement about global warming implied by current NDCs. This should be clarified.	Government of Canada, Environment and Climate Change Canada
5406	13	18	13	18	What is the assessed likelihood that current NDCs imply warming would exceed 1.5 degrees C?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5408	13	18	13	18	This is clearly not a statement of fact and must have uncertainty language attached to it.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5410	13	18	13	18	The first sentence needs clarification or could be deleted. Current NDCs lead to warming well above 1.5C, this is a lot more than a simple overshoot. It is not clear what this first sentence is trying to say.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5412	13	18	13	18	It would be useful to include a likelihood of exceeding 1.5C to strengthen this statement.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5414	13	18	13	18	Recent UNEP analysis indicates that NDCs would result in ~2.4C of warming by 2100. Please can you provide more context to the statement that NDCs result in a high overshoot pathway and state the assumptions that result in such an assessment? It doesn't seem to be consistent with how overshoot is define in footnote 8 - it might be that a different word is more appropriate here, perhaps "substantially exceed 1.5C" to avoid confusing this with overshoot pathways. Please can you also comment on the feasibility of such a pathway as this is not addressed in the SPM, although well articulated in CH3.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5416	13	18	13	18	Footnote 14 as currently phrased implies that current NDCs could imply warming of only 1.6C, and using the term 'overshoot' in B6.3 implies this exceedance of 1.5°C is only temporary. The sentence should be rephrased 'Current NDCs imply warming would substantially exceed 1.5C by at least XX degrees'.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6920	13	18	13	18	The wording "overshoot" in this context is misleading as current NDCs would cause temperatures to increase much higher than what is implied with "overshoot" and the footnote talking about ">0.1°C". Please rephrase to use for instance the same wording as in B.6.	Government of Jamaica, Meteorological Service Division
11298	13	18	13	18	A powerful statement would be to equate the degree of warming that we are heading to based on the current NDCs. Consider quantifying the 'substantial overshoot' more precisely than in footnote 14, i.e. how much more than 0.1°C?.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11944	13	18	13	18	B.6.3 and footnote 14: The text should not refer to a substantial overshoot of >0.1°C as it could be misunderstood as somehow still 1.5°C-compatible. This would be wrong, of course. The sentences should simply repeat what is also already said in the headline statement B.6, which is that current NDCs put 1.5°C out of reach.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13060	13	18	13	18	B.6.3: We think that it would be more helpful here to reiterate that with current NDCs it is not possible to get to the 1.5oC Paris Agreement goal (see also footnote 14)	Government of Gambia, Department of Water Resources
13540	13	18	13	18	This sentence is misleading in that it suggests that NDCs merely cause temperatures to overshoot 1.5°C, while the temperature increase from NDCs in fact would be much higher and there is no reason to assume that temperatures would decline again, as "overhoot" would suggest. Please rephrase, also the associated footnote.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
14728	13	18	13	18	Footnote 14: Is >0.1 "substantial" especially given the error range on temperature estimates?	Government of United States of America, U.S. Department of State
158	13	18	13	23	In the following statement in B6.3 "Current NDCs imply warming would substantially overshoot 1.5°C. Limiting warming to likely below 2°C would require the rate of global emission reductions to accelerate abruptly after 2030 to an average 1.3–2.1 GtCO <sub>2</sub> -eq per year during 2030-2050, around 70% higher than in pathways that assume immediate action to limit warming to the same level.". The statement reads as policy-prescriptive and must be rewritten in a non-policy-prescriptive manner.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
648	13	18	13	23	It is not supported by or consistent with the underlying report in terms of confidence. The first sentence of B6.3 of the SPM is from Chapter 3 (lines 19-22, page 73) of the underlying report and originates from a literature with no confidence level. The second sentence, from Chapter 3 (lines 1-2, page 40) with no confidence level given, is marked as high confidence in the SPM. It is suggested to delete confidences which are not consistent with the underlying report. The whole paragraph, which is not supported by a given confidence, can be considered for deletion.	Government of China, China Meteorological Administration
2434	13	18	13	23	Suggest moving first sentence (line 18) and last sentence (line 22-23) up.	Government of Denmark, Danish Meteorological Institute
3946	13	18	13	23	Since the last sentence in this paragraph is about returning global warming to 1.5C by 2100, it is implicitly referring to overshoot scenarios. In that respect, it would make better sense to have this last sentence moved to follow the first one, which states that current NDCs imply warming would substantially overshoot 1.5C. Then the rest of the paragraph is about the implications of current NDCs for below 2C pathways.	Government of Canada, Environment and Climate Change Canada

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5420	13	18	13	23	"Current NDCs imply warming would substantially overshoot 1.5°C." This is problematic without more context. Current NDCs alone, assuming similar levels of action post-2030, are consistent with 2.4-2.7°C depending on the study. The language here implies they are consistent with 1.5 but just with overshoot.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12516	13	18	13	23	Rewrite as: "Current NDCs imply warming would substantially overshoot 1.5°C, as the cumulative emissions resulting from these NDCs would substantially overshoot the remaining carbon budget. Staying within the 1.5 degree C goal would require substantial negative emissions. Returning warming to 1.5°C by 2100 would rely on achieving large-scale global net-negative emissions. In model scenarios that limit warming to likely below 2°C the rate of global emission reductions accelerates abruptly after 2030 to an average 1.3–2.1 GtCO <sub>2</sub> -eq per year during 2030-2050, which is around 70% higher than in model scenarios that assume immediate reductions in emissions." Reason: For 1.5 degree C warming overshoot, the remaining carbon budget is the most significant constraint.	Government of India, Ministry of Environment, Forests and Climate Change
14730	13	18	13	23	How do the necessary emissions reductions relate to mitigation practices? Is reduction of emissions necessary on top of advances in mitigation?	Government of United States of America, U.S. Department of State
2816	13	19	13	19	Is it possible to make it clear in relation to what is the acceleration?	Government of France, Ministère de la Transition écologique et solidaire
13216	13	19	13	21	The reference to the important findings with respect to the required emission reductions is entirely missing in the lead paragraph. With the rationale that the lead paragraph is highlighting/summarizing the most important findings from each of the following paras, the authors should include these results in the lead para.	Government of Switzerland, Federal Office for the Environment FOEN
6408	13	20	13	20	The term "higher" is somewhat confusing/counter-intuitive here. We suggest to rephrase into "faster" or "steeper".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2818	13	21	13	22	The relationship with development pathways could also be mentioned as developed in TS.4	Government of France, Ministère de la Transition écologique et solidaire
2820	13	21	13	22	The sentence is quite abstract and technical. It should be illustrated with examples in brackets. Moreover, the term challenging is vague and ambiguous: is it a social, economic or technological challenge? Maybe the term difficult would be less ambiguous.	Government of France, Ministère de la Transition écologique et solidaire
3948	13	21	13	22	These interim investments is critical to understanding a key risk of not taking early action for mitigation. However, "particularly challenging" does not clearly convey the contribution of these investments to restricting future emissions. This sentence also requires a confidence statement.	Government of Canada, Environment and Climate Change Canada
9446	13	21	13	22	The sentence "The acceleration would be particularly challenging . . . ." should be added to the sentence "If innovation proceeds rapidly (depends on the progress of innovation).	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11300	13	22	13	22	By 'interim investments' you mean to say lock-ins? What does 'interim investment' mean?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13382	13	22	13	22	Returning warming to 1.5oC by 2100....' rephrasing to show possibility would be better since it reads as though this would be an impossible feat	Government of Kenya, Kenya Meteorological Service
1244	13	22	13	23	A comment on how feasible it could be to achieve such large-scale global net-negative emissions given what is known of technology, risks and governance challenges would be useful, and better relate to what is stated earlier on challenges related to emission reductions and investments.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2276	13	22	13	23	Suggest clarifying what 'large-scale' means, perhaps as a percentage of either current emissions or emissions at the time of implementation.	Government of Australia, Department of Industry, Science, Energy and Resources
2822	13	22	13	23	It should be stressed that limiting global warming to 2°C also rely on net-negative emissions (Table SPM.1)	Government of France, Ministère de la Transition écologique et solidaire
2824	13	22	13	23	This sentence is incomplete and may lead to misunderstandings if quoted out of context : returning to 1,5°C after an overshoot would not only rely on negative emissions but also emission reductions as detailed above. It would be relevant to add a detail in the orther of "additionnaly" or 'further' before 'rely' in order to clarify this	Government of France, Ministère de la Transition écologique et solidaire

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5422	13	22	13	23	"Returning warming to 1.5°C by 2100 would rely on achieving large-scale global net-negative emissions. (high confidence)." implies that large-scale global net-negative emissions are an option, which isn't justified by the underlying chapters. (see for instance ch. 3.5.2.1 "CDR ramp-up rates and absolute deployment levels are tightly limited by techno-economic, social, political, institutional and sustainability constraints"). Please include an additional statement on the feasibility of achieving this scale of CDR.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6410	13	22	13	23	This is a very crucial and policy relevant statement that that returning warming to 1.5°C needs a lot of negative emissions. However, the SPM misses to provide information on the actual (technical and/or sustainable) potentials of CDR options. It is neither clear, if the 200 Gt CO2 of cumulative net-negative CO2 emissions (see Table SPM.1 for C1) are of a magnitude that would actually be realistic nor under which requirements/socio-economic pathways such an amount of net negative CO2 emissions could be realized. There will be an even higher demand of CDR since in addition to net negative emissions, there is also a need to compensate remaining emissions (e.g. from the food sector, aviation...) and to accelerate the pace of mitigation action - these numbers of CDR are not mentioned in the SPM. We request the authors to provide both, the total amount of CDR needed to limit global warming at 1.5°C and if this amount is reasonable at all. Preferably, please add a range of CDR potential, as done e.g. in the SRCCCL.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14	13	23	13	23	It is suggested to provide some additional information in order to clarify what "large-scale" is referring to. Insert e.g. after large-scale global net-negative emissions in the range of several 10 GtCO2-eq per year.	Government of Austria, Federal Ministry of Agriculture, Forestry
2826	13	23	13	23	A reference to TS.4 could be added (see page TS-29 lines 16-26, TS-39 lines 9-26, and TS-43 line 52 to TS-44 line 23)	Government of France, Ministère de la Transition écologique et solidaire
9448	13	23	13	23	Figure SPM.5 does not show significant negative emissions; either remove the reference to Figure SPM.5 or include a figure such as Figure 3.29 a), which includes emissions beyond 2050. It would provide useful information for policy formation if the case of overshoot scenario is also presented.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
	13	23	13	23	"achieving large-scale global net negative emissions" seems that the only challenge is "achieving this" while other dimensions of feasibility - sustainability are mentioned later in the SPM. Maybe another wording would be better.	WGI Bureau,
5424	13	25	13	25	The analysis in B6 and its sub-paragraphs is unfortunately already out-of-date, as it only includes NDCs submitted or announced up to 11 October, significantly before COP26 where a number of other countries submitted updated NDCs. As a result, assessments by other organisations including WRI and UNEP provide a more up-to-date picture. Recognising the literature cut-off date and the difficult job the authors have in a constantly-moving environment, we would request that this is acknowledged and addressed more clearly in section B6.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13796	13	25	13	25	In footnote 12, please consider if it would be possible to include the NDCs from 2021/COP 26.	Government of Norway, Norwegian Environment Agency
	13		13		B6 and B1 have inconsistent emission references for year 2019 (54 versus 59 GtCO2-e for 2019), could this be reconciled in such a high level summary? (like scaling IAM results to inventory estimates or bias correction etc)?	WGI Bureau,
	13		13		There could be a footnote stating that the methods used to link emission scenarios with global warming levels are consistent with the AR6 WGI report (same emulators).	WGI Bureau,
3272	14	0	14	0	We suggest to put the date of the last aggregated NDC in the (grey) title	Government of France, Ministère de la Transition écologique et solidaire
3274	14	0	14	0	The historical emissions shown in the left panel must be extended up to 2019, using 2 different types of curve (e.g. solid and dashed) in order to distinguish the historical emissions trends as used in model studies and the actual emissions actually observed thereafter. This would be very policy-relevant. We also suggest adding a short note explaining why the "historical emissions" and the "current policies" lines differ.	Government of France, Ministère de la Transition écologique et solidaire
3276	14	0	14	0	the y axis of the first figure is « Gt CO2eq » and it should be « Gt CO2eq Yr-1	Government of France, Ministère de la Transition écologique et solidaire
3278	14	0	14	0	It would be quite relevant and visually useful to put in front of the caption another caption showing how this relates to the temperature scenarios introduced in footnote 8 of this version of the SPM.	Government of France, Ministère de la Transition écologique et solidaire
6922	14	1			Emissions have risen since 2015 yet they appear overall stagnant in this figure until about 2019? What is the significance of the gap between historical and modelled emissions levels? The figure (caption) should explain this.	Government of Jamaica, Meteorological Service Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11946	14	1			Figure SPM.5: It seems problematic that historical emissions only extend until --and scenarios already start in-- 2015 instead of 2019, considering that B.6.1 gives the 2019 value from scenarios as 54 (52-56) GtCO <sub>2</sub> eq, while B.1.1 gives 59±6.6 GtCO <sub>2</sub> -eq in reality, and that C.1 footnote 16 states that "all reductions are reported relative to 2019 modelled emission levels". While we assume that this cannot be adjusted anymore in terms of the scenario base, we would like to ask for an explainer to be included if this substantial difference would have a measurable effect on temperature outcomes. This issue must be made dealt with transparently and explicitly in the SPM, e.g. in the figure caption.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
164	14	1	14	1	In Figure SPM.5, the title provides conclusions, "Projected global emissions from aggregated NDCs place limiting warming to 1.5°C beyond reach, and make it harder after 2030 to limit warming to 2°C." The figure would be better reflected to state "Projected global emissions from aggregated NDCs." Required action: Change the title to only state "Projected global emissions from aggregated NDCs" to demonstrate the purpose of the figure with clarity.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
3950	14	1	14	1	Figure SPM.5: title. Revise title to refer to limiting global warming to below 2C (versus 'to 2C' as currently written). This would make the title consistent with the pathways shown.	Government of Canada, Environment and Climate Change Canada
3952	14	1	14	1	Since the historic emissions in this figure seem to end at 2015 or 2016, any discrepancy between modelled emissions up to 'current' (year 2019) and observed emissions, should be explained. Figure SPM.1 gives the value for observed GHG emissions as 59GtCO <sub>2</sub> eq +/- 6.6 GtCO <sub>2</sub> eq. It appears that the uncertainty around modelled emissions in Figure SPM.5 captures the lower end of this uncertainty range, but does not capture the upper end. The implications of this for the modelled emission pathways to 1.5C and <2C should be explained.	Government of Canada, Environment and Climate Change Canada
5426	14	1	14	1	In Figure SPM5, it is unclear what the difference is between the red 'current policies extended' and the purple 'current policies' under 'short term policy assessments for 2030'. This should either be explained, or combined into a simple data point.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5428	14	1	14	1	In Figure SPM5, emissions post-2015 emissions are modelled as opposed to using historical emissions for 2015-2021. It would be helpful to add some text underneath the figure to describe how much of a difference this makes to the findings, and why this is the case, as the 2019 emissions are clearly lower than that stated earlier in the report as 59 GtCo <sub>2</sub> eq yr-1.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5430	14	1	14	1	Title states 1.5 out of reach, not low /no overshoot only as in previous para - should be consistent whichever conclusion is being drawn	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6100	14	1	14	1	Figure SPM.5 - We would like to understand why emissions in 2019/2020 reported here differ from the best estimate in section B.1.1.	Government of Belgium, Belgian Science Policy Office - Belspo
6412	14	1	14	1	Figure SPM.5, 2030 snapshot: Please clarify why there is a difference between the red range ("current policies") and the grey range (also "current policies").	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6414	14	1	14	1	Please add in the legend the headline "types of emission-pathways" on top of the 4 categories.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6416	14	1	14	1	Please indicate the uncertainties ranges (median, 25th–75th and 5th–95th percentiles) also for the current emissions in Figure SPM.5. This visualisation is particularly important to understand the relative uncertainties of observed and projected emissions, since the SPM provides two different values for past emissions in B.1.1 (recently updated data sets) and in B.6.1 for the projections (earlier versions of the same data sets).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9450	14	1	14	1	It should be made clear that figures in Figure SPM.5 are on an annual basis, either by changing the title to "Aggregate annual GHG emissions of..." or putting "yr-1" at the end of the unit.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9452	14	1	14	1	In Figure SPM5, RCP8.5 should be written in the figure, since most of the existing environmental impact assessments are based on RCP8.5.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9454	14	1	14	1	In Figure SPM5, temperature increase in 2030 and 2050 should be written for all scenarios.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13218	14	1	14	1	panels: label them with a. and b. like in other figures.	Government of Switzerland, Federal Office for the Environment FOEN
13220	14	1	14	1	Left-handed panel: In the rest of the document the latest values date from 2019. The figure depicts pathways starting around 2016. Historical emissions need to be depicted up to 2019 until when data is available. Then, the pathways should start from the latest data that is 2019.	Government of Switzerland, Federal Office for the Environment FOEN
13384	14	1	14	1	We commend the authors for a clear figure and easy to understand. Other figures in the SPM could benefit from similar clarity	Government of Kenya, Kenya Meteorological Service
13798	14	1	14	1	The part describing unconditional and conditional elements is unclear. Please consider to include an explanation in the caption.	Government of Norway, Norwegian Environment Agency
14732	14	1	14	1	Recognizing that modeled emissions begin in 2015, it may be helpful to add observed emissions through 2019. The emissions shown in Figures SPM.1 and SPM.2 are higher than those projected in SPM.5 and could lead to confusion. Ultimately, more detail is needed on what scenarios are being shown and how they are being developed.	Government of United States of America, U.S. Department of State
14734	14	1	14	1	Suggest changing the y-axis label to "GtCO <sub>2</sub> -eq" to be consistent with what's in the text.	Government of United States of America, U.S. Department of State
14736	14	1	14	1	How are current policies projected?	Government of United States of America, U.S. Department of State
14738	14	1	14	1	Unclear how the 2050 snapshot adds anything. The 2030 snapshot could be condensed or improved.	Government of United States of America, U.S. Department of State
650	14	1	14	17	The time period covered in Figure SPM.5 is incomplete and it is suggested to use the complete time interval (2010-2100) as reflected in the underlying report (Cross-Chapter Box 4 on page 23 of Chapter 4) for the total global GHG emissions and pathways rather than that ending in 2050.	Government of China, China Meteorological Administration
11304	14	1	14	17	This is an important figure. However, it will be challenging to provide up-to-date emissions estimates for the 2019-25 period - and misleading to provide out-of-date information. The authors must therefore strike a balance regarding how recent the data can be. Most importantly, there will need to be a clear and transparent footnote explaining that IPCC cannot provide up-to-date information of this kind given the constantly changing environment (COVID and its recovery, submission of NDCs very late in 2021 etc). In the NDCs scenario, why is there not a stronger drop in emissions earlier (before 2030)? Is it possible to say what difference inclusion of post-October 2021 NDCs would make? Ideally in the figure itself - or else in a footnote. The Figure also implies that emissions under an NDC scenario have already peaked (in 2019 or 2020). Is this still thought to be the case?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12518	14	1	14	17	Figure captions to be rewritten - All mentions of "pathways" must be qualified by the term "modelled pathways"	Government of India, Ministry of Environment, Forests and Climate Change
14742	14	1	14	17	Why don't the Figure SPM.5 historical and NDC pathways match? Offset affects future pathway of emission reductions. Including the historical emission uncertainties would be one way to reconcile this problem.	Government of United States of America, U.S. Department of State
6418	14	1	14	18	Fig. SPM.5. Please clarify which scenario groups have been used in this figure so that it can be linked to Table.SPM.1 and to footnote 8. Also, please clarify the criteria for these choices, e.g. does the figure not include C1 and C3 scenarios with delayed mitigation until 2030 and larger amounts of negative emissions later? How meaningful is this figure? We strongly prefer Fig. 3.6.b that shows a variety of groups thus also allows for an understanding of the effects of scenario categories. In addition, this figure extends until 2100 which is also useful in order to understand that delayed GHG reductions increase the needs for CDR. Please use this figure instead of the current one, and update with more recent NDCs, see our general comment on this issue.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14740	14	1	14	2	In the 2030 snapshot panel, the "NDCs until 2030" distribution expands below both the conditional and unconditional NDC elements distributions. This means that different ranges are being used. Some explanation would help make this clearer to the reader.	Government of United States of America, U.S. Department of State
5432	14	1	14	3	Historical trends needs to be extended up to the present day to highlight how consistent or not these scenarios are with current levels of global GHG emissions	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11302	14	1	14	7	Figure SPM.5 We suggest expanding the time horizon of the figure beyond 2050 so that net zero timing for each pathway is visible. This is particularly important as a visual companion to the description of the pathways given in Section C1.. Otherwise some findings could be taken out of context. For example p16, line 7 suggests that emissions need to fall by 'only' 76% in a likely 2°C scenario by 2050. This might be true but i) that is only the case for scenarios where absolute reductions begin immediately; ii) even if this scenario, emissions need to reach net zero at some point. This nuances are better conveyed in a chart than through text.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14744	14	2	14	17	Figure SPM.5 is potentially the most important figure in the whole report, but there are multiple problems with the text descriptions that accompany the figure: 1) The figure title would be easier to follow if the word ""place"" was replaced by ""make"". Then, after the comma, add ""also"" so it reads: ""and also make ..."" 2) Each of the bullets in lines 7-12 should be prefaced by the exact text used in the graphic's legend so it is clear that these bullets are providing more detail for the legend. 3) The sentence beginning on line 15 ""Historic GHG ..."" does not apply to the right panel. It applies only to the left panel, so it should be moved out of this paragraph. 4) The sentence beginning on line 16 ""GHG emissions"" applies to the entire figure, not just to the ""right hand panels"". 5) If the snapshots on the RH side of the figure are being considered ""panels"", then perhaps the figure needs to label the three image panels a), b), and c) and adjust the descriptions in lines 5-17 accordingly.	Government of United States of America, U.S. Department of State
2278	14	2	14	2	Suggest 'plumes' instead of 'funnels', consistent with earlier IPCC usage.	Government of Australia, Department of Industry, Science, Energy and Resources
13222	14	2	14	3	Harmonize the terminology: here we use "aggregate" GHG emissions , elsewhere we are using "global net anthropogenic emissions", "total", "cumulative", and others.	Government of Switzerland, Federal Office for the Environment FOEN
6096	14	2	14	4	Figure SPM.5 - The figure legend speaks of 'emissions implied by unconditional and conditional elements of NDCs'. It is not clear to us what unconditional and conditional elements mean. Could you explain please?	Government of Belgium, Belgian Science Policy Office - Belspo
948	14	2	14	3	Just showing 2050 all-GHG does not reveal that many 1.5C scenarios reach net zero CO2 by 2050 which is a key point. A figure on CO2 only showing 2050/mid century would be useful otherwise it is important to clearly show CO2 emissions in 2050, with a symbol showing where they are now (202?).	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
802	14	4	14	4	The information presented 'on updates available by 11 October 2021' is incomplete in the context of new intentions on carbon neutrality expressed before and during COP-26 in November. Figure SPM5 should include additional line indicated potential influence of those intentions on carbon neutrality, otherwise an important part of recent and crucial information for policymakers might be left out.	Government of Russian Federation, Institute of Global Climate and Ecology
2174	14	4	14	4	It is a pity, but on the other hand understandable, that the latest NDCs given in connection with the Glasgow meeting are not included, but for demonstration purposes the solution works well and indicates the key messages that current NDCs are not bringing us to the trajectories consistent with the Paris Agreement long-term goals, and the longer lag to get the emission on a reduction pathway the steeper and deeper the reductions need to be.	Government of Finland, Finnish Meteorological Institute (FMI)
9456	14	4	14	4	It is not clear what the grey bars refer to.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
6098	14	7	14	12	Figure SPM.5 - The figure legend contains the description of the pathways without a link to the colours used in the figure. Linking the pathways with the colours would improve clarity.	Government of Belgium, Belgian Science Policy Office - Belspo
13800	14	7	14	12	Please consider if adding the colors used on the graphs to their respective description in the caption improves readability.	Government of Norway, Norwegian Environment Agency
1246	14	9	14	11	The figure refers to "less than 2oC" viz. these pathways that are coined here as "limit warming to 2oC". The latter would seem to include warming up to two degrees, which is a discrepancy. Suggest clarification, as appropriate.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
3954	14	9	14	11	Figure SPM.5: these pathway descriptions refer to limiting global warming "to 2C" whereas in the legend below the figure these pathways are shown as limiting global warming to "<2C". Consistency is needed.	Government of Canada, Environment and Climate Change Canada
6420	14	12	14	12	Figure SPM.5, legend: please add "based on immediate actions from 2020 onwards" at the end of this line.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14746	14	12	14	12	The last bullet point should read: "Pathways that limit warming to 1.5°C with no or limited overshoot based on immediate action." Inclusion of "immediate action" here clarifies and emphasizes the urgency.	Government of United States of America, U.S. Department of State
6422	14	15	14	16	For the entire report and in particular the SPM, please review the definitions for historic/historical periods and explain why they differ in different contexts (e.g., SPM2, 3, and 5).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
3462	14	16	14	17	A reference to Fig. TS.9 (page TS-29) could be added	Government of France, Ministère de la Transition écologique et solidaire
3958	14				Figure 5. Consider including information on emissions in the SSP scenarios used in WGI here. SSP scenarios are used in WGI and WGII, and were intended to be used as a dimension of integration across WGs, and including this information here would improve linkages between WGs. Alternatively, the SSP scenarios could be included in Figure SPM.6.	Government of Canada, Environment and Climate Change Canada
13542	14				Could an explanation be added to the figure that lays out what it means for temperatures that historical emissions are only shown until 2015 (and pathways begin in 2015), instead of 2019?	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
2172	14		14		Why does the figure show data only until the historical base year 2015? Please extend the historical emissions curve up until latest available year and, please, discuss what kind of dynamic differences this deviation of historical emissions and used initial model values may generate e.g. in terms of the development of sectoral emissions.	Government of Finland, Finnish Meteorological Institute (FMI)
3956	14		14		In the 2030 snapshot panel, it seems that the "short-term policy assessment" data bars correspond to the "projected emissions from the implementation of the NDCs..." written below at lines 14-15. If so, please use same language in both.	Government of Canada, Environment and Climate Change Canada
12328	14		14		Figure SPM.5: The GHG emissions figure in 2020 and before should be adjusted to correspond to the real situation.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
950	15	1	15	1	Use of the word "alone" here is rhetorical and could introduce ambiguity into the sentence.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5436	15	1	15	1	Please clarify that this is 'Central estimates of projected emissions'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11306	15	1	15	1	what do "central emissions" mean here? (footnote?)	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13224	15	1	15	1	Delete "current" or change to "currently"	Government of Switzerland, Federal Office for the Environment FOEN
13802	15	1	15	1	It is unclear what is meant by "central emissions", please consider adding an elaboration in the subsequent paragraphs or rephrasing it to "best estimate of emissions", if appropriate. Furthermore, consider adding "emissions from the use of" or "emissions associated with" in line 1 (before "existing and current") to make it clearer that it is the emissions from the use of the infrastructure that make up most of these emissions (not from construction).	Government of Norway, Norwegian Environment Agency
14750	15	1	15	10	B.7 and B.7.1 are convoluted. The information is important; it is just very tough to understand exactly what the authors are trying to say. B.7.2 is clear.	Government of United States of America, U.S. Department of State
9460	15	1	15	16	The framing of the discussion comparing emissions from existing and planned fossil fuel infrastructure with emissions from no or limited overshoot scenarios would be inappropriate. If existing and planned fossil fuel infrastructure is to be used, an overshoot scenario is inevitably required, but this is not mentioned at all. Overshoot scenarios, such as how much negative emissions will be required if existing and planned fossil fuel infrastructure is used, should also be discussed.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9906	15	1	15	16	(B7): sends in fact a very important, if not crucial, and policy relevant message. But the text does not reflect the urgency of the incompatibility between the Paris warming targets and current and planned fossil fuel operations. Suggest to add language to put more emphasis on the important implications, which are not always consistent with -even weaker- phrasing in section C.4 (see separate comment)	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11310	15	1	15	16	Could maybe something be said about regional split (maybe a graph added?). What about the role of overseas financing of coal? Overall, the language could be sharper here as realistically it puts 1.5 and 2.0 targets out of reach.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13228	15	1	15	16	B.7 including the subparagraphs B7.1 and B7.2: It is unfortunately unclear what the authors are intending to analyse and convey to the reader. Does it assess the role of different sectors and cross-cuttingly tries to differentiate between the 1.5 and 2 degrees scenario respectively? If yes, this should be made clearer in the lead paragraph and the underlying subparas that follow.	Government of Switzerland, Federal Office for the Environment FOEN
14752	15	1	15	16	Delete Section B.7. The point that the authors are trying to make is important, but it is too complex to communicate in this short form summary. The current text would need to be extensively re-written for this point to be understandable. As written now, lines 1-4 are completely unintelligible; Subsections B.7.1 and B.7.2 are only slightly better. If there is a desire to reduce the length of the SPM, cut this section. If retained, re-write the entire thing.	Government of United States of America, U.S. Department of State
5434	15	1	15	17	This section would be more useful if it provided relative contributions from solid (ie coal), liquid and gaseous ffs for power gen	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5438	15	1	15	2	This title could be stronger - e.g. existing infrastructure alone is larger, no need to add "currently planned"	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5440	15	1	15	2	Is currently planned here current policies, or a more asset investment level based definition?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5450	15	1	15	2	The wording of the heading is complex, and the basis for comparison is not entirely clear. It refers to 'Project central emissions', would be better to say 'Estimated future emissions' to match paragraph B.7.1. However, over and above this comment, it might be better to replace the heading with the key message from the section, which appears to be that 'For future power sector emissions to be consistent pathways to limit warming to 1.5C, or even 2C will require cancellation of new fossil fuel installations, and reduced utilisation of existing installations'.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9458	15	1	15	2	The sentence is not clear enough. One should compare "cumulative net CO2 emissions to net zero" with emissions integrated over a certain time period, which is not provided in the present form of the sentence. Setting the time horizon for the emissions from fossil fuel infrastructure would help readers grasp the meaning.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
166	15	1	15	4	B.7: The naming of limiting warming to 1.5°C scenarios is misleading as the likelihood is missing, the names should reflect the likelihood of "more likely than not". Second, as indicated in the footnote in page 5, limiting warming to 1.6°C is included in scenarios limiting to 1.5°C, this is confusing for the decision makers as it is not clear the case of other levels such as 1.7°C, for example. The authors should carefully verify the range of the scenario or category of scenarios and provide the likelihood in the name consistently.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
168	15	1	15	4	The text in B7 states, "Projected central emissions from existing and current planned fossil fuel infrastructure alone are higher than the median of cumulative net CO2 emissions to net zero in scenarios consistent with limiting warming to 1.5°C with no or limited overshoot, if historic operating and decommissioning patterns are maintained. (high confidence)". Required action: Remove this text. This statement is misleading as to suggest that the only way to get net zero consistent with limiting warming to 1.5C is to dismantle existing and planned fossil fuel investments --- this is misleading because existing and planned fossil fuel infrastructure could be adapted to fit with low GHG emissions trajectories through avoiding of emissions, producing low GHG carriers, and/or capturing of emitted carbon.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
832	15	1	15	4	Statement B.7 is difficult to read. Suggestion: to replace 'to net zero' with 'to net zero moment' (of course, if this is actually implied)	Government of Russian Federation, Institute of Global Climate and Ecology

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2176	15	1	15	4	B.7 is an important headline statement. Perhaps there is a way to make the message easier to digest for the policy makers compared with the current version.	Government of Finland, Finnish Meteorological Institute (FMI)
2280	15	1	15	4	This passage could be clearer. Suggest reducing the wording to refer to remaining under the 1.5C threshold, or refer to net zero by mid-century, rather than both.	Government of Australia, Department of Industry, Science, Energy and Resources
2282	15	1	15	4	The use of 'central' in 'Projected central emissions...' is unclear; e.g. is 'central' referring to median estimations, or indicating that these are direct emissions? Suggest rewording or removing the term, noting that 'central' is not used in Chapter 2.7.	Government of Australia, Department of Industry, Science, Energy and Resources
2436	15	1	15	4	Difficult to understand. Suggest redrafting	Government of Denmark, Danish Meteorological Institute
2830	15	1	15	4	The wording of this headline is not clear enough. In order for policy-makers to understand what it means in terms of aligning future CO2 emissions with pathways consistent with 1.5°C, the last sentence from B.7.2 below should be reflected.	Government of France, Ministère de la Transition écologique et solidaire
3960	15	1	15	4	This is a long and hard to read headline statement. If possible, it should be broken into two sentences. Perhaps a first statement could be a statement of fact - giving the median value of cumulative net CO2 emissions to net zero in scenarios limiting global warming to 1.5C with no or limited overshoot. Then the assessment statement could follow about the implications of emissions from current and planned infrastructure.	Government of Canada, Environment and Climate Change Canada
3962	15	1	15	4	This HLS is difficult to understand. Consider rephrasing.	Government of Canada, Environment and Climate Change Canada
5442	15	1	15	4	The summary paragraph could make clear that existing coal power plants in particular will need to be decommissioned earlier or retrofitted worldwide, and new installations cancelled, to limit warming to 1.5 degrees C.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5444	15	1	15	4	The phrasing in this para is quite unwieldy, and in particular the phrase "are higher than the median of cumulative net CO2 emissions to net zero" is difficult to parse. A clear opening sentence would help the reader understand the messages more clearly, for example, "Projected emissions from existing fossil fuel infrastructure puts 1.5C out of reach".	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5446	15	1	15	4	The phrase 'existing and current planned fossil fuel infrastructure alone' should be changed to 'existing fossil fuel infrastructure alone' for clarity, as the meaning is currently ambiguous and could be misconstrued to mean 'the total of planned and existing'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5448	15	1	15	4	This is a difficult summary to understand. What are central emissions? - I can't see the same terminology used in the underlying chapters so a definition would be good. Perhaps splitting the statement into multiple sentences would also add clarity?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6102	15	1	15	4	We do not understand why this headline statement only refers to a 1.5°C limit, while paragraph B.7.2 contains more general statements, which also apply to a 2°C limit. Could you consider adding information from B.7.2 in the headline?	Government of Belgium, Belgian Science Policy Office - Belspo
6424	15	1	15	4	Headline statement B.7 contains a lot of scientific jargon, please improve: - please use the word "budget" - what is the difference between the "central" value and the "median"? - what are "historic operating and decommissioning pattern"? - is this para referring to CO2 or to GHG? Please simplify the language so that the headline will be comprehensible for non-experts. <del>It would also be good to clarify how these budget values compare to the WG I figures</del>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9786	15	1	15	4	Question: to what extent is this statement dependent on the application of CCS and or CDR ?	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11308	15	1	15	4	Does not read smoothly	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12520	15	1	15	4	Headline statement should be rewritten as follows: "Based on historic patterns of operating and decommissioning, estimated future CO2 emissions from existing fossil fuel infrastructure, would amount to 660 (460–890) GtCO2, and to 850 (600–1100) GtCO2 when currently planned infrastructure is included. The remaining carbon budget for more likely than not 1.5 deg. C is 510 GtCO2, for likely 2 deg. C is 890 GtCO2, and for more likely than not 2 deg. C is 1210 GtCO2"	Government of India, Ministry of Environment, Forests and Climate Change
13648	15	1	15	4	The statement/sentence would be easier to read if the order were to be reversed i.e. change to: "If historic operating and decommissioning patterns are maintained, projected central emissions from existing and current planned fossil fuel infrastructure alone are higher than the median .....with no or limited overshoot"	Government of New Zealand, Ministry%20for%20the%20Environment
13804	15	1	15	4	We think the message of this sentence is important, but as it stands, the sentence is long and difficult to understand. Please consider to split it up and /or rephrase it. It would also help if you could explain "central emissions", as this concept might not be well known to all policymakers. Lastly, please consider to explain whether "fossil fuel infrastructure" includes infrastructure for extraction of fossil fuels or if it only includes infrastructure for use of fossil fuels.	Government of Norway, Norwegian Environment Agency
14748	15	1	15	4	The takeaway is that at current pace of fossil fuel infrastructure operation and decommissioning, projected emissions will exceed rates necessary to limit warming to 1.5°C. Syntax needs work. Revise the sentence.	Government of United States of America, U.S. Department of State
13464	15	1	16	4	B7 This s a very difficult to understand headline statement. Talking about central and median emissions complicates the language. Please rephrase in a clear simple language and please quantify.	Government of Estonia, Estonian Meteorological & Hydrological Institute
1248	15	2	15	2	The "higher than the median" is a complicated expression and leaves the reader uncertain on what the point being made is. A simpler "larger" would seem a possible alternative wording.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
11312	15	2	15	2	The "net zero" objective is not clearly defined and a short reminder of the definition (emissions balanced with removals and not compensated emissions) could help avoiding misunderstandings.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11314	15	2	15	2	"cumulative net CO2 to net zero": is it the same as the "remaining carbon budget"? If so, the latter term would seem preferable. If not, it might be useful to explain the difference.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5452	15	3	15	3	Replace 'historic' with 'historical' to get meaning correct. Same in line 5 of this page.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13226	15	3	15	3	What does "decommissioning" mean. Assess if the reader will be in a position to understand that term, in particular in a lead para in the SPM?	Government of Switzerland, Federal Office for the Environment FOEN
5454	15	3	15	4	It could be a more impactful paragraph, perhaps, if it opened with the last line, i.e. 'If historic operating and decommissioning patterns are maintained...'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2832	15	4	15	4	A reference to TS.3 could be added (see page TS-26 lines 23-37)	Government of France, Ministère de la Transition écologique et solidaire
13806	15	4	15	4	Please consider altering "decommissioning" to either e.g. "closure" or "withdrawal" in order to increase the readability for non-native english speakers, if appropriate.	Government of Norway, Norwegian Environment Agency
11316	15	5	12	10	Provide a time reference. Is "majority" the correct word here?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
170	15	5	15	10	B.7.1: The statement only takes into consideration two pathways. Include all GWLs.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20of%20Petroleum%20and%20Mineral%20Resources
5458	15	5	15	10	This section is quite difficult to follow. Would it be possible to shorten the sentences to aid comprehension?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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6428	15	5	15	10	Ch2-72-5 reads "Hence, cumulative net CO2 emissions to limit likely warming to 2°C or lower could already be exhausted by current and planned fossil fuel infrastructure (medium confidence) even though this estimate only covers a fraction of all infrastructure developments over the 21st century as present in mitigation pathways, does not cover all sectors (e.g. AFOLU) and does not include currently infrastructure development plans in transport, buildings, and industry." This information is missing in the SPM - why is it not relevant?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9462	15	5	15	10	B7.1 says "Based on historic patterns of operating and decommissioning, estimated future CO2 emissions from existing fossil fuel infrastructure alone, the majority in the power sector, would amount to 660 (460.890) GtCO2, and to 850 (600.1100) GtCO2 when currently planned infrastructure is included. This compares with cumulative net CO2 emissions from all sectors of 510 (330.710) GtCO2 until net zero in pathways that limit warming to 1.5-C with no or limited overshoot, and 890 (640.1160) GtCO2 in pathways likely to limit warming to 2-C (high confidence) {2.7, 3.3}", but from Table 2.6 of Chapter 2, only one literature calculates emissions from both existing and planned infrastructure. In the Table 2.6, other literatures show smaller emissions from existing ones including 500 (280. 700), but they are not covered here, These should be reviewed whether appropriate or not.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12416	15	5	15	10	We suggest the calibrated IPCC uncretainty language be used to reflect the uncretainties associated with estimation of emission from planned Infrastructure	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
12522	15	5	15	10	Bullet should be rewritten to include the remaining carbon budget for the 50% likelihood of 2 deg. C as well. Suggested rewrite: "Based on historic patterns of operating and decommissioning, estimated future CO2 emissions from existing fossil fuel infrastructure alone, would amount to 660 (460–890) 7 GtCO2, and to 850 (600–1100) GtCO2 when currently planned infrastructure is included. The remaining carbon budget for more likely than not 1.5 deg. C is 510 GtCO2, for likely 2 deg. C is 890 GtCO2, and for more likely than not 2 deg. C is 1210 GtCO2". The term majority from the power sector is not to be included as estimating fossil fuel infrastructure used for power, as opposed to transport, for example is not comparable.	Government of India, Ministry of Environment, Forests and Climate Change
14758	15	5	15	10	Where does range come from?	Government of United States of America, U.S. Department of State
6430	15	5	15	11	Summary B7.1 should be rephrased to make it easier to put the projected emissions and the remaining budget until net-zero emissions into context.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
3964	15	5	15	15	There are two instances in these two paragraphs where pathways are described as being likely to limit warming "to 2C". Again, this is not consistent with how these pathways are defined elsewhere, as likely limiting warming "to below 2C".	Government of Canada, Environment and Climate Change Canada
11318	15	5	15	15	not clear to which time period the statements apply	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5456	15	5	15	5	Text refers to 'estimated future CO2 emissions', for clarity this should presumably be 'estimated cumulative future CO2 emissions'.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14754	15	5	15	5	Recommend being more clear on "historic patterns of operating and decommissioning". Is this pattern with regards to ages? Capacity factor? Something else?	Government of United States of America, U.S. Department of State
2834	15	5	15	7	Could you precise the time horizon for the majority of these committed emissions?	Government of France, Ministère de la Transition écologique et solidaire
6426	15	5	15	7	Add "cumulative" in "estimated [cumulative] future CO2 emissions from existing fossil fuel infrastructure". Otherwise hard to understand.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14756	15	5	15	7	Over what period are the future emissions estimated? 2050? 2100?	Government of United States of America, U.S. Department of State
1164	15	6	15	6	Use of the word "alone" here is rhetorical and could introduce ambiguity into the sentence.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
652	15	7	15	10	The confidence level is not consistent with the underlying report (lines 3-5, page 72, Chapter 2, and lines 1-4, page 43, Chapter 3), in which no confidence level is given. The authors are requested to check and delete the confidence level here.	Government of China, China Meteorological Administration
952	15	7	15	10	"'until net zero' should be clarified.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1250	15	7	15	8	"This compares" is unclear, as no actual comparison is made. The numbers indicate that "This is larger" or suchlike would be appropriate more lucid wording.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2838	15	7	15	8	The year from which the cumulative emissions are considered must be specified. We understand from Table SPM.1 that this year is 2020.	Government of France, Ministère de la Transition écologique et solidaire
2840	15	7	15	8	The comparison approach lacks clarity ("This compares with"). It would be more striking to present it differently ie: This current situation is already higher than what is estimated to be in the 1.5° scenario and if we include the projected infrastructure it is very close to the 2°C scenario estimate	Government of France, Ministère de la Transition écologique et solidaire
2836	15	7	15	9	For greater consistency with WGI it would be clearer to use the term "carbon budget". In addition, the budget shown here differ from Tab. SPM.2 from WGI, which complexify the comparison between working groups.	Government of France, Ministère de la Transition écologique et solidaire
	15	7	15	8	Given the broad uncertainty range, it is a bit strange to report specific numbers, so could not that be : "around 660" etc.	WGI Bureau,
2842	15	8	15	9	The cumulative emissions given in B7.1 differ from those given in Table SPM.2 of the WG1 report (400 and 1150 GtCO2 from the beginning of 2020 to limit warming to 1.5 and 2°C with a 67% likelihood respectively). These differences should be explained in a footnote. Table SPM.1 informs that the likelihood for limiting warming to 1.5°C with a remaining cumulative emission of 510 GtCO2 is only 38%, which contradicts the present finding. Please clarify these differences and modify the numbers if necessary.	Government of France, Ministère de la Transition écologique et solidaire
2844	15	8	15	9	This section mixes both aggregated data and trajectories, making it sometimes difficult to understand. It also lacks the 2050 time horizon, which is implied but not explicit. For example, in this sentence the 510Gt represents the stock of emissions by 2050 and "until net zero", the situation in 2050 following a 1.5°C pathway. Shouldn't it be replaced by "with a trajectory from xx Gt in 2020 to zero in 2050"?	Government of France, Ministère de la Transition écologique et solidaire
14760	15	8	15	9	Assuming that these numbers are based on WGI AR6 Table SPM.1, why are different levels of probability being used for the 1.5 and 2°C thresholds here (and elsewhere in the text)? It would seem much clearer to keep the likelihood level the same and only vary the level of warming in this comparison of carbon budgets. At a minimum, it seems necessary to state the probability of the 1.5°C goal ("about as likely as not") rather than only "likely" for the 2°C goal as in the current text.	Government of United States of America, U.S. Department of State
6432	15	9	15	10	The budget to limit warming to 2° is given here (and in Table SPM.1) as 890 (640 - 1160) GtCO2. In Ch.2, page 7, line 24 it is stated as 880 (640 - 1160) Gt, which one is correct?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2846	15	10	15	10	We suggest to add Table SPM.1 in the line of sight	Government of France, Ministère de la Transition écologique et solidaire
2848	15	10	15	10	A reference to TS.3 could be added (see page TS-26 lines 23-30)	Government of France, Ministère de la Transition écologique et solidaire
14762	15	11	15	11	Timeframes/years should be added to this statement. It is generally misleading to compare fossil cumulative emissions with all emissions from sectors. For example, the statement implies that 2°C warming is less likely because of the exclusion of other sectors.	Government of United States of America, U.S. Department of State
14764	15	11	15	12	Suggest being clear with the probabilistic language on the 1.5°C scenarios. This is written such that "likely" is implied for the 1.5°C scenarios but it's not fully clear that the "likely" refers to both the 2 and 1.5°C clauses because of the transition from "to limit" to "limiting".	Government of United States of America, U.S. Department of State
2284	15	11	15	13	The statement about fossil fuel use being mainly in industry and transport sectors may suggest that no transformation is needed. Suggest emphasising the transformation that will still need to occur in these sectors.	Government of Australia, Department of Industry, Science, Energy and Resources
2286	15	11	15	13	WEO-2021 suggests transport fossil fuel use in transport in 1.5C scenario is not much higher than buildings and other use, is it correct to say industry and transport are the main users? Suggest more context may be useful if these other sectors have end use relatively close to transport and industry.	Government of Australia, Department of Industry, Science, Energy and Resources



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14766	15	11	15	13	Where does food production fall into industry and transport?	Government of United States of America, U.S. Department of State
174	15	11	15	15	B.7.2: The naming of limiting warming to 1.5°C scenarios is misleading as the likelihood is missing, the names should reflect the likelihood of "more likely than not". Second, as indicated in the footnote in page 5, limiting warming to 1.6 is included in scenarios limiting to 1.5, this is confusing for the decision makers as it is not clear the case of other levels such as 1.7 for example. The authors should carefully verify the range of the scenario or category of scenarios and provide the likelihood in the name consistently.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
176	15	11	15	15	The text in B.7.2 states, "In pathways likely to limit warming to 2°C, or limiting warming to 1.5°C with no or limited overshoot, most remaining direct fossil fuel CO2 emissions in 2050 are projected to come from industry and transport, not the power sector. Aligning future CO2 emissions from the power sector with such pathways would require a combination of decommissioning, retrofitting and reduced utilization of existing fossil energy installations, as well as cancellation of new installations (high confidence)." The text singles out CO2 emissions, while also presenting policy-prescriptive language and is inherent advising policy-makers how to act. Required action: Include other GHG missions and remove "aligning future CO2 emissions...." to ensure balance, unbiased, and policy-neutral statements as deemed by IPCC principles.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
654	15	11	15	15	Developed countries and developing countries are significantly different in development stages and energy mix, which leads to great differences in dependence on fossil energy. Retirement, transformation and reduction of fossil energy equipment and cancellation of new capacity will bring tremendous impacts and risks to developing countries, so it is suggested to add a sentence "this will cause tremendous stranded costs and risks to developing countries" at the end of this paragraph.	Government of China, China Meteorological Administration
12454	15	11	15	15	In pathways likely to limit warming to 2°C, or limiting warming to 1.5°C with no or limited overshoot, most remaining direct fossil fuel CO2 emissions in 2050 are projected to come from industry and transport, not the power sector. Aligning future CO2 emissions from the power sector with such pathways would require a combination of decommissioning, retrofitting and reduced utilisation of existing fossil energy installations, as well as possible cancellation of new installations (high confidence).	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
12524	15	11	15	15	This bullet to be removed as it is policy prescriptive. The pathways themselves are not free of assumptions and are as such not value neutral. There should be no call for aligning emissions to outcomes of specific models	Government of India, Ministry of Environment, Forests and Climate Change
14768	15	11	15	15	This paragraph seems like an odd way of describing the analysis, inverting what has been done. It would be better to replace it with something like, "Scenarios that result in temperature outcomes between 1.5 and 2°C by 2100 do so from assumed technology and policy changes that primarily reduce emissions from the power sector, with less reductions deemed feasible or cost-competitive in the industry and transport sectors." The current wording doesn't reflect that the outcomes are a result of the input to the modeling. The point is that most reductions, or least-cost ones, are most likely from the power sector. Also, the second sentence sounds like a policy prescription about what "needs to" happen, and the "needs to" should be deleted. Just state the analytics, that assumptions or modeling indicate that the power sector emissions would be removed by decommissioning, etc., in those scenarios.	Government of United States of America, U.S. Department of State
5460	15	11	15	16	In Chapter 2, Figure 2.2, panel a shows that emissions from the transport sector are mostly from road but this isn't really mentioned anywhere in Section B. This is really useful information and although transport isn't the largest contributor, this could help define policy that could help reduce emissions in the transport sector?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12418	15	12	15	12	Not clear what is meant by "most remaining direct fossil fuel CO2 emission"	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
13466	15	12	15	12	Please quantify 'most remaining'.	Government of Estonia, Estonian Meteorological & Hydrological Institute
172	15	13	15	15	B.7.2: Policy Prescriptive: "Aligning future CO2 emissions from the power sector with such pathways would require a combination of decommissioning, retrofitting and reduced utilization of existing fossil energy installations, as well as cancellation of new installations (high confidence)." Required action: Delete or rewrite without prescribing policy.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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2288	15	13	15	15	Suggest including 'most new installations' rather than 'cancellation of new installations'. Limited new fossil energy installations potentially with CCS, low capacity utilisation, offsets, and/or option for future conversion to renewable fuels such as hydrogen could have a place and even support renewable uptake where it provides flexibility to respond to variable renewable output.	Government of Australia, Department of Industry, Science, Energy and Resources
5462	15	13	15	15	As with above comment, I think the sentence starting 'Aligning future...' is the main policy message here, so should be at the top?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
7042	15	13	15	15	We suggest the phrase to read as the following: Aligning future CO2 emissions from the power sector with such pathways would require a combination of decommissioning, retrofitting and reduced utilisation of existing and new fossil energy installations".	Government of Brazil, Ministry of Foreign Affairs
2290	15	13	15	16	Suggest there are other options for reducing emissions from fossil energy installations, such as building new stations to take alternative fuels (such as gas plants which can also use hydrogen) and building with CCUS (not just retrofitting).	Government of Australia, Department of Industry, Science, Energy and Resources
1252	15	14	15	14	Would "early decommissioning" be correct and more clear? (Just "decommissioning" is less exact, if "early" is intended.)	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6434	15	14	15	14	Regarding ""retrofitting": Please explain in what sense existing fossil energy installations would need to be retrofitted, and please add the definition of "retrofitting" to the glossary.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13808	15	14	15	14	Please consider rephrasing "retrofitting" to "retrofitting including CCS" in this line, if appropriate.	Government of Norway, Norwegian Environment Agency
13810	15	14	15	14	Please consider to alter "decommissioning" to perhaps "closure" or "withdrawal" in order to increase the readability for non-native english speakers, if appropriate.	Government of Norway, Norwegian Environment Agency
9464	15	14	15	16	In addition to phasing out, limiting the use of, or shutting down new fossil fuel power generation processes, the retrofitting of CO2 reduction and removal technologies, such as CCUS, may be an option, the word "retrofitting" should be changed to "retrofitting of CCUS or other carbon removal technologies. In addition, "existing fossil energy installations" and "new installations" should be revised to "existing unabated fossil energy installations" and "new unabated installations", respectively, to be more accurate.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
954	15	15	15	15	the better word here is 'planned' rather than 'new'?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6436	15	15	15	15	Could you please be more specific? Does the last part of sentence imply that all (or almost all?) new installation needs to be cancelled? If yes, please add some wording that makes this clearer.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12434	15	15	15	15	"as well as cancellation of new installation" - as well as to stop planning for new installation. Put a brake on all coal plans is necessary, but supported by different measures as alternative	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
6438	15	17	15	17	Please add supporting figures here to illustrate the key message, similar to figure 3.7 or 3.16 from the main report.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12286	15	27	15	48	There are many publications on how muslim communities/societies can approach the issue of climate change(Kula, 2001)(Hassan, et al., 2019)(Yaacob, et al., 2017)(Mangunjaya, et al., 2018)(Mangunjaya and McKay, 2012)(Fikri and Colombijn, 2021)(Mangunjaya, 2010). Also, since there is no evidence of religious-based denial of climate change in muslim world, providing religious perspective on climate change can be a promising approach.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
15662	15	13	15	15	What are the impacts of these actions on employment, energy access and sustainable development?	Government of Algeria, Ministère de l'Enseignement supérieur et de la Recherche Scientifique

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
530	16	0	16	0	"The global models suggest that such deeper decarbonisation in other sectors could be more cost-effective than enforcing a zero-emissions target for the transport sector in isolation." Include this statement from Chapter 10 P92 L36 in the SPM	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
190	16	0	19	0	The following statement from Ch4 P71 L15-17"ln addition, models may capture only some dimensions of development that are relevant for mitigation options, thereby not capturing distributional aspects and not allowing consistency checks with broader developmental goals (Valakati et al. 2016)." must be added to the SPM as it gives light to some of the limitations of modeling to ensure a balanced and inclusive report	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
15638	16	1			It is somewhat surprising that section C does not make clear how the information, i.e. pathways presented, relates to the Paris Agreement -- especially as the adopted WGIII Chapter 3 outline specifically asks for pathways compatible with the Paris Agreement, including the long-term temperature goal, and higher warming levels and also including balancing sources and sinks. This outline thus links to the Paris Agreement's Articles 2 and 4, which are then however not reflected in the section C pathway information. Specifically, clear statements on how both the findings on limiting warming to 1.5°C with no or limited overshoot and likely 2°C, and the different pathway categories, can be related to the Paris Agreement temperature goal are needed.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
182	16	1	16	1	C.1: "Transformations" require stringent and rapid actions and human and financial resources in very short time which might not be available at this time for every country. The principle of Common But Differentiated Responsibilities and Respective Capabilities (CBDR-RC) outlined in the United Nations Framework Convention on Climate Change (UNFCCC), recognizes that countries have different duties and abilities to address the negative impacts of climate change. System transitions is more suitable implying the varying levels of resources of different countries. "System transformations" should be replaced with "system transitions".	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
3966	16	1	16	1	How do "system transformations" align with "system transitions" from WG2?	Government of Canada, Environment and Climate Change Canada
11948	16	1	16	1	C.1: It is unclear why the headline statement talks of global GHG emissions peaking before 2025 in 1.5°C and 2°C pathways and Table SPM.1 provides a range of 2020-2025 for those pathways, while it is clear from the figures that all relevant pathways peak in 2020. Please reframe this presentation of the corresponding findings and add this range to the C.1 headline statement if above observation is incorrect. Wherever possible the assessment should differentiate between the C1 1.5°C pathways and the other pathways in terms of key characteristics.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12420	16	1	16	1	How immediate is immediate action ? How do you quantify it?	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
14774	16	1	16	1	Insert "needed" afer "transformations" in the C header to clarify meaning.	Government of United States of America, U.S. Department of State
3968	16	1	16	20	One advantage of demand-focused interventions is they are fast-pace compared to switching technologies and associated infrastructures. This is important in addressing climate change, and meeting commitments made under the Paris Agreement, but this has not been reflected here nor through Section C. If this aspect was investigated in the underlying chapter, it should be considered to be included in the SPM.	Government of Canada, Environment and Climate Change Canada
2292	16	1	16	22	These sections need further clarity and readability. Suggest organising C.1.1 and C.1.2 to discuss 1.5 and 2C pathways separately.	Government of Australia, Department of Industry, Science, Energy and Resources
656	16	1	16	31	The systemic transition to address global warming is concerned with not only intensity of emission reduction, but also importance of financial and technological support for developing countries, which is of particular concern to developing countries. It is suggested to add the following to Section C1: "C1.5 System transformations to limit global warming in regards of emission reduction require sufficient financial flow and investment, as well as technological change. But financial gaps for developing countries are the widest, low carbon technology lags also exist in developing countries. {15.2, 15.3, 15.4, 15.5, 16.3, 16.4, 16.5}"	Government of China, China Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
184	16	1	16	6	C.1: The headline statement states with high confidence that "GHG emissions are projected to rise, leading to a median global warming of 2.4°C to 3.5°C by 2100". However, the two statements C.1.3°C and C.1.4°C contributing to this finding are medium confidence. The authors should verify the confidence level of the headline statement.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
13338	16	1	17	6	SPM1. needs better illustration to make sense to policymakers: I would move the NDC explanation (C3b) upfront and turn it into C1.1 and talk through the whole line of Table SPM1. Maybe some of the entries (columns) could be deleted, as they do not say anything to policymakers with short time (even though they are interested).	Government of Switzerland, Federal Office for the Environment FOEN
660	16	1	18	42	Several inconsistencies with the data and expressions of the corresponding underlying report are found in Section C.1. It is suggested to verify and modify. The details are as follows: 1. As stated in line 7 on page 16 "Net global GHG emissions fall by 13-45% by 2030 and 52-76% by 2050", the figures are 12-46% and 52-77% in Table SPM.1 and Table 3.2 of the underlying report, respectively. 2. As stated in line 20 on page 16 "Both types of pathways show similar reductions of CH4 emissions, 50% (26-69%), in 2050", the figure is 33-69% in the underlying report (Line 40, Page 3-5, Chapter 3). 3. Several inconsistencies with the data from Table 3.2 of the underlying report are found in Table SPM-1 (line 1, page 17), for example: 1) Pathway C1, net-zero CO2 [% net-zero pathways], (2035-2070), which is (2020-2025) in Table 3.2; 2) Pathway C3a, GHG emissions, 40 for 2030, which is 41 in Table 3.2; 3) Pathway C3a, GHG emissions, (13-26) for 2050, which is (13-27) in Table 3.2; 4) Pathway C3a, GHG emissions reductions, 27 (13-45) for 2030, which is 26 (12-46) in Table 3.2; 5) Pathway C3a, GHG emissions reductions, 63 (52-76) for 2030, which is 63 (52-77) in Table 3.2; 6) Pathway C3a, net-zero CO2 [% net-zero pathways], 2075-2080 [88%], which is 2070-2075 [88%] in Table 3.2; 7) Pathway C3a, Cumulative CO2 emissions, 2020 to net zero CO2, 860 (640-1180), which is 880 (640-1180) in Table 3.2; 8) Pathway C3a, Cumulative CO2 emissions, 2020-2100, 790 (480-1150), which is 790 (480-1160) in Table 3.2; 9) Pathway C3a, Cumulative negative CO2 emissions, -10 (-280-0), which is -20 (-280-0) in Table 3.2; 10) Pathway C3a, Likelihood of staying below, <1.5, 21 (14-70), which is 22 (14-71) in Table 3.2; 11) Pathway C6, Peak CO2 emission, 2030-2035 [96%], which is 2030-2035 [100%] in Table 3.2; 12) Pathway C6, Peak GHG emissions, 2030-2035 [96%], which is 2030-2035 [100%] in Table 3.2; 13) Pathway C7, Peak CO2 emission, 2070-2075 [56%] (2025-2095), which is 2090-2095 [100%] (2035-2100) in Table 3.2; 14) Pathway C7, Peak GHG emissions, 2070-2075 [56%] (2025-2095), which is 2090-2095 [100%] (2035-2100) in Table 3.2; 15) Pathway C8, Peak CO2 emission, 2080-2085 [89%] (2060-2095), which is 2080-2085 [100%] (2060-2100) in Table 3.2; 16) Pathway C8, Peak GHG emissions, 2080-2085 [89%] (2060-2095), which is 2080-2085 [100%] (2060-2100) in Table 3.2;	Government of China, China Meteorological Administration
5464	16	1	20	30	Throughout C1-3, there are a number of findings that refer to pathways that limit warming to 1.5°C with no or limited overshoot or are likely to limit warming to 2°C, but exclude pathways that limit warming to 1.5°C with high overshoot. Policymakers already have limited information on overshoot, and this information is highly policy relevant, so that informed decisions can be made in the knowledge of what pathways lead to overshoot, and the possible consequences. Therefore, when findings are relevant to both 1.5C and 2C pathways, 1.5 overshoot pathways should not be excluded, and they could collectively be referred to as 'pathways limiting warming to 1.5C or 2C'.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13816	16	1	30	28	With regards to enhanced energy efficiency and how this is covered in the draft SPM, we believe that energy efficiency is described many places in the SPM but it would be useful to describe that this is connected to all components of the energy system, including production, transmission and consumption. In our view it would be useful to describe that it is important potential for enhanced energy efficiency in all these components, otherwise some of the components might be overlooked.	Government of Norway, Norwegian Environment Agency
11320	16	1	31	15	Section C does not take into account the findings of Chapter 16 on the systemic aspects on innovation. It would be worth mentioning these here in a dedicated paragraph, also pointing out that this perspective is currently not sufficiently covered by global integrated assessment models.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13232	16	1	31	15	"scenarios" and "pathways" are used interchangeably. Harmonize and/or explain the use to the reader	Government of Switzerland, Federal Office for the Environment FOEN

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13544	16	1	31	15	The pathway categories as presented in section C and Table SPM.1 in particular are problematic in that it is unclear how they can be related to the Paris Agreement goal of "holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels". It appears that the authors intended to avoid being policy-prescriptive, which is welcome but now has the effect of not being policy-relevant enough in our view. It can be concluded that C1 can be considered aligned with the PA, while this is not the case for the C2 high overshoot pathways with a peak warming of 1.7°C and neither for the C3 "likely below 2°C" pathways, as it appears that this is not aligned with the PA goal of limiting warming to "well below 2°C". The categories should be adjusted/renamed accordingly, and their relevance for the Paris Agreement clearly explained for example in the figure caption. The Paris Agreement is furthermore clear that its objective is "to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century". Based on this, it can be expected from the author team that at least one pathway category reflects what can be understood as "net zero GHG emissions". However, the most ambitious category C1 only has 52% of pathways achieve that. At the same time, the indicated temperature change from peak warming until the end of the century is only achieved by what seems to be little net negative emissions. We therefore request that explanations are given on this and that at least the C1 category is adjusted so that they can inform policy makers about the characteristics of pathways that are aligned with the Paris Agreement.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13812	16	1	31	15	Similarly to how information was provided in the A.3 paragraphs of the special report on land (SRCLL) with respect to net anthropogenic emissions and natural drivers, estimates of both sources and sinks, are of interest for mitigation activities. Please consider to include such information in section C.	Government of Norway, Norwegian Environment Agency
13814	16	1	31	15	Our understanding of "system transformations" is the need for change, adjustments and conversion to a greater extent. But we also understand that the term is used in different ways in different languages, and this can create confusion. Please consider to explain the term, and include what the "system-part" is supposed to cover. E.g. is there some technicalities with this term, which we should have in mind when translating and using it?	Government of Norway, Norwegian Environment Agency
956	16	2	16	10	need to keep text aligned with policy adopted under UNFCCC and Paris Agreement	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1176	16	2	16	2	2030 is a key reference year, referred multiple times in report. It is referred to in Section A and B before a reference to 2025 in Section C. Perhaps make reference to it when saying emissions peak before 2025. Eg: "Global GHG emissions peak before 2025, in less than half the time to 2030, under..."	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5470	16	2	16	3	Global GHG emissions peak before 2025...'. It'd be useful to switch round this first sentence to make it clearer i.e. In pathways that assume immediate action...global GHG emissions peak before 2025.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6440	16	2	16	3	We are wondering, if "immediate action" is a reasonable term in this context, since there is already a lot "action" happening. We request to be more specific and at least emphasize that in C1-C3 pathways there is a significant and immediate strengthening of policies. Maybe you can add some quantification, e.g. "strengthening of policies by a factor of XY".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6924	16	2	16	3	With regards to the timing of global GHG emissions peaking, this statement says "before 2025" while table SPM.1 gives a "2020-2025" range, and for instance figure SPM.5 seems to indicate a peak closer to 2020. Could this be revisited and potentially the 2020-2025 range given for the statement here.	Government of Jamaica, Meteorological Service Division
6926	16	2	16	3	How can these statements with regards to 1.5°C and 2°C be understood in the context of the Paris Agreement temperature goal? Giving these warming levels would suggest a Paris-compatibility to policymakers (who are not necessarily familiar with interpreting the probabilities themselves), so authors should ensure that this is in fact the case, otherwise the statements need to be revised so as not to mislead readers.	Government of Jamaica, Meteorological Service Division
9790	16	2	16	3	Add a probability of meeting 1.5C in tekst or footnote: "have a more than 50% chance of limiting" and after "likely" (>67% chance).	Government of Netherlands, Ministry of Economic Affairs and Climate Policy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13818	16	2	16	3	Please consider the content of this statement. It is stated that "global GHG emissions peak before 2025 in pathways that assume immediate action and limit warming to 1.5°C with no or limited overshoot, ..." This statement is challenging to understand, and might be interpreted as if there also could be other scenarios that would limit global warming with no or limited overshoot, without emission peaking before 2025. Are there scenarios that are consistent with 1.5°C without/limited overshoot, where emissions peak after 2025? Please check for consistency and consider rephrasing to make this clearer.	Government of Norway, Norwegian Environment Agency
5468	16	2	16	31	The information withing C1 and C1.3 about current policies would be better placed in section B (where are we now and where are we headed?), such as B6. It is confusing to have it in section C (System Transformations to Limit Global Warming), as current policies do not involve a system transformation, nor do they limit global warming, and placing it in B6 would allow the information to support the important point already made in B6 that 'global emissions projected under current policies exceed those implied by current NDCs'.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5472	16	2	16	31	The uncertainty in the equilibrium climate sensitivity (2.5-4 degrees C) leads to high uncertainty in the carbon budget needed to restrict global warming to 1.5 degrees C. The implications of this uncertainty on short-term needs and long-term needs are not stated explicitly. There is an important message that despite this uncertainty, all pathways achieving 1.5 degrees C require deep cuts in the period to 2040 as existing emissions are so high, and after that, there might be more or less pressure to address residual emissions to restrict global emissions.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9466	16	2	16	31	We would like an explanation that how the new assessment has been updated from that of SR15 that used a similar set of scenario categories. It would be helpful as the SR15 assessment has already been cited in our national plans.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
14780	16	2	16	31	Section C.1 is too centered on modeling results vs. the gap between current policies and the needed actions to achieve 1.5 or 2°C.	Government of United States of America, U.S. Department of State
186	16	2	16	4	C.1: In the statement "Global GHG emissions peak before 2025 in pathways that assume immediate action and limit warming to 1.5°C with no or limited overshoot, or are likely to limit warming to 2°C." The authors should further provide the range or the percentage of scenarios which conform to the finding in the statement i.e., peak before 2025.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
12624	16	2	16	4	The language is policy prescriptive. It needs to be rewritten to clarify that comparisons are with model scenarios. Also, the scientifically more robust result is that of carbon budgets which has to be the basis of comparison and not the emission pathways as these can change within an overall carbon budget according to the literature as well as results of WG-I. Suggested rewrite: "The remaining carbon budget for more likely than not 1.5 deg. C is 510 GtCO <sub>2</sub> , for likely 2 deg. C is 890 GtCO <sub>2</sub> and for more likely than not 2 deg. C is 1210 GtCO <sub>2</sub> . To stay within the carbon budgets for more likely than not 1.5 deg. C and likely 2 deg. C, most model scenarios assume immediate reductions in emissions." (IIASA Scenario Database)	Government of India, Ministry of Environment, Forests and Climate Change
964	16	2	16	5	The word here should be 'and' because the first clause applies to both types of scenario? Put 'both' after 2025. "both" in pathways that assume immediate action and limit warming to 1.5°C with no or limited overshoot, "and in pathways" likely to limit warming to 2	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
658	16	2	16	6	The conclusion is a scenario-based assumption that is far from reality. In order not to bring ambiguity to decision makers, it is suggested to add "In the scenarios," at the beginning of the sentence, and "support" after "of current policies".	Government of China, China Meteorological Administration
3970	16	2	16	6	The first 2 sentences are substantive and aspirational, but the third sentence is a missed opportunity to contrast reality with the aspiration. Please use "parallelism" in third sentence for increased effectiveness, e.g.: "However, global GHG emissions are projected to rise past 2025 in a pathway based on current policies, leading to projected median global warming between 2.4degC and 3.5 degC by 2100".	Government of Canada, Environment and Climate Change Canada
5466	16	2	16	6	The phrase 'that assume immediate action' should be deleted from this paragraph, as this section should be describing common features across all pathways, for given warming levels, not looking at individual assumptions within those pathways.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12550	16	2	16	6	The section should be substantially rephrased to include the other intermediate scenarios (C4, C5, C6) while presenting results. Reason: The following section predominantly focuses on specific scenarios (restricted to limiting warming to 1.5 deg C including scenarios C1, C2 and scenario C3 which is based on SSP2-2.6) while reporting results. Other intermediate scenarios (C4, C5 and C6) should also be reported to provide a more balanced analysis and avoid focussing on extreme alarmist results.	Government of India, Ministry of Environment, Forests and Climate Change
14776	16	2	16	6	In the case of end of century projections for emissions in C.1, where the analysis assumes the continuation of policies that were in place when the modeled pathways were created, more detail is needed to describe what policies are included and how they align with announced NDC and other mitigation commitments. The authors should consider including a box or table to provide additional detail on which policies are included within the modeling analysis and how the included policies compare with recent NDC announcements.	Government of United States of America, U.S. Department of State
14778	16	2	19	9	At least through C.2, this text does not really talk about systems at all. C.1 and underlying subsections need to say what is meant by systems and systems transformations.	Government of United States of America, U.S. Department of State
11322	16	2	20	7	Summaries C.1, C.2, C3 all have 'limit warming to 1.5C with no or limited overshoot, or are likely to limit warming to 2C' in the first sentence and followed by deep emissions reduction. They can be better coordinated to avoid unnecessary repetition or redundancy.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13234	16	3	16	3	Footnote 15 comes in very late in the document. Consider introducing it earlier in the document.	Government of Switzerland, Federal Office for the Environment FOEN
188	16	3	16	4	In the following statement in C1 "Rapid and deep GHG emissions reductions follow during the two subsequent decades." The use of the terms "rapid" and "deep" is not quantifiable. Replace them with quantifiable, scientific language.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
6108	16	3	16	4	This sentence is unclear: please rephrase to show that it is linked to the first sentence. Rapid and deep GHG emissions reductions is not something that "will" happen, but something that needs to happen to follow trajectories to limit warming to 1.5C.	Government of Belgium, Belgian Science Policy Office - Belspo
13386	16	3	16	4	Rapid and deep GHG emissions reductions follow during the two subsequent decades' is not clear - need to rephrase for enhanced clarity	Government of Kenya, Kenya Meteorological Service
2294	16	4	16	5	'...during the subsequent two decades...' is unclear; suggest replacing with '2025 through 2045'. It is unclear whether 'Without strengthening current policies...' simply means 'Under current policies...'. If so, suggest 'under current policies' to avoid confusion.	Government of Australia, Department of Industry, Science, Energy and Resources
192	16	4	16	6	C1: in the statement "Without a strengthening of current policies, GHG emissions are projected to rise, leading to a median global warming of 2.4°C to 3.5°C by 2100." The paragraph language is policy prescriptive. The scenarios include large number of other assumptions and are not limited to policies only. The authors should re-write and avoid policy prescriptive language.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
3972	16	4	16	6	The confidence level associated with this conclusion about projected median global warming of 2.4 to 3.5C from extrapolation of current policies differs between the SPM and Ch. 3 ES (lines 14-16). In the CH. 3 ES the conclusion has medium confidence. This is also the case for the supporting lines in the SPM for this headline statement (page 16 lines 23-24).	Government of Canada, Environment and Climate Change Canada
12626	16	4	16	6	It is not clear whether the term 'current policies' here refers to the scenario or the NDCs. This sentence should be removed or the estimated warming should be based on NDCs not undefined 'current policies'.	Government of India, Ministry of Environment, Forests and Climate Change
14782	16	4	16	6	"Without a strengthening of current policies, GHG emissions are projected to rise, leading to a median global warming of 2.4 to 3.5°C by 2100.": This seems like a major finding that should be highlighted earlier in the SPM if possible. Also, "current" has been rendered moot by the literature cutoff date since Glasgow NDCs not assessed. Rephrase accordingly.	Government of United States of America, U.S. Department of State
3974	16	5			The meaning of 'median' here is not clear, since a range is given. Either give an overall range sampling over all uncertainties, or if just sampling over some uncertainties and using a median value for others, the text should say which uncertainties are sampled over, and which are not.	Government of Canada, Environment and Climate Change Canada

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5474	16	5	16	6	Needs to read 'global warming above preindustrial levels' for clarity here	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6110	16	5	16	6	The expression "a median global warming of 2.4°C to 3.5°C by 2100" may be unclear to non-specialists, due to the simultaneous use of the term "median" and a range. Could you consider adding a footnote to explain that the range relates to the ensemble of scenarios compatible with current policies, for each of which the median warming is calculated with respect to climate sensitivity?	Government of Belgium, Belgian Science Policy Office - Belspo
	16	5	16	5	What is meant by "median global warming" before reporting a range from 2.4 to 3.5°C? WGI provided a best estimate and a very likely range, what is exactly reported here?	WGI Bureau,
958	16	6	15	6	Use of the word "alone" here is rhetorical and could introduce ambiguity into the sentence.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
14784	16	6	16	6	The "high confidence" in this statement contradicts the "medium confidence" provided in line 24 for the same information.	Government of United States of America, U.S. Department of State
5478	16	7	16	22	In numerous cases, need to specify % reduction relative to which year (I think 2019 based on underlying chapter)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
662	16	7	16	10	The current statement is inconsistent with the data and confidence of the underlying report. Chapter 3, page 4, lines 36-40: This corresponds to reductions, relative to 2019 levels, of 12-46% by 2030 and 52-77% by 2050. Pathways that limit global warming to below 1.5°C with no or limited overshoot require a further acceleration in the pace of the transformation, with net GHG emissions typically around 21-36 GtCO <sub>2</sub> -eq yr <sup>-1</sup> by 2030 and 1-15 GtCO <sub>2</sub> -eq yr <sup>-1</sup> by 2050; thus reductions of 38-63% by 2030 and 75-98% by 2050 relative to 2019 levels. It is suggested to be consistent with the underlying report.	Government of China, China Meteorological Administration
14788	16	7	16	12	If some research groups were unable to model some of the scenarios (particularly the lowest ones) because they were inconsistent with current understanding of technologies and economics, then this should be made very clear up front. Consider adding: "The lowest GHG emissions scenarios require technology, cost, or other assumptions deemed implausible. This may indicate that those scenarios are infeasible under current projections of technologies, socio-demographics, and other factors." An objective scientific assessment would provide that insight to policymakers, not omit an important finding. One supporting reference for this is Rogelj, Joeri, Gunnar Luderer, Robert C. Pietzcker, Elmar Kriegler, Michiel Schaeffer, Volker Krey, and Keywan Riahi. "Energy System Transformations for Limiting End-of-Century Warming to below 1.5°C." Nature Climate Change, 5, no. 6 (June 2015): 519-527. <a href="https://doi.org/10.1038/nclimate2572">https://doi.org/10.1038/nclimate2572</a> . Owing to their representation of a wide variety of emission reduction options, MESSAGE and REMIND are classified as models that are "highly responsive" to climate policy. They are thus well-suited for analysing very deep decarbonization pathways, which other models may not find feasible. Other peer-reviewed articles have demonstrated the same point. It is also supported by the text on page 16, lines 27-28, and Table SPM.1, scenarios C1 and C2.	Government of United States of America, U.S. Department of State
2296	16	7	16	13	Suggest the text here could be clarified: Does 'Net global GHG emissions fall...' mean following the peak in 2025 referred to in C.1? It is unclear whether this whole paragraph refers to 2025 as a base year or another year.	Government of Australia, Department of Industry, Science, Energy and Resources
2298	16	7	16	13	The ranges provided this paragraph are quite broad and do not include an average or median estimate, this appears inconsistent with approach taken for CO <sub>2</sub> and CH <sub>4</sub> . The large range without an indication of a midpoint is likely to be less useful to policymakers. Suggest that an average/median value is provided, in addition to the ranges.	Government of Australia, Department of Industry, Science, Energy and Resources
5476	16	7	16	13	It is difficult to navigate the numbers when only a range is provided. The median (or mean) with the range in parenthesis (as in C.1.2) would make it easier to see the differences between pathways.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
1254	16	7	16	22	For clarity, please use footnote 16 explicitly in conjunction with all the relevant percentages.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5480	16	7	16	22	What's the base year for these % falls? 2019?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5482	16	7	16	22	The confidence statements in this paragraph should be applied consistently throughout.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14790	16	7	16	22	Indicate to what the percentage reductions in C.1.1 and C.1.2 are referenced, such as a reference scenario or a baseline year.	Government of United States of America, U.S. Department of State
13230	16	7	16	31	We have trouble following the line of thinking and the order it is presented. We suggest to arrange the paras in the following order: current policies (C1.3), relevant findings from C1.4. and in particular from Table SPM1, other gases (C1.2)	Government of Switzerland, Federal Office for the Environment FOEN
14792	16	7	16	31	This section would be more understandable if each paragraph started by identifying the pathways of concern rather than sometimes not doing that until the end of a sentence.	Government of United States of America, U.S. Department of State
30	16	7	16	7	FOOTNOTE 16 - reporting relative to 2019 is not suitable. We propose to complete the calculation for 2010, as envisaged by the Paris Agreement.	Government of Czech Republic, Czech Hydrometeorological Institute
1256	16	7	16	7	Footnote 16 would be useful to complement with a short explanation of "modelled emission levels". Would there be a significant difference in the reductions needed, if actual emissions in 2019 were compared to?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6442	16	7	16	7	Net global GHG emissions fall by 13-45% by 2030 and 52-76% by 2050 in pathways... change to for clarity: Net global GHG emissions fall from 2019 by 27 % (13-45%) by 2030 and 63 % (52-76%) by 2050 in global emission pathways (footnote 16 can be omitted).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9858	16	7	16	7	Suggest to add the median percentage here, in addition to the range, and present the reduction percentages as done in paragraph C.1.2 with CH4 emission reductions. Also add a reference year in tekst or a footnoot. If current , add in footnote reduction cpt 1990 as well.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12628	16	7	16	7	This section must begin with a bullet on the remaining carbon budgets and the corresponding model scenarios with also a line detailing past cumulative emissions. Suggestion: "Cumulative CO2 emissions from 1850 to 2019 were 2400±240 GtCO2. The remaining carbon budget from 2020 onwards, for more likely than not 1.5 is 510 GtCO2, likely 2oC is 890 GtCO2, and more likely than not 2 deg. C is 1210 GtCO2." {Reference: B.1.3 of SPM}	Government of India, Ministry of Environment, Forests and Climate Change
12630	16	7	16	8	Rewrite the sentence to clarify that these are model pathways assessed in the report. Suggested change: "In the model scenarios assessed in this report, net global GHG emissions are assumed to reduce by 13-45% by 2030 and 52-76% by 2050 for likely 2 deg. C warming."	Government of India, Ministry of Environment, Forests and Climate Change
14786	16	7	16	8	Change to: "Net global GHG emissions [are projected to] fall by 13-45% by 2030 ..."	Government of United States of America, U.S. Department of State
11324	16	7	16	9	13-45%, 53-76% etc.. Differences seem large. Equally 'likely' limiting to 2C with only 52% reduction by 2050 as with 76% reduction? Also overlaps with 1.5C pathway (eg with 34-45% reduction by 2030 and 73-76% in 2050)	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12632	16	8	16	10	Rewrite the sentence to clarify that these are model pathways assessed in the report. Suggested change: "The model scenarios assessed in this report for more likely than not 1.5 deg. C assume emissions reductions of 34-60% by 2030 and 73-98% by 2050."	Government of India, Ministry of Environment, Forests and Climate Change
14796	16	8	16	12	Add "scenario" or "scenario category" as parentheticals referring to Table SPM.1 to avoid confusion given similar naming convention to report sections.	Government of United States of America, U.S. Department of State
6928	16	8	16	8	"2°C assuming immediate action" does not sufficiently describe this category of pathways; please provide further information on the assumptions behind this category and consider renaming it.	Government of Jamaica, Meteorological Service Division
11950	16	8	16	8	C.1.1: It has to be clarified here what the category "immediate action" (C3a) entails? The relevant information should be added, as the reference to the table is not sufficient. Also, the term "immediate action" is used too generally, suggests a more ambitious outcome than limiting warming to just 2°C, and may therefore not be suitable as a category description. Please consider renaming the category C3a, and providing more information on what the category means and what it is derived from.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13062	16	8	16	8	C.1.1: More clarity on C3a would be important with a clear definition of 'immediate action'. We suggest a renaming to enhance clarity	Government of Gambia, Department of Water Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14794	16	8	16	8	Isn't "immediate action" miscommunicating that those low scenarios would have required policies already to be implemented and effective to be consistent? If so, the language should be clear about that, such as replacing "assuming immediate action" with "assuming that actions would already be having substantial GHG reduction effect by the early 2020s". And perhaps compare it to the state of actions being implemented already and current net emissions. It may be that current emissions and trajectories are already above those in the lowest scenarios and that should be clear to the reader. See, as a reference in the literature, Rogelj, Joeri, Gunnar Luderer, Robert C. Pietzcker, Elmar Kriegler, Michiel Schaeffer, Volker Krey, and Keywan Riahi. "Energy System Transformations for Limiting End-of-Century Warming to below 1.5°C." Nature Climate Change 5, no. 6 (June 2015): 519-527, in which the 1.5°C pathways peaked emissions prior to 2020, and not all participating models were able to produce such low scenarios.	Government of United States of America, U.S. Department of State
5484	16	10	16	13	Is the association of 2030 NDCs with overshoot pathways a helpful framing, given that as you say, they make limiting warming even to a likely 2C by 2100 very challenging - perhaps reference to overshoot pathways could be removed. Also, how does this framing fit with UNEP analysis, which suggests that NDCs are expected to take us to ~2.4C by 2100? Alternatively, could you please also address the feasibility of limiting warming to 1.5C with a high overshoot whilst following the NDCs to 2030, and not just low/limited overshoot/likely 2C. Please also see our comments on B.6.3 - together these statements convey a confusing a message about where NDCs are taking us, which needs to be put into context.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12636	16	10	16	10	Statement including model results for more likely than not 2 deg. C should be added.	Government of India, Ministry of Environment, Forests and Climate Change
14798	16	10	16	10	"Current NDCs" means only those that have been submitted before COP-26. Provide the "as of" date for "current". By the time the report is published, "current" will be obsolete.	Government of United States of America, U.S. Department of State
6444	16	10	16	11	Please clarify what "these reductions" refers to exactly (the C1 reductions?). The C3a pathways do not achieve the reductions cited for the C1 pathways either.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
966	16	10	16	12	This material should be central to the headline statement	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2300	16	10	16	13	Suggest strengthening the comment that the challenge of limiting warming is harder without early action (i.e. current NDC pathways) by incorporating more supporting statements on the social, technological and economic knowledge/data that supports this outcome.	Government of Australia, Department of Industry, Science, Energy and Resources
6446	16	10	16	13	We request to be more specific than the vague term "strongly increase the challenge". You could for example add the fraction of the 2°C budget that would be used by 2030 without strengthening current NDCs. How much would be gone by then and what would be the budget for the following decades?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9468	16	10	16	13	Since "...strongly increase the challenge of likely limiting warming to 2 degrees" is not clear, it would be better to add the sentences on page 44, lines 6-10 of the Technical Summary to the end of this sentence; "After following the NDCs to 2030, to likely limit warming to 2 degrees the pace of global GHG emission reductions would need to abruptly increase from 2030 onward to an average of 1.3-2.1 GtCO <sub>2</sub> -eq per year between 2030 and 2050. This is similar to the global CO <sub>2</sub> emission reductions in 2020 that occurred due to the COVID-19 pandemic lockdowns, and around 70% faster than in pathways where immediate action is taken to likely limit warming to 2 degrees. "  Table SPM.1 shows that pathways following current NDCs until 2030 (C3b) has a 73% likelihood of staying warming below 2 degrees, which is not significantly different from pathways likely to limit warming to 2 degrees (C3a), which has a 78% likelihood of staying warming below 2 degrees. Therefore, the above addendum makes the message clearer.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12634	16	10	16	13	The sentence is policy prescriptive and implies that reductions must match with model pathways. The sentence should be removed as potential warming assuming NDCs is already covered in Section B.	Government of India, Ministry of Environment, Forests and Climate Change
14800	16	11	16	11	Recommend replacing "make it impossible to limit warming" with "and therefore do not limit warming". "Impossible" seems counter to the probabilistic nature of this report (e.g., "high confidence").	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14802	16	11	16	11	Figure SPM.5 shows 1.5°C is impossible. This "impossible to limit warming to 1.5°C with no or limited overshoot" means otherwise.	Government of United States of America, U.S. Department of State
6930	16	11	16	12	What does "strongly increase the challenge" mean in terms of probabilities? If the pathways following current NDCs also puts limiting warming to 2°C out of reach with a likelihood that can be defined, this should be stated here.	Government of Jamaica, Meteorological Service Division
14804	16	11	16	12	Awkward phrasing. Suggest rephrasing to: "... strongly reduce the likely ability to limit warming to 2°C."	Government of United States of America, U.S. Department of State
960	16	13	16	15	This is a more direct and clear statement of the potential impact on 1.5 and 2.0 pathways on global energy infrastructure that the somewhat vague and lengthy statement in B7	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5486	16	14	16	22	feels like an omission not to specify net zero GHG year	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
1258	16	14	16	16	Would it be possible to make a comparison here, in some way, to the relevant results in SR1.5? How has the challenge evolved since then?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
3976	16	14	16	18	This paragraph is extremely difficult to read because of a lack of parallelism between sentences. Suggested change: "Emissions of different gases are reduced at different rates across pathways that limit global warming. In pathways likely to limit warming to 2degC, global CO2 emissions fall by 50% and reach net zero by 2040 and 2070 respectively. In pathways limiting warming to 1.5degC with no overshoot, global emissions fall by 50% and reach net zero by 2030 and 2050 respectively." The first sentence begins with the main point and ends with the comparatives. And the comparison between two following sentences is improved by writing them using the exact same structure in both. Such structuring simplifies information uptake. Doing the same thing to the text in lines 18-22 on NH4 would also be helpful.	Government of Canada, Environment and Climate Change Canada
178	16	14	16	22	C.1.2: Required action: expand scope to cover all GHGs.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
194	16	14	16	22	C.1.2: The naming of limiting warming to 1.5°C scenarios is misleading as the likelihood is missing, the names should reflect the likelihood of "more likely than not". Second, as indicated in the footnote in page 5, limiting warming to 1.6 is included in scenarios limiting to 1.5, this is confusing for the decision makers as it is not clear the case of other levels such as 1.7°C, for example. The authors should carefully verify the range of the scenario or category of scenarios and provide the likelihood in the name consistently.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
3978	16	14	16	22	This sub-bullet is very dense with wide ranges on many of these values without confidence statements. It also refers to the Figure. Perhaps a better summary of the Figure can be provided rather than repeating the numerical content would be preferred.	Government of Canada, Environment and Climate Change Canada
5488	16	14	16	22	In the 2040s' and 'In the 2030s' should be replaced with 'by the 2040s', and 'by the 2030s', to be clear that this is in reference to 2019, not within the years 2030-2040 or 2040-2050.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9470	16	14	16	22	Most of the net-zero emission targets of countries put focus on GHGs rather than CO2. Therefore, it would be useful to indicate not only the net-zero year for CO2, but also the net-zero year for GHG from a policy perspective. It could be integrated with C.2.4, which has a related discussion.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11326	16	14	16	22	Mitigation pathways for CO2 are more or less known. The pathways for other GHGs less so. If the maximum potential for reduction of anthropogenic CH4 is 50% and there is projected CH4 release from the ocean and thawing permafrost and melting cryosphere, then how does that relate to mitigation and CDR needs?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12638	16	14	16	22	This bullet needs to be redrafted so as to clarify that the results represent model scenarios assessed in this report only. Suggested Change: "Model scenarios assessed in this report assume different rates of emissions reductions for different greenhouse gases.	Government of India, Ministry of Environment, Forests and Climate Change

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968	16	14	16	25	perhaps include this information as a table which shows pathways etc.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5490	16	15	16	15	fall by 50% in 2040s' is confusingly worded here. Could be interpreted as falling 50% over 2040-2050 as written	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9792	16	15	16	16	The reference year for % reductions is missing. Add: "from current (2019) levels "and" in footnote note add also reductions compared to 1990 levels.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
9472	16	15	16	18	It would be helpful if the timing of reaching net zero CO2 emissions in the 1.5 degrees and 2 degrees pathways were more specifically stated, rather than in the 2050s and 2070s. However, the values differ depending on underlying chapters: in the Technical Summary, page TS-49, lines 9-14, the values are 2055-2060 (2035-2090) and 2070-2075 (2055-2100), and in Chapter 3, page 3-38, lines 34-37, the values are 2050-2055 (2035-2070 ) and 2070-2075 (2060-...) . <u>Please examine the values in the underlying report and provide accurate values in the SPM.</u>	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
664	16	15	16	21	The confidence level is not consistent with the underlying report, in which it is reported as medium confidence. The authors are requested to <u>check and keep the confidence consistent with the underlying report.</u>	Government of China, China Meteorological Administration
11952	16	17	16	18	C.1.2: Is it possible to clarify in a footnote how the assessment of emission reductions by 50% in 2030s relative to 2019 relates to the assessment in the SR1.5 of 45% by 2030 from 2010 levels?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
3980	16	17	16	31	This should be unpacked a little bit. Is this due to methodological changes or actual changes? Also lowest scenarios -> lowest emission scenarios.	Government of Canada, Environment and Climate Change Canada
5492	16	18	16	18	It would be useful to be clear here, or in a footnote, about with what probability these pathways will limit warming to 1.5C	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
972	16	18	16	21	Please provide breakdown into fossil (or energy-related) and biogenic (or land-use-related) methane, as was done in the SR1.5 report and the underlying chapters and scenarios. Trends, maximum mitigation potential and sectoral implications of the two are very different.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
666	16	20	16	20	According to Chapter 3 (page 5, line 37-40), it is suggested that all future emission reductions should be formulated by adding "relative to 2019". A footnote alone is not enough to avoid ambiguity.	Government of China, China Meteorological Administration
3982	16	20	16	21	Please clarify what "potential" is referring to here in the statement that "in many pathways, this (i.e. a 50% emissions reduction) is the maximum potential for CH4 reductions (high confidence)." Is this economic potential (vs max feasible potential)? There is a potential inconsistency with the WGI SPM Figure SPM.4 which shows methane reductions of about 75% by 2100 in the two lowest emission scenarios; hence our question about the 50% value.	Government of Canada, Environment and Climate Change Canada
13820	16	20	16	21	It is interesting that CH4-reductions in 2050 are identical in pathways limiting warming to 2C and 1.5C, and that the reduction (in many pathways) is identical to the maximum potential for CH4-reductions. Please consider adding an explanation. Furthermore, consider adding more specificity as to what "maximum potential" means (technical potential, techno-economical potential or something else).	Government of Norway, Norwegian Environment Agency
2302	16	20	16	22	Suggest including an explanation of why this is the maximum potential for CH4 reductions.	Government of Australia, Department of Industry, Science, Energy and Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14806	16	20	16	22	Recommend deleting the sentence "In many pathways, this is the maximum potential for CH4 reductions ..." because it is unclear and may further the misperception that methane emissions must reach net zero to achieve climate targets. From a climate stabilization perspective, what matters is when anthropogenic emissions of methane are reduced to a level below natural removal rates. See, e.g., Sun T., Ocko I.B., Sturcken E., & Hamburg S.P. (2021) Path to net zero is critical to climate outcome, Scientific Reports 11(1): 22173. <a href="https://www.nature.com/articles/s41598-021-01639-y">https://www.nature.com/articles/s41598-021-01639-y</a> . "There has been confusion over the role of short-lived GHGs in net zero targets; combining all GHG emissions into one target obfuscates the different actions needed for short- versus long-lived GHGs (most prominently methane and carbon dioxide, respectively). For example, while we need to prevent the build-up of long-lived GHGs in the atmosphere via net zero emissions (and thus adhere to a budget), short-lived GHG emissions don't need to reach zero, only have their rates reduced to not contribute to additional warming. The emphasis on a combined net zero target can therefore lead to a lack of attention to cumulative emissions for long-lived GHGs, and a misguided perception that short-lived GHGs need to reach zero, or more commonly, that net negative carbon dioxide emissions must compensate for residual short-lived GHG emissions. Rather, we can still achieve climate stabilization with residual nonzero emissions of short-lived GHGs that are not compensated for by negative carbon dioxide emissions as long as their emission rate is gradually declining over time, because these pollutants do not build up in the atmosphere over long time periods."	Government of United States of America, U.S. Department of State
14808	16	20	16	22	Recommend rephrasing "in many pathways" to be more precise (e.g., "across most pathways"). Also, is that all CH4, including potential reductions of CH4 from natural systems, or something else?	Government of United States of America, U.S. Department of State
14810	16	20	16	22	This sentence could lead to misinterpretation and furthermore its purpose in this paragraph is not clear. First, "maximum potential for CH4" reductions is poorly defined here. For human and technological systems, certain types of abatement are well constrained but others, e.g., in agriculture, are not. New innovations could well shift the potential for agricultural methane emissions reductions. Second, the purpose of identifying a maximum range in this paragraph is unclear. Is this to say that "Levels of methane reduction by 2050 would be at the very upper end of our current understanding of methane abatement potential, indicating the critical importance of rapid and deep methane reductions"? Or is it to say "methane reductions are of limited value in achieving 1.5°C scenarios after 2050". Or is it to say simply that our current understanding shows maximum methane abatement of 26-69%? Suggest editing the language in this sentence to use a framing more in line with the first approach. If that is not possible, or is contrary to the intent of the sentence, suggest deleting this sentence.	Government of United States of America, U.S. Department of State
1260	16	21	16	21	It would be informative to add some explanation to why this is the maximum potential for CH4 reduction. Which assumptions or thresholds in the modelling does cause this?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
3986	16	23		24	The text says 'median global warming', but a range is given. Please give more explanation.	Government of Canada, Environment and Climate Change Canada
1264	16	23	16	23	Concerning footnote 17, it would be useful to provide an idea on the time when the pathways were developed, not least as policy has evolved rather a lot during the past few years and the present. This would help readers' orientation.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
3984	16	23	16	23	Footnote 17 may be revised to indicate the date up to which the announced policies are covered.	Government of Canada, Environment and Climate Change Canada
5496	16	23	16	23	Footnote 17 should give an indication of when these pathways were developed, otherwise the reader is unable to make a judgement on how up-to-date this assessment is. The footnote should also clarify whether further policies have been developed and/or implemented.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11328	16	23	16	23	"current policies" and Footnote 17: can the years be provided?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13822	16	23	16	23	In footnote 17, please consider to add the period of time when the pathways were developed.	Government of Norway, Norwegian Environment Agency
14812	16	23	16	23	Footnote 17 needs clarification. It suggests that "current policies" means something different from "current NDCs" in the previous section. Also, what does "policy" mean? A political statement, or something enacted, in regulation, and funded? Or does it vary across studies and therefore introduces some inconsistencies across model results?	Government of United States of America, U.S. Department of State
668	16	23	16	24	The confidence level is not consistent with that in lines 4-6 of the same page. The authors are requested to check and maintain consistency.	Government of China, China Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
974	16	23	16	24	Insert "and continued warming after 2100". Many people alive today that will still be alive then.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6448	16	23	16	24	Could you please add the information of the estimated GHG emissions by 2030 for current policy pathways? Do emissions decrease at all? To what category do the warming level of 2.4-2.5°C relate in SPM Table.1? We expected that C7 ("Cur-Pol") is meant, but there is a temperature range of 2.5-3.9°C in 2100 given. Please consolidate or provide the reason for this discrepancy.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12552	16	23	16	24	The statement should be preferably removed or restructured to clarify that these have been obtained through modelling results. Reason: The Supplementary Material on Chapter 4 provides a list of the models and various assumptions used to build and estimate the "Current Policies" scenario demonstrating a lot of regional variations and assumptions which have been used to arrive at the possible emissions gap. Since different cut-off years have been used by different models while assuming their reference pathways for current policies, it becomes erroneous to then compare and aggregate the results of such modelling studies and also compare it to the current levels of conditional and unconditional commitments under NDCs for countries which have been updated more recently. A fair comparison can be made with current trajectories of possible warming based on estimated emissions reported in the NDCs.	Government of India, Ministry of Environment, Forests and Climate Change
14814	16	23	16	24	Footnote 17: What year were the pathways developed?	Government of United States of America, U.S. Department of State
1262	16	23	16	25	Would it be appropriate to more clearly comment that such development (reversal of current trends) is not something that is foreseen, if supported by the collective evidence and expertise? (This could be in line with the WGI, where discussion is referenced on the highest emission scenarios such as SSP5-RCP8.5 seen as not very realistic any more.)	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2304	16	23	16	26	B.6 suggests that the current policies pathway has a different emissions outcome than implementation of conditional and unconditional NDCs. Suggest linking these together in this paragraph and also including the projected temperature response for the implementation of NDCs.	Government of Australia, Department of Industry, Science, Energy and Resources
5498	16	23	16	26	Paragraph C.1.2 is not currently balanced, as it only talks about the median warming of pathways at 2100, not the possibility of warming above that median, or post-2100. This could be rephrased to say 'Pathways resulting in median warming of >4C by 2100 would imply a reversal of current technology and/or by policy trends, though such warming could occur with current trends if climate sensitivity is higher than central estimates'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9474	16	23	16	26	For the pathways mentioned in C.1.3, it would be helpful if the category names in Table SPM.1 could also be specified. Probably it is the C7 and C8 pathways, otherwise C.1.3 should be revised to explain C7 and C8.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12640	16	23	16	26	Remove this bullet as current policies are for an earlier year (when scenario was constructed) as clarified in the footnote and the results of the same are no longer relevant in light of enhanced NDCs and new policies.	Government of India, Ministry of Environment, Forests and Climate Change
14816	16	23	16	26	The wording in the paragraph is vague and could be misinterpreted. Consider rephrasing to follow the structure of C.1.2: "In pathways that assume continuation of current trajectories, GHG emissions continue to rise leading to a median global warming of ..."	Government of United States of America, U.S. Department of State
180	16	23	16	31	C.1.3: The statements relates to "current polices" as defined in footnote 17 on page 16, which states "Current policies refer to policies that were in place at the time when the pathways were developed". These "current policies" are not necessarily expected to remain unchanged. As such, they do not support making any assertions, such as "Pathways resulting in median warming of >4°C would imply a reversal of current technology and/or policy trends".	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
5494	16	24	16	25	median global warming of 2.4-3.5 C' - does this select a particular range of climate sensitivities (e.g. the IPCC likely range), and other sources of uncertainty? Could authors clarify please?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11330	16	24	16	24	medium confidence' should be in italic	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
976	16	24	16	25	This sentence is not true, because it is missing the qualifier "by 2100". It must be made clear that current policies do not limit warming, they simply delay warming from what it would have been under an RCP8.5-type "no policies" scenario. Avoid confusing 2100 temperature with peak temperature.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2306	16	24	16	25	Suggest referring to an emissions pathway, e.g. 'C8' as in Table SPM.1, to make this statement clearer.	Government of Australia, Department of Industry, Science, Energy and Resources
5500	16	24	16	25	"Pathways resulting in median warming of >4°C would imply a reversal of current technology and/or policy trends. (medium confidence)" A naive reader would assume that this implies temperature rises of 4 degrees will not be seen, but this discounts high-end climate sensitivities and tipping points. The issue here is the use of "median" global warming, which is undefined in this SPM, but presumably uses median climate sensitivities from WG1? A fuller explanation of the possible range of outcomes if climate sensitivity is far from the median value would be useful.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5502	16	24	16	25	As a none expert, 'reversal of current technology or policy trends' could be interpreted ambiguously, given the view that current policies remain insufficiently ambitious to keep 1.5 alive. Please could I suggest clarifying what is meant by 'reversal'.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
10312	16	24	16	25	It is stated that "Pathways resulting in median warming of >4°C would imply a reversal of current technology and/or policy trends". It would be useful to elaborate on this statement for a better understanding.	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
11332	16	24	16	25	Pathways resulting in median warming of >4°C would imply a reversal of current technology and/or policy trends. (medium confidence)'. This para translates into the message that no matter what we do short of reversal, GHG emissions will not go beyond 4 degrees. At global level? With population increase? How about with natural sinks losing effectiveness? Then why do we have scenarios at higher warming going up to 8 degrees?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12554	16	24	16	25	The following statement presents an alarmist argument which does not seem necessary and should be excised from this section.	Government of India, Ministry of Environment, Forests and Climate Change
6112	16	24	16	26	This sentence is not easy to understand. To clarify, we suggest indicating that these pathways generally have higher emissions than those that would result from current policies and trends.	Government of Belgium, Belgian Science Policy Office - Belspo
6114	16	24	16	26	We wonder what would happen if the climate sensitivity turns out to lie in the upper end of the range assessed by WGI. By solely referring to the median warming, this paragraph may give the impression that a warming of more than 4°C is excluded if current trends continue. We think that it is important to clarify that it is not the case. A possibility could be to provide the likelihood (associated to climate sensitivity) that 4°C could be exceeded, assuming the continuation of current policies and trends. That would follow the same logic as the last columns in table SPM.1, but for 4°C.	Government of Belgium, Belgian Science Policy Office - Belspo
6450	16	24	16	26	To shorten the overall text length, this sentence could be omitted: "Pathways resulting in median warming of >4°C would imply a reversal of current (...) trends."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14818	16	24	16	26	More about this might be useful here. Does this mean policymakers don't need to worry about temperatures exceeding 4°C? This is medium confidence. Why not high?	Government of United States of America, U.S. Department of State
14820	16	24	16	26	Replace this sentence with "Current technology or policy trajectories are very unlikely to result in temperature increases above 4°C, and such temperature increases (as with C8 or SSP5-8.5 in Table SPM.1) would require a reversal of current trends." That sentence should be clearer, especially because so much attention has been given to some who labeled SSP-8.5 as "business-as-usual" and this report should be as clear as possible to dispel that misconception.	Government of United States of America, U.S. Department of State
2438	16	25	16	25	The sentence "Pathways resulting in median warming of >4°C would imply a reversal of current technology and/or policy trends." is unclear. Should it be <4 degrees?	Government of Denmark, Danish Meteorological Institute
3988	16	25	16	25	The last two sentences require confidence statements.	Government of Canada, Environment and Climate Change Canada
6452	16	27	16	27	Please add to "C1" in the bracket "in Table SPM.1" .	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13824	16	27	16	27	If appropriate, please consider to refer to footnote 8 on page 6, similarly as in the end of the para where you refer to Table SPM.1.	Government of Norway, Norwegian Environment Agency
14822	16	27	16	27	Consider changing "scenario" to "pathway" to be consistent with the rest of the section.	Government of United States of America, U.S. Department of State
14824	16	27	16	27	Need better wording than "lowest scenarios." What does "lowest" mean?	Government of United States of America, U.S. Department of State
962	16	27	16	28	This would appear to be a major findings from this assessmnt, yet is not fully reflected in the headline text.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
970	16	27	16	28	Qualify the meaning of "lowest" here.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
10314	16	27	16	28	Please elaborate on the "lowest scenarios in the literature"	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
12422	16	27	16	28	AR6 cycle encompasses SR1.5. Why do we compare the SR1.5 and AR6?	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
13826	16	27	16	28	Please consider to start the sentence with "The scenarios with lowest emissions" instead of "The lowest scenarios"	Government of Norway, Norwegian Environment Agency
14826	16	27	16	28	Where is SR1.5 in Table SPM.1? Authors must mean SSP1-1.9? Also, this sentence is unclear: "lower" than what?	Government of United States of America, U.S. Department of State
2308	16	27	16	29	Suggest clarifying that 'the lowest scenario' is the lowest scenario in terms of GHG emissions.	Government of Australia, Department of Industry, Science, Energy and Resources
2440	16	27	16	31	Suggest moving up. Underscores the need to handle now and than even few years delay matters.	Government of Denmark, Danish Meteorological Institute
5504	16	27	16	31	This bullet is a bit confusing. The categorisation surely sets the probability of exceeding global warming of 1.5C by definition, so this shift in probabilities must be very small - could authors clarify whether it is meaningful? It is important that the size of this shift in probabilities of exceeding 1.5C is communicated at very least if it is worth commenting on at all in the SPM? It is also not clear whether this refers to the average of the scenario category or to the lowest scenario in the databases - neither seem particularly relevant for policy in the real world, so would be good to ensure clarity.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11334	16	27	16	31	Perhaps this section could be after the figure, so it is clearer which scenarios pathway C1 refers to?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13828	16	27	16	31	We would appreciate if the text could invite the reader into the table by including information on the purpose and how to read it e.g. by extension of C.1.4 to also include the rationale behind Categories and possibly also by stating the emissions in the base year 2019 for this table.	Government of Norway, Norwegian Environment Agency
14828	16	27	16	31	The purpose and conclusion of this paragraph in the SPM is unclear. If current emissions and recent emissions trends are not aligned with the SR1.5 C1, how does it follow that achieving reductions consistent with C1 scenarios would lead to higher median peak-warming and a lower likelihood of limiting warming to 1.5°C? Wouldn't this only be true if the C1 scenarios were not adjusted to current real-world conditions? Without additional context, the value of this paragraph in the SPM appears to be limited as it appears to be communicating to policymakers that the most stringent 1.5°C scenarios are already out of date and potentially not useful to support policymaking.	Government of United States of America, U.S. Department of State
196	16	28	16	30	C.1.4: The text uses 'emissions' and 'CO2 emissions' in the same sentence. The discussion should be focused on 'GHG emissions' consistent with the convention focus and the PA.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14830	16	30	16	30	"Slightly" is a subjective word. Be precise with the date range for net zero in those scenarios.	Government of United States of America, U.S. Department of State
6454	16	32	16	32	Please add in footnote 17 a time span for when the pathways were developed.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
	16	32	16	38	There is a need to ensure that the paragraph C2.4 and the WGI SPM paragraph D1.8 are understood to say exactly the same thing (currently they are written a bit differently).	WGI Bureau,
16	16		16		footnote 16: it would be helpful to inform the reader how well those modelled historic GHG emissions compare to the actual global emissions and why modelled data have been used.	Government of Austria, Federal Ministry of Agriculture, Forestry
2476	16		19		For policy makers, this chapter should be better discussed. It would be important to highlight the essential information.	Government of Hungary, Ministry of Innovation and Technology - Climate Policy Department
3280	17	0	17	0	We strongly recommend to specify the value of this emission level, which does not seem to be the same value as the assumed emissions introduced in B6.1 (54 GtCO <sub>2</sub> -eq).	Government of France, Ministère de la Transition écologique et solidaire
3282	17	0	17	0	We suggest to use a different labelling for the NDC because it is not a pathways properly speaking before 2030	Government of France, Ministère de la Transition écologique et solidaire
3284	17	0	17	0	Emissions from lines C5 to C8 are not stabilized in 2100, these scenarios do not reach net zero, temperatures will continue to drift. Why not add a column "2100" in the column "GHG emissions reduction from 2019	Government of France, Ministère de la Transition écologique et solidaire
3286	17	0	17	0	It is not easy to relate the results of the table to the temperature and carbon budget projections from WGI. Please clarify the meaning of the column "WGI SSP & IPs alignment". We suggest a method box explaining the methodology, following the approach of WGI which provide a Box on "scenarios, climate models and projections" in its SPM.	Government of France, Ministère de la Transition écologique et solidaire
3288	17	0	17	0	Please precise in the title of the 7th column the definition of the temperature change considered here (projected GSAT versus pre-industrial GSAT? - please refer to WG1 definition).	Government of France, Ministère de la Transition écologique et solidaire
3290	17	0	17	0	We suggest to delete the data in the column "Cumulative CO <sub>2</sub> emissions, 2020 to Net Zero" for the line C5 to C8 that do not reach NZE.	Government of France, Ministère de la Transition écologique et solidaire
3388	17	0	17	0	We think that having all these numbers in the SPM is very useful, but the table as it stands seems very complex. We suggest to study all the solutions to make it more easily readable (ex: split it), while keeping as much as information as possible.	Government of France, Ministère de la Transition écologique et solidaire
5528	17	0	17	0	The emissions milestones column could be reduced in size by including only the mid-year and range, and removing the % figures.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13470	17	0	19	0	Figure SPM6. The scenario names are rather confusing here. For example, below 2C (C4) for sure includes scenarios below 1.5 (C1)? It is a very complex table - if there is a way to improve its readability would be much appreciated.	Government of Estonia, Estonian Meteorological & Hydrological Institute
5510	17	1	17	2	Need consistency with carbon budgets in WGI or explanation as to why they are different. E.g. how is the 510 Gt here different to the 500 at 50% 1.5C in table SPM.2 of WGI SPM? Certainly by the Synthesis report they need to be rationalised but ideally here too (or an explanation as to why different). Also for th 510 from what year? - the text in Table SPM.1 and para C.2.1 suggest they are consistent.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11954	17	1			Table SPM.1: The category C2 "below 1.5°C with high overshoot" (1.7°C peak warming), corresponding to IMP-Neg, and assuming extensive use of net negative emissions, is problematic. This category is still easily understood as fully compatible with the Paris Agreement temperature goal (which it isn't) and should therefore be labelled according to the probability of overshooting 1.5°C (e.g. as "likely to overshoot 1.5C and returning to below 1.5°C in 2100"). Furthermore, there is currently no pathway category that would allow to capture the "well below 2°C" language Paris Agreement (which should translate to "very likely below 2°C"). The Paris Agreement Long-Term Temperature Goal has to be interpreted as one goal combining "well below 2°C" and "efforts to limit the temperature increase to 1.5°C". Consequently, category C1 should reflect any temperature outcome probability criteria that would be fully PA compatible, i.e. accommodate the "very likely below 2°C" part by enforcing a "90% below 2°C" criterion. Currently, Table SPM.1 shows that C1 is just missing out by including 5th percentile pathways with 86% likelihood of staying below 2°C. Please revisit and extend the label to capture this change: "Below 1.5°C with no or low overshoot, very likely below 2°C". The pathways categories have to be as policy-relevant as possible. The adopted chapter 3 outline calls for an assessment of "pathways compatible with the Paris Agreement". This has to be reflected in the SPM and the overall pathway classification.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11956	17	1			Table SPM.1: The column "GHG emissions reductions" now refers to "from 2019" while the equivalent column in the SOD referred to "from 2020". Could an explanation be given on why 2019 is chosen, does this have something to do with COVID?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11958	17	1			Table SPM.1: The column on the cumulative CO2 emissions from "2020 to net zero CO2" provides 510Gt for the C1 pathway. Could an explanation be given on how this compares to the WGI SPM Table SPM.1, stating 500Gt as the remaining carbon budget?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11960	17	1			Table SPM.1: Given the fast-changing NDC updates, the category C3b "NDCs" should be specified as "2021 NDCs" or similar in order to be clear that the NDCs reflected in this assessment represent a snapshot of 2021 pre COP26. Furthermore, this categorisation of C3b implies that the NDCs would lead to likely below 2 degrees. It should be made more clear that this is a category of pathways that are constrained to follow the NDCs to 2030 and then to achieve likely below 2 degrees. Lastly, what is the % reduction from 2019 levels under the NDCs in 2030? This table implies 0-14%; is that consistent with the values in B6.1?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11962	17	1			Table SPM.1: There is an issue with the fact that the majority of C1 pathways does not reach net zero GHGs, while the percentage of pathways reaching net zero CO2 is very high in most categories (100% for C1 and C2). This may suggest that the focus of "net zero" pathways is placed on CO2 instead of all GHGs. In fact, this would be highly problematic for the policy relevant messaging of the SPM, considering that Paris Agreement Article 4.1 clearly refers to a "balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases" (generally understood as achieving net zero GHG emissions), so not just CO2. While we understand from that the relatively low proportion of net zero GHG pathways results from the fact that no-overshoot-pathways do not necessarily require net zero GHGs based on the current design, this exact design does not appear robust. How is it possible to achieve 0.3°C cooling with "only" 200 Gt of net negative CO2 emissions accumulated to 2100, while GHG trajectories for non-CO2 gases like CH4, in particular, are not showing very strong reduction rates (as shown in Table 3.6 in Chapter 3 where CH4 reduction in 2050 is limited to 50%)? The SPM and specifically Table SPM.1 must clarify any scenario assumptions that may be able to explain this cooling. Also, the table states that net zero GHGs are only reached at the very end of this century (2095-2100); which would not/barely be aligned with the PA's Art4.1 to balance emissions and removals "in the second half of this century". We would like to urge the authors to consider the C1 pathway classification, in particular, in the context of Art4.1 and the implications of not doing so.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11964	17	1			Table SPM.1: It is very helpful that the table now includes a column that allows for comparability of the pathway categories with SSPs and IPs. This column, as well as Table 3.1 in Chapter 3, would indicate that the vast majority would correspond to SSP2? We would therefore like to ask for clarification from the authors, for example in the form of a footnote in the SPM, what the proportion of the different SSPs as represented in the WGIII report is, and how that can be interpreted.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11966	17	1			Table SPM.1: Could the authors elaborate on why in the last column, only the likelihood of staying below the different warming levels is given, and not (also) the exceedance probability?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
978	17	1	17	1	The category descriptions can be improved. C2 is not really a high over shoot pathway	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1266	17	1	17	1	Concerning the characterisation of the categories (column to the right), it is noted that only one ("C3") has an explicit mention of a likelihood level. It could be useful to also provide similar explicit likelihood level for the other categories either in the table, for readability and also consistency. (The column furthest to the right is harder to decipher into confidence levels and the caption does not complete the table when viewed visually.)	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2478	17	1	17	1	Basically this table is quite informative and contains a lot of relevant information but on the other hand we feel that the table loses its essence and it is difficult to understand every details, although on the next page the table is explained very well.	Government of Hungary, Ministry of Innovation and Technology - Climate Policy Department
6456	17	1	17	1	There is a lack of clarify regarding the difference between the abbreviation IMP and IP. While "IMP" is defined in C3 as "illustrative mitigation pathways" and used throughout the report (e.g., C3, C3.1, Figure SPM.6, figure 3 of this table), IP is not. Please draw on the last paragraph of 3-11 and define IPs in the suggested box on the categories of scenarios and pathways.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9476	17	1	17	1	The table contains so much information and not comprehensible in the present form. Readability can be improved by, for example, enlarging the letters and shortening some of the expressions like "2020-2025" to "2020-25". Further exploration of the possibilities to make the table more reader-friendly would be appreciated.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9580	17	1	17	1	It is helpful if there are detailed descriptions on the relations between the pathways in Table SPM.1 and SSPx-y scenarios to understand the SPM in relation to the WG1 findings.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11336	17	1	17	1	Table SPM.1 in the second row '2020 to netzero CO2' should be net-zero	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11338	17	1	17	1	Table SPM.1 peak CO2 and peak GHG emission columns display identical values. If it is correct, then they could be combined into one column.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11340	17	1	17	1	Table SPM.1: some text is very small. Why do footnotes start from 0 and not from 1?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11342	17	1	17	1	Scenario C3 should be re-labelled: for example as "NDCs then rapid reduction". Otherwise some readers may mistakenly interpret C3b as the NDC-consistent pathway (i.e. assuming they give the post-2030 pathway implied by NDCs rather than a 'forced' catch-up to likely below 2°C). The labels for C3 & C4 should also include the 67% and 50 probability respectively, so as to differentiate them from each other more easily.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11344	17	1	17	1	Could "current policies" scenario be included as a baseline?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12972	17	1	17	1	Table SPM.1 ignores historical emissions. These must be included as a row.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13830	17	1	17	1	Please consider to use lighter colors for C2 and C3, as it is now these rows are difficult to read.	Government of Norway, Norwegian Environment Agency
13832	17	1	17	1	The rightmost column gives the impression that C3b (NDCs) gives a higher probability of staying below 2 degrees than C4 (below 2 degrees). This seems counterintuitive and is not in line with the statement in the last sentence of C.1; that the warming will rise to 2,4- 3,5 degrees with current policies. Please include a more precise category description of C3b in the Table itself.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14832	17	1	17	1	A key feature of pathways that limit warming to 1.5°C with no or limited overshoot is that they reduce anthropogenic emissions of methane by over 30% by 2030 (IPCC SR1.5, UNEP & CCAC 2021). This important information does not appear to be clearly represented in the summary table or the discussion in Section C.	Government of United States of America, U.S. Department of State
14834	17	1	17	1	Table SPM.1 has interesting data but is hard to digest. Could the most pertinent information be visualized? Otherwise the content may be lost on the reader. The level of detail is not appropriate for an SPM. It needs to be completely re-thought starting with: What is the key message (recognizing that the underlying report can easily be accessed and consulted)?	Government of United States of America, U.S. Department of State
2182	17	1	17	2	Heading of column "year of net-zero CO2 to 2100" is unclear. Clearer formulation could e.g. be just "from year of net-zero CO2 to 2100".	Government of Finland, Finnish Meteorological Institute (FMI)
3990	17	1	17	2	Table SPM.1: While we hesitate to add length to the WGIII SPM, this table is challenging to read through and to be confident of interpreting properly. It would be enormously helpful if a Box were included (or some other mechanism) to walk readers through interpreting a sample row in this table (e.g. Category C1). If there is not space in the SPM, then this could be added to the chapter or TS and a footnote in the SPM could point readers there. Also - please check whether the square bracket should specify year 2050 or 2055 for category C1 for the column net zero GHGs. We noticed a discrepancy between the result in this table and that in CCB 3 (page 41 line 5).	Government of Canada, Environment and Climate Change Canada
5506	17	1	17	2	This figure is useful and comprehensive, but it is much too complex for the SPM and it would be better suited for the technical summary. Numbers in this SPM table should summarise the key information, namely, when net zero CO2 & GHG is needed for the 1.5 and 2C scenarios, and the associated reductions needed in 2030. It would also be useful to policymakers to summarise some of the key features of the Illustrative Mitigation Pathways that limit warming to 1.5C and well below 2C that feature throughout section C, which would build on the detail provided in Fig SPM3.b of SR1.5, and would enable policymakers to better interpret these findings. We also suggest removing lines in the table after C3 as they are much less policy-relevant. We have made some specific suggestions in our other comments on this table as to how the table could be simplified.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5508	17	1	17	2	Consider adding a short sentence above the table, in large grey font (to match the short sentences that precede other Figures in the report) to summarise what the table is showing.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5512	17	1	17	2	The 40 Gt 2030 value in the table appears to be referenced as 40 Gt in line 5, page 43 of underlying chapter 3. The figures presented in the underlying chapters suggest 2019 emissions of 56 Gt	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5514	17	1	17	2	Under the heading Emissions milestones, it is not clear what the percentages in square brackets mean. Can this be made clear in the heading somehow? I know in footnote 8 it says that this is the fraction of pathways reaching net zero, but would be useful to be in the overarching heading.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5516	17	1	17	2	The fact that emissions milestones are expressed as the five year period within which the median peak emissions year or net zero year falls, instead of simply stating the median year, means that it is not as easy to see trends in the data, and differences between different categories are obscured. These ranges should be replaced with the median value for clarity.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5518	17	1	17	2	The C3, C3a and C3b categories are quite confusing and it's not immediately clear what differentiates them. Moreover, category C3b should not be labelled 'NDCs' as the stats represented (such as pak warming of 1.8C) could be interpreted as the natural implications of current NDCs - whereas it actually represents an unrealistic scenario of NDCs until 2030 followed by an abrupt acceleration of mitigation action. It should therefore either be deleted or renamed 'NDCs + accelerated action post 2030'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5520	17	1	17	2	Category C8 is not illustrative and potentially confusing, as it encompasses such a broad range of pathways that it is misrepresentative to badge them as 'above 4C'. For example, a pathway resulting in 10C of global warming would still be included here, and the calculations leading to median figures. Since these figures cannot be interpreted as a guide to emissions that would lead to a given temperature outcome, category C8 should be deleted.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5522	17	1	17	2	Naming of specific scenario within each category (e.g. LD Ren) seems too much detail for the SPM. The multiple ranges within the emissions milestones columns are complex and could be confusing. Can this be simplified? A column for likelihood of sticking below 4C should also be added to the table as this is relevant for many policy framings around the world.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5524	17	1	17	2	The final column title is a little confusing - the footnote is helpful, but maybe the column could include "at peak temperature" or "not temporarily exceeding" or something similar?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6116	17	1	17	2	Table SPM.1 is very dense: can this be improved? (in particular, could the "Emission milestones" columns be simplified to save space?) Layout details: column 2 and 3 (with the dark coloured backgrounds) are not readable on inkjet printouts. Units in column titles (% , °C, ... ) should be written the same way, with or without ( ).	Government of Belgium, Belgian Science Policy Office - Belspo
13836	17	1	17	2	The font used in the Table are too small and makes it challenging to read, therefore please consider to split the table into two sub-tables. In addition and so far we don't see that the coloring of the categories is justified, since it seems that they don't consistently match with the colors used in the figures of the SPM (especially SPM.5 and SPM.6). If there is any rationale and logic, for the coloring of the different categories, please explain in the Table caption or footnotes. Regarding the category description, we believe it could benefit from highlighting that this is with respect to warming during at the end-of-century. Please consider to add "during this century" in respect to the "Global mean Surface Air Temperature Change".	Government of Norway, Norwegian Environment Agency
14836	17	1	17	2	Table SPM.1, column 3 (WGI SSP column) should say SSP1-2.6 where it currently says SSP2-2.6, as that was the 2.6 W/m2 scenario used throughout WGI AR6 Table SPM.1.	Government of United States of America, U.S. Department of State
198	17	1	17	6	Table SPM.1: The color scheme in the table is confusing as it does not reflect the colors of the scenarios in the figures of the entire SPM. Tables should not be colored.	Government of Saudi Arabia, Sustainability Advisor to the Minister of Ministry of Petroleum and Mineral Resources
2072	17	1	17	6	Information in the column "Emissions milestones" is difficult to understand. A detailed note is recommended to explain each phrase of information.	Government of Republic of Korea, Korea Meteorological Administration
6932	17	1	17	6	It stands to reason that the classification of pathways would also contain a category that fulfils the Paris Agreement goal of reaching net zero GHGs. However, none of the categories fulfil this criterion, especially not C1 where this would be expected. It is unclear how the lowering of temperatures to 1.3°C in 2100 is achieved in these pathways that assume only relatively low levels of net negative CO2 emissions as well as CH4 reductions as chapter 3 states. To ensure that the scientific findings presented in this table are relevant for policymakers, a subcategory should be added that includes 100% of pathways that reach net zero GHGs. In addition, the C1 category, to ensure full Paris Agreement-compatibility, should then also make sure to capture the entirety of the Paris Agreement temperature goal, i.e. the likelihood of staying "well below 2°C", and reflect this in the category title, e.g. simply by adding "and very likely below 2°C".	Government of Jamaica, Meteorological Service Division
6934	17	1	17	6	It is unclear what the difference of category C3 is compared to C3a and C3b. Please be more clear here!	Government of Jamaica, Meteorological Service Division
6936	17	1	17	6	Our issue with the Paris Agreement-compatibility of categories includes C2, which suggests compatibility due to the "below 1.5°C" in its title, while in fact it is likely to overshoot 1.5°C, as the table caption makes clear. The "overshoot" wording furthermore suggests a temperature change much less severe than what 1.7°C peak warming would presumably mean for all regions of the world. C2 should simply be renamed using the probability language from the C2 table caption.	Government of Jamaica, Meteorological Service Division
6938	17	1	17	6	The new table column very usefully displays how the categories relate to the WG1 SSPs and IPs. It would appear that most categories align with SSP2. Could information be provided regarding the relative role of SSPs in this report?	Government of Jamaica, Meteorological Service Division
6940	17	1	17	6	The table gives the likelihoods of staying below different warming levels. It could be useful if the likelihoods of exceeding those levels could also be added to the table.	Government of Jamaica, Meteorological Service Division
9794	17	1	17	6	Note that the amount of CO2 removal in SPM 1. may be more than the net removal as part of the removal may be to offset remaining emissions. Would be good to have an indication of the gross CO2 removal levels as well.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
9796	17	1	17	6	Add in SPM 1 in the table itself in the description of the pathways the probability of meeting the indicated temperature level.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy

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If any fields are not readable, please ensure to expand relevant cells. If reading this in PDF format, please refer to the Excel format version of this document available on: <a href="https://www.ipcc.ch/report/ar6/wg3/downloads/drafts-and-reviews">https://www.ipcc.ch/report/ar6/wg3/downloads/drafts-and-reviews</a>						
Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13834	17	1	17	6	In our view Table SPM.1 is comprehensive and takes time to digest, but a table like this should be kept in the SPM. We propose the following changes and modifications: It would be helpful if the text could guide the reader into the table by including information on the purpose and how to read it e.g. by extension the text in C.1.4 to include also the rationale behind categories, and possibly also by stating the emissions in the base year 2019 used in this table. In column 2 and the last column: Is it meant below (<) or below or equal(<=)? Is cut-off in 2100 or later? The abbreviations SP, LD, Ren, Neg, GS, Mod Act, Cur-pol could also be explained in connection with the table. What does the dots represent when it is said e.g. in the net zero GHGs column (2050- ...). That the 95 percentile is not reached? Numbers in square brackets is not explained for Peak CO2 emissions and peak GHG emissions, maybe do it similar as for net-zero Co2 and net-zero GHGs? Also, please consider to include an additional column for CO2 only, similarly to the column for GHG emissions (2030, 2040 and 2050). This would highlight CO2, but would also make it possible to extract non-CO2 information. However this makes the table even broader visually, so perhaps you could consider splitting this table into two parts, where in our view the most natural split would be between "Emission milestones" and "Cumulative CO2 emissions".	Government of Norway, Norwegian Environment Agency
14838	17	1	17	6	Aspects of Table SPM.1 are not immediately obvious. The color-coding in the far-left column is not explained, but conceivably corresponds with global mean surface air temperature. Add a key. It's also not clear if the table is explaining "avoided" mean surface air temperatures.	Government of United States of America, U.S. Department of State
14840	17	1	17	6	Has IP been defined before? Spell it out.	Government of United States of America, U.S. Department of State
2310	17	1	18	42	Suggest adding a footnote or a new section to C1 explaining the broader emissions trends of C1 and C2, and why net zero GHGs is projected to be later in C1 despite having less overshoot. The net zero GHGs year for C1 being 25 years later than C2 in table 1 is likely to be confusing for policymakers who do not understand that an earlier net zero GHG year will be required in order to reduce temperature from their peak.	Government of Australia, Department of Industry, Science, Energy and Resources
6458	17	1	19	5	Table.SPM.1: Please change the title of the second last column from the right to "Temperature change (median) °C" because this is easier to understand than "50% probability", and which is mentioned in footnote 11 anyway. In addition, in this footnote please replace GSTA to GMT since according to WG I these are equivalent.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2194	17	1	19	9	Table and caption refers to SP, LP, Ren, etc. As pointed in comment on Footnote 8, not all scenarios are defined. Also, the Illustrative Mitigation Pathway discussion does not start until at C.3. It would be helpful for the reader, if this information could be compiled together, e.g. in a box with footnote.	Government of Finland, Finnish Meteorological Institute (FMI)
6460	17	1	19	9	<p>_TABLE SPM.1: We appreciate the assessment of a broad spectrum of emission pathways and the information provided in the SPM on their key characteristics. However, we think that the complexity of information contained in Table SPM.1 is too high for the audience of the SPM, who often does not have a scientific background. We, therefore, suggest referring the interested reader to Table TS.3 and making the following simplifications in the SPM:</p> <ul style="list-style-type: none"> <li>- Please delete the column "peak GHG emissions" since the numbers are the same as in "peak CO2", hence this information could be provided in the caption.</li> <li>- Please delete the columns "net zero GHGs" or provide sufficient explanations on why net zero GHGs are not reached in the course of this century for most categories (because of less CDR in some newer pathways SLCF are not compensated for).</li> <li>- Please delete the lines for categories below C3 since these the conditions of these are not explained anyway, and since they are less relevant for climate policy that is bound by the Paris Agreement, including the information on the NDCs pathways if this cannot be updated with the pledges of late 2021. Only the C7 pathway might be of relevance since it provides the direction we are heading right now and should be Therefore, kept in the table.</li> </ul> <p>Furthermore, we invite the authors to consider inclusion of Table 3.6 in the SPM, because it provides policy-relevant information that has been requested during the SR1.5 approval session.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6462	17	1	19	9	All assumed 2 C pathways peak by 2025. This is remarkable since the AR4 noted that peaking by 2015 was needed to stay below 2°C and the AR5 did not provide information on the timing of the peak year since it is determined by the amount of negative emissions considered in the emission pathways. In addition, the timings of emission milestones in the scenarios depend on current and locked-in near term emissions. Furthermore, quantitative information about mitigation milestones is associated with observation and model uncertainties. Updates and revisions are normal in scientific contexts but might confuse policy makers who are not necessarily familiar with the research processes and have different expectation on the accuracy and granularity of information. We, therefore, urge the authors to explain the robustness of information on the timings of net zero and all other emission milestones mentioned in this report, so that policy makers can appropriately interpret the information provided. Section 3.2 might provide relevant information.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6464	17	1	19	9	Table SPM.1: Please add two columns for CO2 emissions/year and CO2 emission reductions from 2019, i.e. replicate the 2nd and 3rd column of the table for CO2. This information is essential since CO2 is the most important GHG and mitigation targets are often expressed in terms of CO2, including in the SR1.5 and in COP26 decision 1/CP.26, para 17. To this end please provide the emission levels for GHG and CO2 in 2010 and 2019 in the caption of the table for easy reference and conversion to 2010 as the reference year of the SR1.5.  To make space for the additional columns, we suggest to delete "20" in the years, i.e. please write "25" instead of "2025", which would create additional room.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15640	17	1	19	9	It does not become clear from this table in how far the pathways/categories are illustrating potential ways of achieving the Paris Agreement temperature and mitigation goals. One would assume that C1 contains this information because of its temperature characteristics, yet net zero GHGs are only reached 2095-2100 and only in 52% of pathways, which would not be aligned with the PA mitigation goal. The remaining 7 pathway categories could thus then especially not be considered aligned (as also PA-alignment of high overshoot is questionable, and it does not become clear how the different 2°C categories can be linked to the PA's "well below 2°C"). With 1.5°C front and centre in political discussions, and widespread net zero targets announced by countries, the SPM must provide policymakers with the relevant findings that the literature provides. The pathways included in the assessment must be carefully vetted and categorized with this in mind in order to be policy-relevant. Therefore, also the relevance of many of the other categories is in question; levels such as "below 2.5°C" for instance do not have a particular policy-relevance. This should be reflected in the table, and the table simplified where possible.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
9478	17	2	17	2	The acronyms of SSP and IPs (perhaps IMPs) should be briefly described in one of the table footnotes.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
13838	17	2	17	2	The calculated percentage emission reduction from 2019 do not seem to fit with the 2019 emission of 59 GtCO2eq/yr as stated on page 4 line 6. Please clarify this, e.g. in footnote 6 to the table, with a reference to figures SPM.1 and SPM.2 where it is stated that the 2019 GHG-emissions are 59 GtCO2eq/yr.	Government of Norway, Norwegian Environment Agency
988	17	3	17	3	Replace temperature change at peak warming for categories C6, C7 and C8 with ... or equivalent: there is no temperature peak in these scenario categories. Among other categories, it would be helpful to document the fraction that fail to peak temperatures by 2100	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
990	17	3	17	3	Providing both ranges at which scenarios reach net zero and the fraction that reach net zero is partly redundant information and potentially very confusing: what is the reader to make of ...[42%] Why can no 5% lower bound be given when 42% of scenarios reach net zero?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
13412	17	3	17	3	The statement "CO2 and GHG" should be revised to read "CO2 and other GHGs) since CO2 is also a greenhouse gas.	Government of Kenya, Kenya Meteorological Service
3992	17	3	17	5	Table SPM.1 caption: please add to the caption the source of this table in the main assessment report.	Government of Canada, Environment and Climate Change Canada
5526	17	3	17	6	While understandable, this table takes a long time to understand, and the figure caption could be rephrased to become clearer, requiring less thorough reading of the lengthy description which covers each column. Furthermore, the first caption could refer or at least explain, the numbered points below as these do not seem to match the column number. A few suggestions would be: line 4- "likely temperature outcomes, categorised by the pathway numbers C1 to C8 in the first column". The outcomes are defined by the likelihood of emissions reductions (column 12) and by peak and 2100 temperature change (column 11).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6118	17	5	17	5	Caption of Table SPM.1: Please clarify where "(p50)" and "(p5-p95)" are to be found. Given that parenthesis are used for both of these in the caption, it may be hard to understand that p50 does not have parenthesis in the table, while (p5-p95) is shown in this way. You might perhaps write something like "for the median (on top) and the 5-95th percentiles (in parenthesis under the median value)". To further clarify, the median might be in bold (so that there is no need to guess what "on top" means). In addition, it would be useful to state what these statistics are about, i.e. that they describe the ensemble of scenarios in each category (not the climate-related uncertainties).	Government of Belgium, Belgian Science Policy Office - Belspo
12974	17	12	17	12	C.2 Good statement on net zero CO2 emissions globally. However, this statement should be strengthened by 1) indicating clearly BY WHEN net zero CO2 needs to be reached for 1.5 and 2 °C; and 2) making clear that JUST TRANSITIONS to net zero emissions (see 1/CMA.3) will differ in different countries and contexts.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
980	17	20	17	23	What is gradual decline, can this be quantified and put in a analysis framework?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
982	17	24	17	27	Confusing and not clear	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
984	17	28	17	33	Not clear if the physical carbon budget can be expanded, if so how is this done. Include explanation of physical carbon budget at the outset and explain how it can be expanded?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
986	17	28	17	33	WGI seems to suggest black carbon is not an actor; how about cooling aerosols and their roles as highlighted in WGI?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
4000	17				Table SPM.1. Quoting five-year ranges in the 'Emissions milestones' column is confusing. By showing a five-year range instead of a single year, this is intended to avoid unjustified precision, but this just makes the table harder to interpret. Each cell now contains two ranges, and the reader has to read the footnote to understand that the 5-yr range is not an uncertainty interval, just an arbitrary 5-yr range in which the median lies. Just replace each 5-year ranges with the median in all cases.	Government of Canada, Environment and Climate Change Canada
13546	17				As we commented with regards to section C, we have concerns with regards to the way the pathways are categorised and presented, particularly in this table. They lack relevance for the main intended audience of the SPM, policymakers, as they will not be able to determine which of the pathway categories can be considered in line with the Paris Agreement. We appreciate the authors' desire to not be policy-prescriptive, but simply representing pathways that reflect the PA's Article 2 (temperature goal) and Article 4 (balance of GHGs) would not be policy-prescriptive in our view but simply provide the necessary policy-relevant insights, and furthermore respond to the information requirements regarding PA-compatible pathways as described in the adopted chapter outline. Therefore, we propose the following amendments: (1) change category C1 to comprise both 1.5°C and 2°C elements and covering language of the PA LTTG, (2) revisit why the category C1 only has 52% of pathways achieve net zero GHG emissions but 100% net zero CO2 emissions, while it remains unclear how the temperature change from peak warming to end-of-century warming goes together with only 200Gt of cumulative net negative CO2 emissions, (3) to potentially resolve the aforementioned issues, introduce a new category "C1a" where 100% of pathways achieve net zero GHGs in order to fully encompass the PA's Article 4, (4) rename category C2 to reflect that it is likely to overshoot 1.5°C and then return to below 1.5°C, (5) revisit categories C3a and C3b as it is unclear what these sub-categories mean in relation to the parent category C3.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
3994	17		17		Table SPM.1. At first glance, this is very difficult to read and use for policy purposes. Perhaps, this can be more visual.	Government of Canada, Environment and Climate Change Canada
1178	17		18		p18 details table SPM1 p17. Add note at end of table caption p17 or at top of page 18 saying the points p18 0-12 (p18-19) detail, explain,referring to the table page 17. *** First point page 18 is 0, change to 1?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3996	17		19		We suggest adding the text below to the Table description to improve its clarity by defining the acronyms used, which was taken from Chapter 3 of the underlying report: "Current Policies (CurPol) and Moderate Action (ModAct), and Illustrative Mitigation Pathways (IMPs): gradual strengthening of current policies (GS), extensive use of net negative emissions (Neg), renewables (Ren), low demand (LD), and shifting pathways (SP)."	Government of Canada, Environment and Climate Change Canada
3998	17		19		Table SPM.1. There is a lot of detail in this table and in its caption. This may be too much detail for an SPM figure. Consider simplifying, and relying on the TS for some of the detail.	Government of Canada, Environment and Climate Change Canada
14842	18	1	18	1	Delete redundant "Values in the table refer to the 50th and (5th-95th) percentile values".	Government of United States of America, U.S. Department of State
14844	18	1	18	1	Percentiles of what? A footnote should explain that it's the frequency with which certain values occur in the submitted modeled scenarios, like vote-counting among submitted studies. If that is what the second sentence means, it isn't clear.	Government of United States of America, U.S. Department of State
3292	18	2	18	3	Why choosing only MAGICC's results for the 50th percentile value of temperature and not the 50th percentile value from the 3 climate emulators ?	Government of France, Ministère de la Transition écologique et solidaire
14846	18	3	18	3	What does IMP-Neg refer to in Table SPM.1?	Government of United States of America, U.S. Department of State
14848	18	3	18	3	Is this MAGICC 6.0 or MAGICC 5.3? A policymaker will have no idea what MAGICC is, and an informed reader would want to know the model version.	Government of United States of America, U.S. Department of State
14850	18	5	18	5	Include a footnote describing the three climate model emulators (MAGICC, FaIR, and CICERO-SCM).	Government of United States of America, U.S. Department of State
5530	18	6	18	7	"i.e. the lowest p5 of three emulators, and the 7 highest p95, respectively" - it would perhaps be clearer to say 5th percentile and 95th percentile here, rather than p5 and p95	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
994	18	7	18	8	Do the numbers in round brackets include climate response uncertainty? Please clarify.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
14852	18	7	18	8	In the past, models generally have underestimated the speed and magnitude of warming. What does AR6 say about this? Why should policymakers believe these models more than the last? Any reason to think they also do not underestimate the rate and magnitude? Presumably AR6 addresses these points and those findings should be brought into the SPM.	Government of United States of America, U.S. Department of State
2312	18	9	18	17	Suggest that understanding of the pathways presented here and in Table SPM.1 would be improved if they were 'mapped' where possible and appropriate, to the SSPs.	Government of Australia, Department of Industry, Science, Energy and Resources
14854	18	9	18	17	It is a misnomer to say that the frequency results from counting the values produced in submitted model runs is a "probability". A better word should be used, such as "frequency" or "median" or "percentile among submitted results." "Probability" implies a more systematic and valid method for estimating likelihoods than was used, just as the scenarios themselves do not have probabilities or likelihoods. Same issue on page 19, lines 6-9.	Government of United States of America, U.S. Department of State
6466	18	10	18	11	The probabilities indicated for categories C1 and C2 (e.g. for C1: "Below 1.5 °C with a GREATER THAN 50% probability and a peak warming higher than 1.5 °C with LESS THAN 67% probability") is not consistent with footnote 8 ("Scenarios that limit warming [...] with a probability OF 50% OR GREATER, and also have a probability OF 67% OR LESS of exceeding warming of 1.5 °C [...]"). Please ensure consistency.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
4002	18	10	18	13	Table SPM.1 note 1: Category definitions - the definitions of categories C1 and C2 are confusing/surprising since previously we have had these scenarios described in terms of the magnitude of overshoot (i.e. for category C1, no or limited overshoot of < 0.1C and for C2, high overshoot has been defined as >0.1C). As written, the current category definitions do not say anything about the magnitude of overshoot.	Government of Canada, Environment and Climate Change Canada
6942	18	15	18	16	We noticed that the probabilities given in the table caption for staying below the given warming levels are now greater than 50% but were just 50% in the previous SOD version, maybe the authors could clarify this choice?	Government of Jamaica, Meteorological Service Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11968	18	15	18	16	Table SPM.1: Whenever the caption footnote 1 gives "greater than 50% probability" for limiting warming to a certain level in the different pathway categories, the same statements in the SOD table caption gave "a 50% chance". It appears that probabilities have been shifted overall. Could an explanation be given on why that is?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
992	18	15	18	46	Why are these regions nearer netzero can they avoid development that increases this distance?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
3294	18	18	18	18	For a better understanding, the "category definition" and "all warming levels" should be included directly in the table	Government of France, Ministère de la Transition écologique et solidaire
18	18	19	18	19	Explain "IMP-Neg". (Illustrative mitigation pathway with extensive use of CDR in the energy and the industry sectors to achieve net negative emissions). Unfortunately such explanation is currently only in the context of subchapter C.3	Government of Austria, Federal Ministry of Agriculture, Forestry
3296	18	19	18	19	We suggest to make a reference to C3.1 where there is the explanation of "IMP-Neg"	Government of France, Ministère de la Transition écologique et solidaire
6468	18	19	18	19	The abbreviation "IMP-Neg" is used the first time but not explained - please add some clarification.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6944	18	19	18	19	The comparability to IPs given in the column is very useful but potentially confusing as IPs have not been mentioned before or are explained here, while later sections talk about IMPs. Please add a footnote for example to briefly introduce the IPs here and how they are to be understood in comparison to the categories.	Government of Jamaica, Meteorological Service Division
11346	18	19	18	19	The "IMP-Neg" peak is not clearly defined. (it is introduced only on page 20)	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11970	18	19	18	19	Table SPM.1: This is the first time that the reader will be confronted with the IMP acronym. IMPs have not been introduced yet, also not in the table. An explainer/introduction has to be added here and IMPs have to be explicitly called out in the table, too, with the corresponding cell reading e.g. "WGI SSP, IP and IMP alignment". Otherwise, this is very confusing.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13840	18	19	18	19	Please consider to include descriptive language of the different IMP-categories here, similarly as how it is done on p. 20. We believe it is useful to have these descriptions when reading the table.	Government of Norway, Norwegian Environment Agency
1268	18	26	18	26	It would be useful to include some explanation of "modelled 2019 emission levels", and how comparison to actual emission levels would affect the percentage reductions.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
3298	18	26	18	27	We strongly recommend to specify the value of this emission level, which does not seem to be the same value as the assumed emissions introduced in B6.1 (54 GtCO <sub>2</sub> -eq). The big difference should be explained and the numbers in the Table updated in order to ensure consistency between actual and modelled emissions. Otherwise, who would understand why the 2030 GHGs emissions for scenarios C1 to C6 are lower than the actual 2019 emissions provided in B1.1 (59 GT CO <sub>2</sub> eq)?	Government of France, Ministère de la Transition écologique et solidaire
9480	18	26	18	38	Table footnote 5 has a reference to Annex III section II 2.5 for 'the harmonized and infilled projections', but it would be better to add a brief description about those concept considering its relation to 'native model emissions profiles' in table footnote 8.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
4004	18	29	18	30	Why do the authors harmonise model data to 2015? What is the advantage of using data for this year?	Government of Canada, Environment and Climate Change Canada
1270	18	30	18	30	Could a short explanation be provided why the comparison is to 2015 levels?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
4006	18	34	18	35	Table SPM.1 note 8: please provide guidance about how to interpret the square brackets for the first two columns under the Emissions milestones part of the table (i.e. for the columns on peak CO <sub>2</sub> and GHG emissions).	Government of Canada, Environment and Climate Change Canada
13842	18	39	18	40	Please consider to explain the term "Kyoto basket", as this might not be well known to all policymakers.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2314	19	1	19	3	To correctly describe this column in the table, suggest that Footnote 10 should refer to 'cumulative CO2 emissions' not 'cumulative GHG emissions'.	Government of Australia, Department of Industry, Science, Energy and Resources
996	19	1	19	5	What are "decent living standards"? Is there an IPCC definition?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1272	19	5	19	5	If these probabilistic climate model emulators are the same as those mentioned earlier in the caption (note 0 on page 18, lines 1-8), it would be useful to indicate so, so that there is less risk that the reader gets the idea that the emulators used are different.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6470	19	5	19	5	What are "probabilistic climate model emulators"? Please explain and find a description comprehensible for policy makers.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14856	19	5	19	5	State whether the emulators are based on CMIP5 or CMIP6 or WGI AR6 science.	Government of United States of America, U.S. Department of State
11972	19	11	19	12	C.2: Likely limiting warming to 2°C is not the same as limiting warming to "well below 2°C" as per the Paris Agreement temperature goal (very likely below 2°C), as the Paris Agreement Long-Term Temperature Goal represents a significant strengthening of the Cancun language of "below 2°C. It has to be clarified that likely below 2°C cannot be interpreted as "well below 2°C" or the pathway category has be adjusted accordingly.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
4008	19	11	19	13	The phrasing "or making it likely that warming is limited to 2C." reads rather awkwardly. It would be simpler to say "...or likely limiting warming to 2C". Again, here as elsewhere in the SPM, should this be <2C rather than 2C?	Government of Canada, Environment and Climate Change Canada
4010	19	11	19	13	An indication of Net Zero CO2 globally required by the year will be useful.	Government of Canada, Environment and Climate Change Canada
9800	19	11	19	13	Add to C.2. the probability of the pathways for 1.5C.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
9802	19	11	19	13	An indication of the time of global net zero CO2 is essential for policy makers and has been included in previous IPCC reports , like SR1.5. Unclear why not included here in C.2. Thus add: "around the middle of the century".	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12556	19	11	19	13	Rephrase the statement to the following: "Limiting warming to 1.5°C with no or limited overshoot, or making it likely that warming is limited to 2°C, requires limiting global emissions to within 510 GtCO2eq globally". The last part of the sentence "and deep reductions in other GHG emissions" should be deleted.	Government of India, Ministry of Environment, Forests and Climate Change
14858	19	11	19	13	Propose to add "... , particularly methane" to the end of the first sentence of C.2, such that it reads: "Limiting warming to 1.5°C with no or limited overshoot, or making it likely that warming is limited to 2°C, requires reaching net zero CO2 emissions globally and deep reductions in other GHG emissions, particularly methane."	Government of United States of America, U.S. Department of State
204	19	11	19	17	C.2: Required action: clarify that these conclusions are based on predictions from model outcomes.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
206	19	11	19	18	C.2: The naming of limiting warming to 1.5°C scenarios is misleading as the likelihood is missing, the names should reflect the likelihood of "more likely than not". Second, as indicated in the footnote in page 5, limiting warming to 1.6 is included in scenarios limiting to 1.5, this is confusing for the decision makers as it is not clear the case of other levels such as 1.7°C, for example. The authors should carefully verify the range of the scenario or category of scenarios and provide the likelihood in the name consistently.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
208	19	11	19	18	C.2: The statement is specific to certain sources not on emissions. Re-write to focus on all emissions.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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210	19	11	19	18	C.2: The statement only takes into consideration two pathways. Re-write to account for other scenarios.	Government of Saudi Arabia, Sustainability Advisor to the Minister of Ministry of Petroleum and Mineral Resources
11974	19	11	19	18	C.2: It is appreciated that the headline statement is clear on the necessary "deep reductions in other GHG emissions". However, it is our understanding from Table 3.6 on p75 in Chapter 3 that CH4 emissions reductions in 2050 relative to 2019 do not exceed 50% across the four scenario classes limiting warming to 1.5°C and 2°C. Could information be included in the C.2 statement or in a footnote what exactly the assumed reductions for non-CO2 and CH4 specifically are and why? Information from Chapter 3, section 3.3.2.2 p30 could be added: "technical measures can significantly reduce CH4 and N2O emissions at relatively low costs to about 50% of the current levels (e.g., by reducing CH4 leaks from fossil fuel production and transport, reducing landfill emissions gazing, land management and introducing measure related to manure management, see also Chapter 7 and 11). However, technical potential estimates becomes exhausted even if the stringency of mitigation is increased (Harmsen et al. 2019a,b; Höglund-Isaksson et al. 2020). Therefore, further reduction may come from changes in activity levels, such as switching to a less meat-intensive diet reducing livestock"	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12642	19	11	19	18	Headline statement must include the budget and not a statement about net zero alone to be consistent with WG-I. Suggested Change: "Limiting warming to 1.5° C or 2o C with no or limited overshoot, requires limiting global cumulative emissions to 510-1210 GtCO2 and deep reductions in other GHG emissions. The level of peak warming depends on the cumulative CO2 emissions until the time of net zero CO2 and the warming contribution of non-CO2 climate forcers at that time." The sentence "Deeper emissions....long term" should be removed as it is speculative - the risk is not quantified.	Government of India, Ministry of Environment, Forests and Climate Change
13844	19	11	19	18	The timing of net zero for 1,5 scenarios as well as necessary emission reductions by 2030, are key parameters guiding policy-making. Please consider if this could be reflected in C.2 as an overarching finding.	Government of Norway, Norwegian Environment Agency
5532	19	11	19	38	Section C.2 hasn't quite reached its potential yet. As it stands, it provides explanations of how things work, but with few insights on what needs to be done when, and what actions are most important. A few key numbers would be useful in the top paragraph and in each bullet point. A reflection is needed on what really comes out of the analysis of net zero among scenarios. A key policy-relevant point to make is that net zero CO2 and deep reductions in other GHGs are needed (and by when), but deep reductions in the 2020s and 2030s are more important to achieve the temperature targets, than the net zero GHGs by 2050. This needs to be written in a way that supports the net zero commitments but makes it clear that on their own, they won't lead to success. Section C2 also needs to ensure that the detailed and useful analysis in Chapter 3 on the timing of both net zero CO2 and net zero GHG are elevated to the SPM and summarised clearly and succinctly, to make clear, as is well articulated in the underlying report, that the shifts in Net Zero dates do not give more time to cut emissions, but rather stem from implementing steeper reductions in this decade i.e. make clear why there is a difference between SR1.5 and AR6.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5534	19	11	19	38	Within section C2, it can be quite difficult to differentiate between the information relevant to CO2 and to GHG - could authors review and ensure this is made clear?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6472	19	11	19	38	Different terms complicate the understanding: emissions, CO2 emissions, GHG (CO2-eq). Please ensure consistency.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6474	19	11	19	38	How to deal with CDR in agriculture and forestry in the scenario group "Limiting warming to 1.5°C with no or limited overshoot..."? In this field are currently numerous activities on the way. Please elaborate on the CDR options related to land.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14860	19	11	19	38	Consider simplifying, paring, or deleting Section C.2 as it is mostly duplicative of the information in Table SPM.1.	Government of United States of America, U.S. Department of State
14862	19	11	19	38	This whole section is tough to get through. It needs a good edit and revision to focus on the key messages and articulate them cleanly and clearly.	Government of United States of America, U.S. Department of State
5536	19	11	20	30	Sections C.2, C.3 and possibly others in Section C could be written in a way that bring the key elements forward more. Many sentences start the same thing (e.g. in the 1.5C and 2C pathways...). For example, C.2 could start with "Net zero CO2 emissions and deep reductions in other GHG emissions are needed globally to limit warming...".	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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6476	19	12	19	12	Please be more specific about "deep reduction". E.g. "more than halve"?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13236	19	12	19	12	The sentence "Deeper emissions ... in the long term" is an excellent example of a message that is placed in a lead paragraph, suitable and accessible for the policy-makers (policy relevant). The language is phrased adequately.	Government of Switzerland, Federal Office for the Environment FOEN
200	19	12	19	13	C.2 The statement "Limiting warming to 1.5°C with no or limited overshoot, or making it likely that warming is limited to 2°C, requires reaching net zero CO2 emissions globally and deep reductions in other GHG emissions." prescribes policy for all nations. Required action: delete or rewrite without using the verb "require" which indicates policy prescription.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
6946	19	12	19	13	It would be necessary to quantify the deep reductions in other GHG emissions in the headline statement or in para C.2.3 which specifically covers CH4. Section 3.3 listed in the line of sight explains that CH4 and N2O could seemingly quite easily be reduced to 50% of current levels, which is then also reflected in table 3.6 in chapter 3. So if all 1.5/2°C-related statements in this regard are made under the assumption that their emissions are not reduced beyond 50%, this should be made clear in the SPM, including explanations on why that is.	Government of Jamaica, Meteorological Service Division
20	19	13	19	13	The information in the first sentence (from line 11 to 13) is not very helpful - because limiting warming to any temperature goal requires reaching net zero CO2 emissions. The key question is: by when? And unfortunately that information is not included in the whole subsection C2. It is strongly suggested to include such information - as well as the amount of net negative emissions that are expected to be removed during the 21st century.	Government of Austria, Federal Ministry of Agriculture, Forestry
14864	19	13	19	13	Indicate "by what year" for the first sentence of C.2 that ends on this line.	Government of United States of America, U.S. Department of State
1016	19	13	19	14	This sentence, as written, appears to refer to all scenarios, not simply the 1.5 and below2C scenarios assessed. It should say "The level of peak warming depends on the cumulative CO2 emissions until the time of peak warming and the warming contribution of non-CO2 climate forcers at that time." Is it possible to state that in scenarios considered, peak warming occurs within a decade or so of the date of net zero CO2 emissions, and the level of peak warming is indistinguishable from the temperature at the time of net zero CO2 emissions.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
3396	19	14	19	14	It should be of "change in non-CO2 climate forcers" since the warming due to aerosols is due to change in cooling aerosols not to warming from aerosols.	Government of France, Ministère de la Transition écologique et solidaire
12558	19	14	19	17	The following statement should be removed "Deeper emissions reductions by 2030 and 2040 reduce the risk of overshooting warming limits and the associated need for net negative CO2 emissions in the long-term. Net zero GHG emissions lead to a decline in warming after a temporary peak (high confidence)"	Government of India, Ministry of Environment, Forests and Climate Change
	19	14	19	14	"the warming contribution of non CO2 climate forcers" is a bit strange because aerosol have a cooling contribution. An alternative formulation could be : "and the net effect of changes in non CO2 climate forcers"	WGI Bureau,
4012	19	15	19	15	Is "risk" used appropriately here? Or should probabilistic language be used here instead?	Government of Canada, Environment and Climate Change Canada
14866	19	15	19	16	Change "associated need for" and replace it with "quantity of" and replace "in the long-term" with "that could achieve a given temperature target in 2100." Using "need" implies a subjective recommendation, not objective.	Government of United States of America, U.S. Department of State
5538	19	15	19	18	Can figures be separated for 1.5 and 2 degrees pathways?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14868	19	16	19	16	What time period is "in the long-term"?	Government of United States of America, U.S. Department of State
998	19	16	19	17	This may be true if net zero GHG emissions are evaluated on the basis of GWP100 metric. This needs to be clear.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1006	19	16	19	17	Net zero GHG emissions defined using the GWP100 metric lead to a decline in warming after a temporary peak in all scenarios (it is not true in general: e.g. in hypothetical scenarios with zero or negative SLCF emissions at the time of peak warming.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
4014	19	16	19	17	The conclusion that reaching net zero net GHG emissions results in declining warming after a temporary peak is a WGI conclusion (IPCC AR6 SPM D1.8 " Emissions pathways that reach and sustain net zero GHG emissions defined by the 100-year global warming potential are projected to result in a decline in surface temperature after an earlier peak (high confidence)." We recognize this topic is covered in WGIII CH. 3 as well although the primary assessment is, we think, in WGI. We recommend citations (lines-of-sight) be given to both WGI and WGIII.	Government of Canada, Environment and Climate Change Canada
14870	19	16	19	17	This sentence implies non-CO2 sources and mitigation strategies contribute to a temporary peak. This appears to conflate non-CO2 including aerosols with non-CO2 GHG sources, whereas cooling aerosol emissions (primarily sulfates and nitrates) are associated with CO2 sources. As shown by Shindell and Smith (2019), reducing non-CO2 GHG emissions is the only way to limit the temporary warming associated with CO2 decarbonization strategies. Here's the citation: Shindell D. and Smith C.J. (2019) Climate and air-quality benefits of a realistic phase-out of fossil fuels, NATURE 573(7774): 408-411, <a href="https://www.nature.com/articles/s41586-019-1554-z">https://www.nature.com/articles/s41586-019-1554-z</a> .	Government of United States of America, U.S. Department of State
14872	19	16	19	17	What is a "temporary peak"? Aren't all peaks temporary by definition? Would the peak occur after net zero emissions achieved or before?	Government of United States of America, U.S. Department of State
2316	19	16	19	18	Suggest inserting 'Sustained' at the start of this sentence to clarify that this refers to an ongoing net-zero state, not an instantaneous one.	Government of Australia, Department of Industry, Science, Energy and Resources
4016	19	16	19	18	The corresponding conclusion is expressed better in CH. 3 ES page 6 lines 6-7: "Reaching and sustaining global net zero GHG emissions, measures in terms of GWP-100, results in a gradual decline in temperature." Two important pieces of information are included in this phrasing vs the current text in the SPM - that sustaining net zero GHGs emissions is needed to get a decline in temperature, and that this result is based on projections using the GWP-100 metric. Using the CH. 3 ES text would also bring the text more in line with the conclusion in the WGI SPM in paragraph D.1.8.	Government of Canada, Environment and Climate Change Canada
5540	19	17	19	17	temporary' is not needed here	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2318	19	19	19	22	Suggest that this explanatory text could be moved to a footnote.	Government of Australia, Department of Industry, Science, Energy and Resources
5542	19	19	19	22	Is this just saying that the carbon budgets used are the right ones? If so, could this just be a footnote to the SPM?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5544	19	19	19	22	This information is not needed in the SPM, or could be moved to a footnote.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9482	19	19	19	22	Cumulative CO2 emissions shown in Table SPM.1 cannot be directly compared with remaining carbon budgets shown in WGI Table SPM.2 because of the category effect and non-CO2 differences described in Box 3.4. In this paragraph, such inconsistency should be stated first to avoid misunderstanding, rather than conditional consistency only stated.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11348	19	19	19	22	C2.1 - the fact that the WGIII assessment is consistent with the WGI carbon budgets is of course most welcome. However, it is not necessary to have a standalone SPM statement just for this. It would be better as a footnote to Table SPM.1.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13238	19	19	19	22	We understand the information in C2.1 to be of general nature, more informative in nature. This is more adequate to be placed as an explanation, even as a footnote for the figure or here in the text.	Government of Switzerland, Federal Office for the Environment FOEN
14874	19	19	19	22	Almost impossible to understand the relevance. This is hard to understand and should be written for a "policymaker" to understand or deleted.	Government of United States of America, U.S. Department of State
6478	19	20	19	20	Please define "are consistent". Since this phrase is being used very often in the AR6 reports, we suggest to add an entry on "consistent with" to the Glossary.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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2320	19	23	19	23	Suggest clarifying the meaning of 'deeper' in 'deeper emissions reductions'. Perhaps insert 'relative to ...' or provide a quantitative estimation of the reductions.	Government of Australia, Department of Industry, Science, Energy and Resources
6480	19	23	19	23	Please specify whether the limitation of temperature overshoot refers to the temperature overshoot itself (e.g. overshoot < 0.1 °C - "not substantial" as being expressed in paragraph B.6.3, footnote 14) or related to the probability of exceeding global warming (e.g. scenarios with no or limited overshoot).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13240	19	23	19	23	What is meant by "deeper" emissions reductions? We need a more robust quantification as a qualifier here.	Government of Switzerland, Federal Office for the Environment FOEN
4018	19	23	19	24	If the conclusion "Pathways designed to limit temperature overshoot involve deeper emissions reductions by the 2030s" is specific to overshooting a global warming level of 1.5C, which we think it is, then the text should be revised to reflect that.	Government of Canada, Environment and Climate Change Canada
9484	19	23	19	24	Does "Pathways designed to limit temperature overshoot" include pathways other than those that limit warming to 1.5 degrees? If not, it would be better to specify "limiting warming to 1.5 degrees with no or limited overshoot."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11350	19	23	19	24	C2.2 "deeper reductions" compared to what? Presumably it is comparing the immediate action scenarios to pathway C3b that achieves the NDCs followed by steep 'forced' reductions.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13242	19	23	19	24	"by the 2030s": this is a too vague of a statement with respect to the timing. Be more precise or rephrase.	Government of Switzerland, Federal Office for the Environment FOEN
14876	19	23	19	24	This statement is contingent on the scenario design, and the results to which it refers are an artifact of the scenarios analyzed. One could submit scenarios that push GHG reductions later and entail deeper negative GHG emissions. It needs to be revised to reflect the contingency on these particular scenario constructions, or deleted.	Government of United States of America, U.S. Department of State
202	19	23	19	25	C.2.2: Required action: clarify that these conclusions are based on predictions from model outcomes.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2322	19	23	19	26	Suggest this sentence is clarified to specify if the deeper reduction is for all GHG gases.	Government of Australia, Department of Industry, Science, Energy and Resources
5546	19	23	19	26	It would be useful to to elevate here language from Chapter 12, "The total emission potential achievable by the year 2030, calculated based on sectoral assessments, is sufficient to reduce global greenhouse gas emissions to half the current (2019) level or less", from p4 lines 2-4	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6482	19	23	19	26	Limiting the temperature overshoot will directly reduce the need for CDR. Hence, deeper emissions reductions by the 2030s will lead to a lower need for net-negative emissions and CDR. We strongly urge the authors to include this crucial relationship (early emission reductions -> lower overshoot -> less CDR demand) here or in the CDR section C.11.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12644	19	23	19	26	Rewrite the sentence to clarify that these are model pathways assessed in the report. Suggested change: "The model scenarios assessed in this report that assume deeper emissions reductions by the 2030s, rely less on net negative emissions in the long term. Rapid near-term reductions also allow the timing of net zero CO2 to be delayed for a given warming level."	Government of India, Ministry of Environment, Forests and Climate Change
13846	19	23	19	26	This para gives very important information, but in our view it should better express that in order to achieve deep reductions by the 2030s it is an urgent need for almost immediate implementation of mitigation efforts. If implementation of mitigation efforts are delayed such deep reductions in the 2030s might not be within reach. Please consider to add language in the start of the sentence on line 24, such as: "Such pathways rely on urgent, timely, ambitious and coordinated action to enhance implementation of mitigation measures, and rely less on ...".	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14878	19	23	19	26	This sentence should be expanded to include the potential impact from timing of more vs. less rapid non-CO2 reductions. Methane reductions in particular could have a significant impact on near-term peak warming and this should be mentioned. This sentence could be rewritten to be more clear, such as "To achieve a given temperature target below current trajectories, GHG mitigation (below current policies) could occur earlier in the period with a longer time to reach net zero or negative emissions; alternatively, GHG mitigation could be delayed and the higher early emissions offset by a greater quantity of negative emissions later. Many pathways on timing and quantities of positive and negative emissions could be compatible with a given temperature target."	Government of United States of America, U.S. Department of State
13244	19	24	19	25	"allow the timing of net zero ... to be delayed for a given warming level". This statement is almost giving a policy recommendation that is: if you do react rapidly now, the timing of net zero can be delayed. Omit the sentence entirely, it is almost policy descriptive.	Government of Switzerland, Federal Office for the Environment FOEN
14880	19	27	19	27	Consider clarifying that aerosol emissions have both cooling and warming effects depending upon the ratio of BC/OC. This sentence could be misinterpreted to conclude that aerosols only have a cooling impact on the climate.	Government of United States of America, U.S. Department of State
1000	19	27	19	28	This is rather odd language. At one level it is a tautology: Non-CO2 warming is due to Non-CO2 emission On another level it is noting that some non-CO2 warming (actually cooling) is caused by CO2 activities i.e FF use. Throughout there is a conflating of the climate impact of non-CO2 GHG emissions (warming) and that of aerosols (cooling). when the reality is that the masking impact aerosol cooling has had on CO2 warming, as both largely derive from the same activities (FF use).	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
4020	19	27	19	28	Suggest adding "warming from" before "non-CO2 GHG emissions". This mirrors the text about 'cooling effect of aerosols'. However, given that some aerosols (e.g. black carbon) have warming effects, should this text be revised to say "net cooling from aerosols"?	Government of Canada, Environment and Climate Change Canada
13848	19	27	19	28	Non-CO2 warming depends not only on non-CO2 GHG emissions and the cooling effect of aerosol emissions, but also on biogeophysical climate forcers, such as albedo. We therefore propose to rewrite: "Non-CO2 anthropogenic warming depends on non-CO2 GHG emissions, cooling or warming from changes in albedo and other biogeophysical forcings, and the cooling effect of aerosol emissions, the latter mostly associated with fossil fuel use.	Government of Norway, Norwegian Environment Agency
1274	19	27	19	31	The contribution of black carbon could be relevant to mention as well (also as it is a win-win when considering air quality)?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
11352	19	27	19	31	C2.3 - The opening line of this paragraph should be the same as in the TS: "Rapid reductions in non-CO2 GHGs, particularly CH4, would lower the level of peak warming". It is really not necessary to say that "non-CO2 warming depends on non-CO2 GHG emissions". The point about warming and cooling effects is important but should come at the end of the paragraph (rather than as a caveat in its opening sentence). The main message (on the need to reduce methane emissions) is the most important. While the effect of mitigation on aerosol cooling is an important issue - we do not see much elaboration on this point when following the line of sight to Chapter 3.3. Perhaps the line of sight should also refer to the relevant sections of the WGI report.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12560	19	27	19	31	The following section should be rephrased to clearly acknowledge the fact that non-CO2 climate forcers do not influence levels of peak warming until net-zero CO2 emissions are achieved, as is mentioned in the headline statement of the following section. Additionally, the cooling effect of aerosols should also include an analysis of cooling provided due to forest fires and volcanic eruptions.	Government of India, Ministry of Environment, Forests and Climate Change
13548	19	27	19	31	Could information be added to this statement regarding what the assumed emissions/reduction levels for non-CO2 (especially CH4) are? Chapter 3 explains that emissions can mostly be reduced to 50%, which is also the maximum reduction given for CH4 in table 3.6. If 50% is the maximum reduction assumed for 1.5/2°C pathways, this should be transparently said in the SPM.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
14882	19	27	19	31	This point about necessary reductions in methane is very important for the agriculture sector. How do F-gases, which are more persistent and trap more heat than CO2 and methane, fit into the necessary emissions reductions?	Government of United States of America, U.S. Department of State
14884	19	27	19	31	Consider separating non-CO2 GHGs and aerosols into separate paragraphs or at least separate sentences. Aerosols and GHGs impact the global climate in fundamentally different ways and should not be combined as a single category of climate forcers compared only to CO2. Furthermore, anthropogenic aerosols (as indicated in line 28) are primarily linked to fossil fuel use and co-emitted with CO2. Due to close links between CO2 and anthropogenic aerosol emissions, there is a stronger agreement to link aerosol forcing with CO2 rather than that of non-CO2 GHGs.	Government of United States of America, U.S. Department of State



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11354	19	28	19	28	Insert "currently" before "mostly" to read "latter currently mostly associated". The relationship is neither necessary nor constant, reductions in coal and diesel use will likely make other sources dominant.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
212	19	28	19	30	C.2.3: The use of 'pathways that limit warming to 1.5' is not accurate and is inconsistent with other working groups reports and with the rest of this report. Replace pathway with 'scenario'.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
13246	19	30	19	30	Harmonize throughout the document: percentage then absolute values in brackets. Here: what is the percentage, of the warming effect by CO2?	Government of Switzerland, Federal Office for the Environment FOEN
14886	19	30	19	30	Change "are" to "are modeled in the range of". These are model results and are a result of the assumptions and methods.	Government of United States of America, U.S. Department of State
1002	19	30	19	31	It this point about CH4 emissions not also true for any greenhouse gas? What is singular about CH4? There is a need for clarity. Policies that provided deep reduction in CO2 emissions will lead to a reduction in aerosols in the atmosphere, leading to less cooling, which to date have mask some of the warming. A reduction in CO2 emissions is likely to lead to a reduction in methane emissions (at least those associated with FF extraction and distribution). However, the impact of these reductions in CH4 emissions are unlikely to fully offset the warming due to the reduction in aerosols. Therefore either greater reduction in CH4 emissions are required (from activities which are not related to FF use), or an accelerated rate of carbon removals (negative emissions). The IAMs use CDR at the scale required but it is not possible (cost effective) on the timescale required for CO2 reductions.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2324	19	30	19	31	Suggesting clarifying why only CH4 is specified in this sentence. Deeper reductions in all non-CO2 GHG emissions at the time of net-zero CO2 would lead to lower peak warming levels.	Government of Australia, Department of Industry, Science, Energy and Resources
13850	19	30	19	31	To our understanding, deep reductions in CH4 emissions will lead to lower peak warming levels also if they happen at another time than exactly "at the time of net zero CO2". Please consider to rephrase this sentence for clarity, if appropriate.	Government of Norway, Norwegian Environment Agency
14888	19	30	19	31	Consider clarifying that deeper reductions of all short-lived non-CO2 GHGs would lead to lower peak warming levels. The scale of CH4 emissions and forcing makes it a particularly important target but targeting HFCs would also lead to lower peak warming levels.	Government of United States of America, U.S. Department of State
2326	19	32	19	32	Suggest clarifying whether 'Net zero GHG emissions based on the GWP100...' refers to CO2 and non-CO2 GHGs.	Government of Australia, Department of Industry, Science, Energy and Resources
4022	19	32	19	33	This assessment that two-thirds of scenarios which limit warming to 1.5C with limited or no overshoot do not reach net-zero GHG emissions is hard to relate to the results shown in Table SPM.1. Table SPM.1 shows that 52% of the corresponding C1 scenarios reach net zero this century, and 30% of the C3 scenarios do. If 2/3 of C1 and C3 scenarios taken together do not reach net zero, then there must be a lot more C3 scenarios than C1 scenarios. Also it is not clear why C2 scenarios are omitted from this assessment - according to Table SPM.1 87% of them reach net-zero GHG emissions this century, so their inclusion would presumably substantially change the assessment. And finally, although it is explained in a footnote, most readers will assume that 'scenarios likely to limit warming to 2C' includes all scenarios likely to limit warming to this level, rather than excluding C1 and C2 scenarios. Suggest re-phrasing in terms of all scenarios likely to limit warming to below 2C (i.e. C1, C2 and C3).	Government of Canada, Environment and Climate Change Canada
11976	19	32	19	33	C.2.4: We understand that two thirds of C1 and C3 pathways do not reach net zero GHGs during the 21st century, but we are not entirely sure if this interpretation is correct. If this statement only refers to C1 pathways, it appears to be inconsistent with the 52% of pathways limiting warming to 1.5°C with no or limited overshoot as provided in Table SPM.1. Please reword in order to be more clear.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
214	19	32	19	34	C.2.4: The use of 'pathways that limit warming to 1.5' is not accurate and is inconsistent with other working groups reports and with the rest of this report. Replace pathway with 'scenario'.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
4024	19	32	19	34	This conclusion that 2/3 of emission pathways that limit GW to 1.5C with no or limited overshoot, or are likely to limit GW to 2C, do not reach net zero GHG emissions during the 21st century is a critical finding for policymakers given the current policy focus and commitments of many governments to net zero GHG emission targets by 2050 or later in the 21st century. These commitments have been understood to be consistent with current science about what is needed, globally, to limit GW to 1.5C (reaching net zero global GHG emissions in the second half of the century as per SR1.5 and UNEP emission gap reports). This result needs to be explained. It is critical. The take home message to governments as it stands will be that reaching net zero GHG emissions this century is not needed and mitigation efforts could be delayed accordingly. We note the useful information in Ch3 section 3.3.2.1 (page 26 lines 50-53) that "IN fact, for scenarios in the category that avoids temperature overshoot for the 1.5C scenarios (C1 category), GHG emissions are reduced already to almost zero around the middle of the century." This implies that while reaching net zero GHGs in ~50% of C1 pathways may not occur before 2100, emissions are almost at net zero by mid-century and presumably stay at that very low level for the remainder of the century.	Government of Canada, Environment and Climate Change Canada
4026	19	32	19	34	This conclusion that 2/3 of emission pathways that limit GW to 1.5C with no or limited overshoot, or are likely to limit GW to 2C, do not reach net zero GHG emissions during the 21st century is not clearly traceable to Table SPM.1 which makes it challenging for readers to be sure of its derivation. We assume this is a rough approximation of the 48% of C1 pathways and 70% of C3 pathways that do not reach net zero GHGs this century, taking into account the much larger number of C3 pathways. This explanation should either be footnoted, or the results should be presented separately for each category. In addition, we would like to see the results for category C2 discussed here also, in particular as the results are so different than for C1 and C3 pathways, with only 13% of C2 pathways not reaching net zero GHG emissions this century. The reasons for this difference need to be made clear.	Government of Canada, Environment and Climate Change Canada
5548	19	32	19	34	"Net zero GHG emissions...are not reached...in two thirds of the pathways that limit warming to 1.5°C with no or limited overshoot, or are likely to limit warming to 2°C." Confusing to group the 1.5 low/no overshoot and likely 2 sets here, when they are referred to separately in almost all other cases. Can they be separated?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5550	19	32	19	34	It is confusing to have the number mentioned here (lumping two scenario categories together) not being one from Table SPM1 - can this fraction be given for categories C1 and C2 separately instead?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5552	19	32	19	34	The language around net zero period should be amended to separate 1.5 low overshoot and well-below 2 degrees.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6948	19	32	19	34	How can the two thirds be derived from the Table SPM.1? And just to reiterate our point that it is problematic that the majority of these 1.5/2°C pathways does not reach net zero GHG emissions, especially as the 1.5/2°C somewhat implies Paris-compatibility. This is of course not the case if net zero GHG is not reached, which is the clear goal of PA's Article 4.1. Please revisit this statement so as not to be potentially misleading.	Government of Jamaica, Meteorological Service Division
13472	19	32	19	34	Which one is the GWP100 here? From AR6?	Government of Estonia, Estonian Meteorological & Hydrological Institute
14890	19	32	19	34	Based on the underlying text (Cross-Chapter Box 3, page 3-41, lines 6-8), the statement in the SPM that "two-thirds of the pathways that limit warming to 1.5°C with no or limited overshoot, or are likely to limit warming to 2°C" is not accurate. From the chapter text (not the Executive Summary text), the share for 1.5°C pathways is 50% and for 2°C pathways is 70%. Thus, recommend changing the statement to either reflect both percentages or to only discuss the 2°C pathway if the "two-thirds" value is used.	Government of United States of America, U.S. Department of State
14892	19	32	19	34	This sentence, stating that net zero GHG emissions are not reached in the 21st century, understates the importance of reductions in non-CO2 GHG emissions. Providing more detail on when net zero GHG emissions is reached or the implications of later net zero would better convey the meaning.	Government of United States of America, U.S. Department of State
5554	19	32	19	35	It's a bit confusing to bundle together 1.5 and 2 here - and the 10-20 years doesn't come out from the table (due to different pathway grouping?)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
4028	19	32	19	38	Some countries have net zero targets for CO2 only while others have targets for all GHGs. How does this influence this finding. Is it more efficient to use one of the other to limit warming?	Government of Canada, Environment and Climate Change Canada

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6484	19	32	19	38	_NET ZERO GHG: If it is the intention of this paragraph to explain that the timing of net-zero GHG is dependent on the GHG metric, please reformulate in a manner that also non-scientists can understand. In addition, it would be very useful for policy makers to understand the key characteristics of the updated pathways (as categorized in the SPM including Table.SPM.1) in comparison to the subset of those pathways that reach net-zero GHG in this century, including their differences in pathway milestones. Please draw on information in section 3.3.2.3 and Cross-Chapter Box 3.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11356	19	32	19	38	C2.4 should be re-organised to include the following points and enhance the policy relevance: i) the finding that net zero GWP100 is not reached in 'two thirds of 1.5°C or likely 2°C scenarios' is not very informative. The more relevant questions to answer are: is net zero GWP100 required in most 1.5°C scenarios? (presumably yes)? What about in 2°C (perhaps not)? ii) rather than focus on whether or not 2°C & 1.5°C require reaching net zero GWP100, it would be more useful to frame the message in terms that are not metric-specific. i.e. in 2°C & 1.5°C scenarios, what level of net negative CO2 emissions are required in order to compensate for temperature overshoot and/or residual non-CO2 emissions? The point that net zero GWP100 implies a gradual decline of warming was made in the WGI report. Here, it is more important to inform policymakers about the eventual need for net negative CO2 emissions to meet temperature goals. Whether or not these combinations of CDR and non-CO2 are considered net zero in the GWP100 metric is of secondary importance.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5556	19	33	19	33	Do you mean two thirds of the pathways including all 1.5C and 2C pathways, or two thirds of 1.5C? I think the former. This needs clarification.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13550	19	33	19	33	We are unable to relate the "two thirds of the pathways" back to the numbers given in Table SPM.1. Maybe this sentence could be more clear on what this refers to.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
4030	19	34		35	This range of 10-20 years seems inconsistent with the results shown in Table SPM.1. For C1 scenarios the difference between median years of net-zero CO2 and net-zero GHG is 45 years.	Government of Canada, Environment and Climate Change Canada
11358	19	34	19	34	Clarify the sentence 'In pathways that do...'. Perhaps to 'In pathways in which they are reached...'	Philippe Tulkens, European Union (EU) - DG Research & Innovation
1012	19	34	19	35	C1 and C3 category results in Table SPM.1 indicate net zero all-GHG is achieved 40-50 years or greater later than net zero CO2 -- please clarify.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5558	19	34	19	35	Net zero GHG '10-20 years later' than CO2 does not appear to be consistent with C1 scenarios in table SPM.1. I assume this is because by referring to "pathways that do [reach net zero GHG by 2100]" it is a different subset, but it is nonetheless confusing presented this way. Separating the two scenarios sets (as per comment above this one) may help to clarify.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14894	19	34	19	35	Based on the underlying text (Cross-Chapter Box 3, page 3-41, lines 11-2), the statement in the SPM that "net zero GHG occurs around 10-20 years later than net zero CO2" is inaccurate. The actual values in the text are 11-14 years (so if one was to round these, they would be 10-15, not 10-20). There is also the issue that the Chapter 3 Executive Summary doesn't accurately reflect the underlying text in the chapter, which is most likely how the inaccuracies made their way into the SPM.	Government of United States of America, U.S. Department of State
11360	19	35	19	35	Insert "anthropogenic" before "CO2 emissions" if that is what is meant. Most removals are (and likely to remain) natural, and it is not always clear to the reader whether the "negative emissions" do or do not include them. Temperature responds to atmospheric concentrations, and concentrations are affected by both natural and anthropogenic emissions/removals alike.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14896	19	35	19	35	"Net zero GHG emissions imply net negative CO2 emissions to compensate for remaining emissions of other GHGs." Suggest more precise language -- for example, "require" instead of "imply" given the finding emphasized in C.11.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
1008	19	35	19	36	Need to qualify "if CO2 removal is the only negative emission option available", or words to that effect.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2328	19	35	19	36	This sentence gives the unhelpful impression that negative CO2 emissions offset ongoing non-CO2 GHG emissions, contrary to the useful framing in the SR15 and the AR6 WG1 that different gases have different behaviours and will follow different reduction trajectories. Suggest rewording to say that negative CO2 emissions compensate for earlier or ongoing CO2 emissions, as is stated in C.3.3.	Government of Australia, Department of Industry, Science, Energy and Resources
14898	19	35	19	36	This sentence is one of the most salient for policymakers and merits putting in the summary of the section: "If non-CO2 GHG do not reach net zero, net CO2 emissions would need to be negative in order to reach net zero total GHG emissions." It seems obvious, but the point is useful for policymakers to understand.	Government of United States of America, U.S. Department of State
1004	19	35	19	37	The statement "Net zero GHG emissions imply net negative CO2 emissions to compensate for remaining emissions of other GHGs." is misleading. It is not clear what "compensation" means in this context. It depends on the metric being used to compare emissions of different gases.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
4034	19	36		37	The conclusion that reaching net zero net GHG emissions results in declining warming after a temporary peak is a WGI conclusion (IPCC AR6 SPM D1.8 "Emissions pathways that reach and sustain net zero GHG emissions defined by the 100-year global warming potential are projected to result in a decline in surface temperature after an earlier peak (high confidence).") This is an assessment about the physical climate system and should not be re-assessed here. Recognizing that there is coverage of this topic in Ch. 3, we recommend including a citation to WGI for this conclusion.	Government of Canada, Environment and Climate Change Canada
1010	19	36	19	37	Replace "are consistent with a gradual decline of warming" with "lead to declining global temperatures in these scenarios" it is a causal link not just "consistent with", and "gradual decline of warming" is ambiguous, since it could refer to a gradual warming slowdown. Also need to be clear this is true across available scenarios, not a physical fact (in a scenario in which net SLCF emissions reach zero, net zero all-GHG emissions would result in approximately stable temperatures).	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
14900	19	36	19	37	This sentence does not convey meaning and could be deleted at no loss.	Government of United States of America, U.S. Department of State
4032	19	36	19	38	Again, as per our comment on the headline statement C.2, should this not state that sustained global net zero GHG emissions based on the GWP-100 metric are consistent with a gradual decline in warming? (i.e. add the word 'sustained').	Government of Canada, Environment and Climate Change Canada
1014	19	39	18	40	This is ambiguous: are missing species expressed as CO2-eq then treated as SLCFs or as CO2-like long-lived forcings? Most will probably be SLCFs, so the former would be more accurate, but the latter is implied.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
526	20	0	20	0	Chapter 6 on Energy systems states in P44 L38 "fossil energy combined with CCUS provides a mean to produce low- or near-zero carbon energy..." this needs to be stated in the SPM to give all possible options to decision makers.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
13474	20	0	20	0	How do the IMP scenarios relate to the C scenarios and WG1 and SR1.5 scenarios?	Government of Estonia, Estonian Meteorological & Hydrological Institute
9806	20	1	20	2	Add in line 2 before "deep", "immediate"	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11362	20	1	20	2	The current formulation can be confusing, and interpreted as (individual) pathways that both keep within 1.5 and 2 degrees. Suggest: Both pathways that limit warming ..... , and pathways that are likely to limit warming to 2 C... involve....	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12562	20	1	20	2	Remove the following part from the statement "and regions"	Government of India, Ministry of Environment, Forests and Climate Change

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238	20	1	20	23	C.3.3: The use of 'pathways that limit warming to 1.5' is not accurate and is inconsistent with other working groups reports and with the rest of this report. Replace pathway with 'scenario'.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
6486	20	1	20	28	The very important component of CDR in all IPs is not really clear in the report. Please elaborate on the scale and associated risks, challenges and overall importance of these technologies for all IPs. In particular, the likelihood of the technical feasibility of using CDR in the scales required for each pathway is missing.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
3410	20	1	20	30	Regarding this whole section, there are no detailed information in this section on carbon sequestration within the land system. AFOLU being in the top 3 sectors in terms of emissions, this would be policy relevant. This last point relates to a more general comment on the treatment of CDR in this report : there is an imbalance between the treatment of technological CDR options, on which a strong and optimistic emphasis is made, and the treatment of "natural" options related to protection, sustainable management and restauration of natural sinks, as well as societal and demand related options, the stakes of which are barely covered. This is the case in particular for solutions related to the AFOLU sector, which lack detail throughout the SPM (not all AFOLU options are equivalent, and neither are all land-based CDR options – the report emphasizes mostly on BECCS and barely details existing soil carbon sequestration options) as well as nature based solutions and ecosystem based approaches. The underlying chapters indicate clearly that without a protection of natural sinks efforts will have to be compensated by additional mitigation action. This seems self-explanatory but it is not covered in the SPM and there is a risk of misunderstanding, in particular from the biodiversity community, if this is not addressed. On demand management options, as a reminder, SR1.5 SPM indicated that "Significant near-term emissions reductions and measures to lower energy and land demand can limit CDR deployment to a few hundred GtCO2 without reliance on bioenergy with carbon capture and storage (BECCS) (high confidence)."	Government of France, Ministère de la Transition écologique et solidaire
5562	20	1	20	30	Section C3 contains some extremely policy-relevant and helpful language on the reductions needed across different fossil fuels, which should be elevated to the headline statement. In particular, clear language on coal, oil, and gas reductions compatible with 1.5C for 2030, 2050, and 2100 should be included here.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5564	20	1	20	30	The models that have been used have limitations that affect the projected reductions in fossil fuel use in this section. For example, if models do not have alternative options to coking coal in steelmaking, then coal will continue to have a role in the sector, even though bio-coke or hydrogen could be used instead. Similarly, some models only consider natural gas as a feedstock for ammonia production when there are options to remove gas from the process entirely. The move to net zero requires a systematic consideration of how to decarbonise each process in the economy, whereas in the past the more minor processes were assumed to not change in the future. Decarbonisation routes under development for some industrial processes are not considered in most models, and it would be useful to comment to this effect if suitable evidence has been collected in the underlying report (which should have happened).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6488	20	1	20	30	<u>_ILLUSTRATIVE SCENARIOS:</u> We appreciate the assessment of various illustrative mitigation pathways since it is very policy-relevant to understand how different combinations of sectoral strategies influence the pathways' properties. However, we miss information about the scenario conditions in the context of the wider sustainable development. We have some questions and would kindly request the authors to amend this section accordingly: 1) It would be very helpful to learn more about the co-benefits and trade-offs of the various IMPs (e.g. in the context of the SDGs). Probably the IMP-SP has the most synergies and co-benefits and only little trade-offs with SDGs. But what about the others? Is IMP-GS or IMP-Neg most advantageous for other SDGs?? Is it correct that only IMP-SP would be beneficial for all SDGs? What is the difference of IMP-Ren and IMP-LD in relation to the SDGs? 2) Why does IMP-SP assume much less CH4 and NO2, and how much more SDGs can be advanced compared to other IMPs? 3) How much CDR (including gross values, not only net-negative emissions) does IMP-Neg need, is this realistic and under which circumstances?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6490	20	1	20	30	<p><b>_UNDERSTANDING SCENARIO INFORMATION:</b> While the usefulness of the categorized emission scenarios and the Illustrative Pathways are intuitively accessible, limitations of the underlying models and their effects on interpretations thereof require explanation. Accordingly, the subject is discussed in some detail at the beginning of Chapter 3 and in Annex III. However, the modelling drawbacks will escape the policymakers' attention when not included in this summary. And especially the policymakers must be made aware of the possible risks that model scenarios can become self-fulfilling prophecies disregarding the fact that they are based on uncertainties or solutions based on technologies with feasibility constraints – which are addressed independently later on in the set of chapters of the WGIII draft report and the SPM – deflecting attention from other mitigation or removal measures. It is clearly stated in Chapter 3 that any model outcome needs to be carefully interpreted and integrated with other inputs in the decision-making process, but this essential information is missing in the summary.</p> <p>Categorized emission scenarios and illustrative pathways as well as the respective models represent complex systems and rely widely on assumptions. Models, Furthermore, can be chosen or designed differently and inputs to the models are not unique while, on the other hand, scenarios often depend on each other. Most models used in this context are heavily influenced by certain economic assumptions, mostly they do not include all mitigation options or do not consider other Sustainable Development Goals. Most do not include the effects of climate change damages nor mitigation benefits of avoided damages. With respect to cost optimization, model results may yield similarly adequate results when allowing for minor deviations or technology deployment – where projecting cost evolution obviously is a difficult task anyway. The quintessence of these arguments is given by the following quote: "Cost-effective pathways can provide a useful benchmark, but may not reflect real-world developments" or mathematically spoken: The approach chosen for the scenarios does not allow for probabilistic interpretation of the outcome. Beyond that, the aforementioned shortcomings of the scenarios amid growing concerns regarding the overreliance on bioenergy and technical carbon dioxide removal have to be assessed with respect to their need for governance.</p> <p>Hence, we propose to add a paragraph that summarises the pivotal limitations discussed in Chapter 3 and gives guidance to the fact that the "different combinations of sectoral strategies" (C.3, SPM-20, 5-7) are not equally realistic or desirable in terms of sustainable development.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13852	20	1	20	30	In our view, the SPM chapter C3 should describe the link between BECCS and DACCS towards the CCS solution when bio-energy is combined with other energy sources. This type of CDR project will most likely utilize the "multiple source - single storage" concept together with other CCS projects on energy and industry. One relevant venue for BECCS will probably be co-firing of biomass and fossil carbon in existing facilities retrofitted with CCS. BECCS and CCS are similar projects in our view. Please consider to elaborate on this in C.3.	Government of Norway, Norwegian Environment Agency
1018	20	1	20	7	It could be emphasised/made clearer that CDR measures are a necessity are seen in all scenarios for 1.5 or 2C.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2330	20	1	20	7	Unclear why CCS is not referenced in this section when Chapter 3 is clear that both CCS and CDR are used extensively in the mitigation pathways as reported in the underlying assessment (Chapter 3, page 3-19). Suggest an additional paragraph be added to expand on the role of <u>CCS in these mitigation pathways</u> .	Government of Australia, Department of Industry, Science, Energy and Resources
3412	20	1	20	7	On this section headline, it may be relevant to modify the order of sentences in order to clarify the logical flow and that various mobilisation of emission reduction options depend on IMPs : 1st, pathways to 1,5/2°C involved deep emissions reductions, 2nd IMPs show different combinations of strategies, 3rd These are achieved through substitution, etc.	Government of France, Ministère de la Transition écologique et solidaire
5560	20	1	20	7	The CDR, energy reduction and renewables trade offs could usefully be here as a key message	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6120	20	1	20	7	This paragraph deals with very low emission scenarios, but does not question consumption patterns. The limitation of energy demand (energy sobriety) is really important, especially for such scenarios. We would like to suggest adding 'limit energy demand' after energy intensity (see C.10.4). In addition, it might be useful to reorder the sections so that C.10 appears at the beginning of the paragraphs about solutions (with C.5), given its fundamental role.	Government of Belgium, Belgian Science Policy Office - Belspo

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9804	20	1	20	7	Add to C.3. Mitigation pathways limiting warming to 1.5°C with no or limited overshoot reach 50% CO2 reductions in the 2030s, relative to 2019, then reduce emissions further to reach net zero CO2 emissions in the 2050s. Pathways likely limiting warming to 2°C reach 50% reductions in the 2040s and net zero CO2 by 2070s"	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12646	20	1	20	7	The word 'regions' here should be removed as the section provides results on sectors and not regions. Additionally, rewrite the sentence to clarify that these are model pathways assessed in the report. Suggested change: "Model scenarios assessed in this report, for more likely than not 1.5 deg. C assume deep GHG emissions reductions in all sectors." The headline statement should not have a subset only of a long list of emission reduction strategies implemented either in reality or in the models. The statement "These are achieved.... remaining emissions" should be removed.	Government of India, Ministry of Environment, Forests and Climate Change
13856	20	1	20	7	Please consider to include that the transition towards a circular economy is a crucial step in order to reach the ambitions of the Paris Agreement. This paragraph underlines the importance to substitute energy intensive materials, but does not consider the option to reduce the amount of materials that are being produced.	Government of Norway, Norwegian Environment Agency
14902	20	1	20	7	The use of "substitution" implies fossil fuels are a first choice, and others are less attractive. Suggest rewording to "reducing or eliminating the use of fossil fuels and rapid deployment of very low or zero carbon energy generation and carriers".	Government of United States of America, U.S. Department of State
14904	20	1	20	7	What is the role of fossil fuels with carbon capture and storage (CCS)? Given government investment and planning in these technologies, it would be useful for policymakers to understand whether scenarios included coal and/or gas with CCS and, if so, the contribution (or not) of these point source CCS technologies (clarifying for what scenarios and noting the limitations of modeling). Page SPM-22 discusses carbon-based fuels produced with net zero emissions and acknowledges regional variation, but providing some sense of the scale would be useful even as a range of regional values.	Government of United States of America, U.S. Department of State
14906	20	1	20	7	This header should include and emphasize the great influence of demand-side measures, which are given a nod in the final bullet in this section (C.3.5) but which receive far greater attention in Chapter 5 and in other parts of the underlying report. The whole demand-side view has received increasing attention over the last 15 years, but here in the SPM is still not given the prominence that it deserves. The text here needs to be more tightly linked to Figure SPM.7 on page SPM-28.	Government of United States of America, U.S. Department of State
14908	20	1	20	7	Except for the reference to CDR, it is not clear that AFOLU included (although the supporting material references it). Suggest modifying header text to read: "... limiting energy intensity, conserving, sustainably managing, and restoring carbon-rich ecosystems, ..."	Government of United States of America, U.S. Department of State
4036	20	1	21	4	This section seems one of the sections that draws the audiences' attentions towards the high-level ideas and illustrations to achieve global net zero GHG emissions. It will be interesting if molders explain in a paragraph/sentences about those driving assumptions or technical options that lead them to the mitigation solution. Particularly, how this illustrative example is consistent with the UN Agenda for sustainable development.	Government of Canada, Environment and Climate Change Canada
13854	20	1	22	19	Regional emission reductions implied by illustrative mitigation pathways could be much more specific, because this is important to allow better informed target setting at national level by policy-maker, and should in our view be reflected in the summary. E.g. C3, line 2, tell us that deep emissions cuts are needed in all regions, and could be supplemented by illustrative numbers or figures. Please also ensure that you include in the line of sight references to the underlying chapters where regional information is provided. Please consider if relevant caveats/reservations on equity considerations in chapter 3 and 4, could be brought forward to accompany such numbers/figures.	Government of Norway, Norwegian Environment Agency
14910	20	1	22	21	Paragraphs C.3 and C.4 are redundant. C.4 is written more clearly.	Government of United States of America, U.S. Department of State
236	20	1	25	32	The text in Chapter 13, L2-3, Pg. 57, states, "Fossil fuel resources are a significant source of exports, employment and government revenues for many countries." This text should be reflected in the SPM, as it discusses the significance of fossil fuel resources for many countries.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20of%20Petroleum%20and%20Mineral%20Resources
14912	20	2	20	3	For clarity, change "These are achieve through" to "Deep GHG emission reductions are achievable through." They are not literally "achieved" as they are hypothetical.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
228	20	2	20	5	C.3: The statement "Pathways that limit warming to 1.5°C with no or limited overshoot, or are likely to limit warming to 2°C, involve deep GHG emissions reductions in all sectors and regions. These are achieved through the substitution of fossil fuels by very low- or zero-carbon energy carriers, limiting energy intensity, reductions in non-CO2 emissions, and deploying carbon dioxide removal (CDR) measures to counterbalance remaining emissions." is prescribing policy with specific policy action rather discussing desired outcomes. It is not in line with Paris Agreement as it targets sources and not emissions. Required action: delete or rewrite the statement without language that prescribes policy.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
6122	20	2	20	5	We do not understand why the expression "energy carrier" is used here. It seems to us that what is needed to achieve GHG reductions is to use low or zero carbon energy sources, regardless of the "carrier" (e.g. H2 is a zero-carbon energy carrier, but depending on how it was produced, it might be actually emission-free or not?).	Government of Belgium, Belgian Science Policy Office - Belspo
14914	20	2	20	5	This is the first time "CDR" appears in the SPM and it would be useful to define in, say, a box of key terms in Section A; it is used repeatedly from this point forward and is not defined until page 29. The explanation should also include the distinction between point source capture (CCS) and CDR options. Clearly distinguish between AFOLU more broadly and intentional biological CDR approaches. This definitional issue also appears on page 32, lines 33-36.	Government of United States of America, U.S. Department of State
1166	20	3	20	3	in lower text expand/define what is an 'energy carrier'	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
4038	20	3	20	3	Would it be appropriate to replace "limiting" by "decreasing"?	Government of Canada, Environment and Climate Change Canada
6492	20	3	20	3	Please clarify what exactly is meant with low-or-zero carbon energy carriers - perhaps some examples could help or a footnote to give a short explanation.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6950	20	3	20	3	Please add an explanation to the text or as a footnote as to what those very low- or zero-carbon energy carriers are.	Government of Jamaica, Meteorological Service Division
11978	20	3	20	3	C.3: The definition of what exactly "very low- or zero-carbon energy carriers" are remains unclear. This should be specified here, possibly in a footnote, and/or in a glossary entry.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
11364	20	3	20	4	fossil fuels have to be substituted by "low - ..... Energy sources" not carriers. Electricity and hydrogen are energy carriers, but produced from carbon sources, they do not led to the needed GHG reduction. On page 22, line 22 the sentence is correct and in line 23 it is wrong again.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11366	20	3	20	4	Some reflection on high-carbon energy carriers such as biofuels and solid biomass would be important.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
6952	20	4	20	4	A balanced and transparent presentation of carbon dioxide removal is important for this SPM so as to give policymakers the full picture. Please point to the feasibility and sustainability constraints mentioned in C.11 here.	Government of Jamaica, Meteorological Service Division
11368	20	4	20	4	What is meant here by "energy intensity"?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11980	20	4	20	4	C.3: While we understand that this section is descriptive only, a footnote should still be added here pointing to potential side effects of CDR (as done in the WGI SPM D.1.4, footnote 45 for instance) or uncertainties of deployment at (the global) scale. This could be done by adding a footnote and pointing to C.11 where this issue is also covered.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13064	20	4	20	4	Provide more information on CDR deployment. This is of relevance for LDCs because of its implications and capacity for access by LDCs, SIDs and other developing countries.	Government of Gambia, Department of Water Resources
13388	20	4	20	4	More clarity on CDR deployment required so as not to imply this as the sole solution - relies on future tech for this being available where tech based CDR is envisioned. This point has also been highlighted above	Government of Kenya, Kenya Meteorological Service



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13552	20	4	20	4	As CDR is mentioned here for the first time in this SPM, a short explainer/footnote should be added here that points to the later assessment of CDR feasibility and sustainability concerns in section C.11.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
1276	20	5	20	5	The "illustrative mitigation pathways" is used here for the first time. A definition should be added where these IMPs are used for the first time in the text.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6954	20	5	20	5	Please introduce the IMPs more clearly here. This comes shortly after the table with the focus on emissions pathway categories and so it is not clear what part the IMPs now have to play? The coverage of IMPs that then follows is very useful and could be expanded further.	Government of Jamaica, Meteorological Service Division
11982	20	5	20	5	C.3: With the IMPs introduced here, it remains unclear how they compare to the emission pathway categories used in the previous sections. Of course, Table SPM.1 relates the pathway categories to the I(M)Ps, but the question remains what the role of the IMPs is. Information could be added to C.3, or more generally. Any revision should include an explanation on how the IMPs here relate to the IPs in the SR1.5.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12564	20	5	20	5	Remove the following part of the sentence "to counterbalance remaining emissions".	Government of India, Ministry of Environment, Forests and Climate Change
5566	20	5	20	6	"Illustrative Mitigation Pathways (IMPs) show 6 different combinations of sectoral strategies that can be consistent with a given warming level." This seems to be contradicted by the heading in SPM.6 (e) where the sectoral breakdown by sectoral source is "for all scenarios reaching net-zero GHG". It may be useful to clarify in C.3 that there are different sectoral strategies, but in all cases it involves the same proportion of emissions to be reduced. (E.g., it isn't the case that in one scenario that more aviation emissions are still allowed, while in another a greater proportion of steel/cement emissions are allowed, as long as these are offset by e.g. afforestation). Alternatively, this could be clarified after lines 15-19 on p.22.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13554	20	5	20	6	The IMPs are mentioned here for the first time (aside from Table SPM.1), which may lead to confusion as their relation to the previously described pathway categories remains elusive. In line with our overall comment regarding the IMPs, kindly provide more information on IMPs and how they can be interpreted vis-a-vis the pathway categories, and more generally consider placing more emphasis on the IMPs in this SPM. They can be clearly understood and provide important information for policy makers regarding the potential design of mitigation portfolios.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
1278	20	5	20	7	The mention of IMPs might suffice to have in C3.1. The point here to make is, assumedly, that different combinations of sectoral strategies can be consistent with a given warming level. The IMPs is a chosen method/framework and as such not a finding.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
4040	20	5	20	7	This sentence does not seem like it needs a high confidence. Perhaps, "different combinations of sectoral strategies can be consistent with any given warming level"?	Government of Canada, Environment and Climate Change Canada
4042	20	5	20	7	Do these illustrative mitigation pathways reflect regional mitigation efforts or do they incorporate International cooperation? If pathways are based on international mitigation cooperation, it can be highlighted to emphasize the significance of cooperative dimensions.	Government of Canada, Environment and Climate Change Canada
6124	20	5	20	7	The expression "different combinations of sectoral strategies" is somewhat mysterious: it would be useful to clarify what "sectoral strategies" refers to (somewhere in this section, in the figure, or in a footnote).	Government of Belgium, Belgian Science Policy Office - Belspo
12566	20	5	20	7	Illustrative Mitigation Pathways are descriptive in nature and are based on SSPs which illustrate key characteristics of possible climate policy futures (as illustrated in Chapter 3), and hence should not be utilised to make definitive statements which might be policy prescriptive. Thus, the following statement should be excised: "Illustrative Mitigation Pathways (IMPs) show different combinations of sectoral strategies that can be consistent with a given warming level".	Government of India, Ministry of Environment, Forests and Climate Change
12648	20	5	20	7	Rewrite the sentence clarifying connections between IMPs and pathways described in Table SPM 1.	Government of India, Ministry of Environment, Forests and Climate Change
9808	20	7	20	7	Add to C.3: The AFOLU and energy supply sectors reach net zero CO2 emissions earlier than the demand sectors. Mitigation challenges are significantly reduced in pathways that assume lower demand or shift development pathways towards sustainability.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
234	20	8	20	14	c.3.1: The statement only takes into consideration two pathways. Re-write to account for other scenarios.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
3414	20	8	20	14	Why is the word "extensive" used here only to describe the use of CDR in energy and industry sectors and not for the other options such as IMP-Ren and IMP-LD?	Government of France, Ministère de la Transition écologique et solidaire
5568	20	8	20	14	Here it is important to note that all pathways have ambitious reductions and immediate and deep actions. "Have common features" in line 9 could be expanded to say "have rapid and deep emissions reductions and other common features", or the common features could be noted in a separate sentence.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6494	20	8	20	14	Please consider pointing a bit more clearly on the general difference between "emission pathways" (see Table SPM.1) on the one hand and "illustrative mitigation pathways" on the other hand.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12650	20	8	20	14	Rewrite describing the relationship between IMPs and pathways as in Chapter 3 in Sec 3.2.5. Add a further bullet describing the key assumptions, including equity, of these pathways.	Government of India, Ministry of Environment, Forests and Climate Change
13248	20	8	20	14	Abbreviations do only make sense if they are used later in the text, in a frequent matter. This argument does not hold true for the ones in the <del>brackets in this paragraph, please delete.</del>	Government of Switzerland, Federal Office for the Environment FOEN
13860	20	8	20	14	Please consider referring to the relevant panels of figure 6, so it is easier to access relevant information in the figure while reading C.3	Government of Norway, Norwegian Environment Agency
12446	20	8	20	18	Although the model shows the pathways that limit warming to 1.5°C, the scenario is only focusing on emission reduction. In reality, energy is more complex than that which also covers reliable supply (energy security) and the affordability of the consumer to pay. Once these factors are taken into consideration, the result will totally be different. This is a classic case of which CCUS was introduced in the first IPCC report in 1996 but unimplementable.	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
13858	20	8	20	30	Net zero with 13% from the AFOLU sector; what is the equivalent in land areas? The land report showed much clearer connections between emissions and land areas. In chapter 3, they refer to specific figures on forests. Please consider to include these perspectives, e.g. in C.3.4.	Government of Norway, Norwegian Environment Agency
5570	20	8	20	9	The IMPs could be usefully summarised in a table.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11370	20	8	20	9	The current formulation can be confusing, and interpreted as (individual) pathways that both keep within 1.5 and 2 degrees. Suggest: Both pathways that limit warming ..... , and pathways that are likely to limit warming to 2 C... involve....	Philippe Tulkens, European Union (EU) - DG Research & Innovation
6126	20	8	22	11	The description of the 5 illustrative mitigation pathways appears too limited. In particular, what is meant by "shifting pathways" in IMP-SP? Please provide a more complete explanation and consider grouping the information that is currently in section C.3.1 and in the caption of figure SPM.6. Perhaps could a small table help in this regard?	Government of Belgium, Belgian Science Policy Office - Belspo
14916	20	9	20	11	All acronyms used in the SPM need to be explained in the SPM text -- for example, the IMPs (IMP-Ren) and low energy demand (IMP-LD), and the extensive use of CDR.	Government of United States of America, U.S. Department of State
4044	20	10			The word 'different' is not needed here and should be deleted.	Government of Canada, Environment and Climate Change Canada
13556	20	10	20	11	Also for this statement on the use of CDR, it is important that the headline statement level C.3 includes a footnote pointing to potential caveats with regard to CDR. Considering that the use of CDR is described as "extensive" here for IMP-Neg, it has to clarified what share of emissions reductions in the IMP-Neg pathways is achieved through CDR (compared to other instruments such as renewable energy).	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
6128	20	11	20	14	The "gradual strenghtening of mitigation actions" (IMP-GS) would benefit from being more detailed, in particular by specifying the temporality. With this limited description, it may seem that we could gradually increase commitments only after 2030, while this pathway actually implies increasing the 2030 NDCs and increasing action already now. It is also important to describe the implications of this scenario in a very clear way.	Government of Belgium, Belgian Science Policy Office - Belspo

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12568	20	11	20	14	The following statements should be removed. Reason: The following pathways are based on the assumptions of SSP1-1.9 which is highly contested and widely considered inaccurate. Thus, this should not be used as a basis for making policy prescriptive statements.	Government of India, Ministry of Environment, Forests and Climate Change
4046	20	12		14	The meaning of 'shifting development pathways' was not clear to us. Could a few more words be added to explain what this scenario is? We note that it appears to be an outlier in terms of its non-CO2 GHG emissions, but the reason for this is not clear from the material contained in the SPM.	Government of Canada, Environment and Climate Change Canada
11372	20	12	20	12	"gradual strengthening": gradual compared to what? The rationale behind these pathways need more explanation. What is the difference in rationale between 'gradual strengthening' and 'moderate action' (shown in Figure 6)?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
1280	20	12	20	14	The statement is rather descriptive without bringing up substance. Further information would be useful here, such as what the implications ARE and HOW the shifting pathways can lead...	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
13250	20	13	20	13	Delete "goals" in "sustainable development goals". First, the 2030 Agenda for Sustainable Development does not only consist of the SDGs but its implementation mechanism is broader than the goals themselves. Second, the Agenda 2030 ends in 2030, whereas we will continue to work towards sustainable development in a broader and general way. The 2030 Agenda is a time-bound agenda that should guide us all towards sustainable development	Government of Switzerland, Federal Office for the Environment FOEN
6496	20	13	20	14	We very much appreciate the inclusion of IMP-SP. However, we think that there is a lot of information missing to make policy makers able to fully understand the main characteristics of IMP-SP. We urge the authors to add information concerning the following issues: 1) Does IMP-SP imply the best (and only?) chance of achieving the SDGs? 2) Does IMP-SP imply transformations in all sectors? 3) From Figure SPM.6 we learned that this is the IMP with the lowest remaining GHG emissions at net zero CO2, as well as IMP-SP exhibits the highest methane and N2O emission reductions. What are the most important mitigation options to achieve the reduction for non-CO2 GHG? As we learned in the SRCCCL that about 44% of CH4 and 81% of N2O emissions can be attributed to the AFOLU sector, we would very much appreciate information on the role of the food sector (diet shifts, reductions of food waste and overconsumptions)? 4) From other statements within the SPM we learned that low non-CO2 emissions at the timing of net zero CO2 will lead to lower overshoots and hence lower demand of CDR. Is this the case for IMP-SP as well? 5) We also find the naming not ideal. To us "shifting pathways" is not a common term, what are they actually? We request to use a wording that is intuitively, e.g. IMP-SDG or IMP-ALL (as in ALL sectors).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11374	20	14	20	14	It is unclear what the confidence statement refers to. The last sentence or the whole paragraph?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
230	20	15	20	16	The following statement in C.3.2 "In pathways that limit warming to 1.5°C with no or limited overshoot, or are likely to limit warming to 2°C, the use of coal, gas, and oil falls on average by about 90%, 25% and 40% by 2050, and by 90%, 40% and 80% by 2100." There is only mention of pathways related to 1.5 there needs to be mention of all pathways as to ensure a balanced view.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
216	20	15	20	17	C.3.2: Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
670	20	15	20	17	The percentages of the use of coal, gas, and oil are not consistent with the underlying report. It is suggested to check to be consistent with the underlying report.	Government of China, China Meteorological Administration
5572	20	15	20	17	This is highly policy-relevant and important information but it's confusing for 1.5C and 2C pathways to be included within the same sentence here - could the figures for fossil fuel reductions separated out for the two temperature goals? Additionally, it would be useful to include a figure for FF reduction in 2030 compatible with 1.5C.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5574	20	15	20	17	again missing base year for % changes	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5576	20	15	20	17	What year are these reductions relative to? Needs to be explicit here.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6498	20	15	20	17	The sentence "... the use of coal, gas, and oil falls on average by about 90%, 25%, and 40% by 2050, and by 90%, 40%, and 80% by 2100" requires further context: we suggest to add a reference to CDR, also mentioned in the headline statement C.3 in line 4.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13558	20	15	20	17	We provided an overarching comment with regards to the problematic bundling together of information on 1.5°C and 2°C. This bullet makes this problem particularly evident, because it seems unlikely that both limiting warming to 1.5°C and to 2°C would require the same level of reducing coal, oil and gas. It is imperative that for this statement, and all such statements in the SPM, differentiated information for 1.5 and 2°C pathways is provided. Particularly after the COP26, its emphasis on 1.5°C as well as the discussions surrounding coal reductions, this information will be needed.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13862	20	15	20	17	Given that oil has higher GHG emissions per unit of energy when combusted compared to gas, and that the reductions are larger than for gas (in the pathways), the sentence could be easier to read if oil is listed before gas.	Government of Norway, Norwegian Environment Agency
218	20	15	20	18	C.3.2: The statement "In pathways that limit warming to 1.5°C with no or limited overshoot, or are likely to limit warming to 2°C, the use of coal, gas, and oil falls on average by about 90%, 25% and 40% by 2050, and by 90%, 40% and 80% by 2100. Almost all electricity is supplied from no- or low- carbon fuels and there is electrification of energy demand." prescribes specific policy with focus on certain sources specific sources. Required action: rewrite without policy prescriptive language.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
220	20	15	20	18	C.3.2: The statement "In pathways that limit warming to 1.5°C with no or limited overshoot, or are likely to limit warming to 2°C, the use of coal, gas, and oil falls on average by about 90%, 25% and 40% by 2050, and by 90%, 40% and 80% by 2100. Almost all electricity is supplied from no- or low- carbon fuels and there is electrification of energy demand." discusses only two warming levels. Required action: rewrite to include other warming levels.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1020	20	15	20	18	the fuels should be ordered according to carbon intensity; coal, oil, gas.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2332	20	15	20	18	Section C3.2. does not include a 5-95% range when quantifying reductions from coal, gas and oil implied from emissions pathways, only averages are given and this appears to be inconsistent with the rest of the SPM. Suggest that a range is provide in addition to the average.	Government of Australia, Department of Industry, Science, Energy and Resources
2334	20	15	20	18	Unclear from the current text how much CCS has been assumed in these reductions. Are these reductions in the absence of CCS, with full implementation of CCS or a mix? Suggest adding text to elaborate on the role of CCS in these reductions	Government of Australia, Department of Industry, Science, Energy and Resources
2336	20	15	20	18	Reductions from gas in the pathways are substantially lower than for coal and oil, is this because of the lower emissions intensity of gas combustion for energy or recognising its role as an industrial feedstock? Suggest adding text on why pathways include less reductions for gas, compared to coal and oil, given the findings provided in section B.7 and C.4 on fossil-based infrastructure which could lead readers to make an equivalence regarding reductions required from different fossil fuels.	Government of Australia, Department of Industry, Science, Energy and Resources
5582	20	15	20	18	Why isn't CCUS and H2 mentioned for end uses, only electrification? If it's about most important/largest, this is useful to say, or add in a sentence on other end use decarbonisation. E.g. C.4.1 covers this	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6500	20	15	20	18	The emission pathways for 1.5°C in this assessment shows much weaker emission reductions by 2050 for gas and oil (-25% and -40%) than the IEA (-55% and -75%). We assume that this difference is caused by the unfortunate merging of 1.5 and 2 C scenarios and strongly suggest to provide separate information for these pathways.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6956	20	15	20	18	A clear narrative for 1.5°C in this SPM is important and will be expected especially after the 1.5 Special Report as well as the political discussions under the UNFCCC, i.e. COP26. Only providing summary statements on 1.5/2°C, and especially regarding fossil fuel phaseouts here, is not acceptable. Please provide separate percentages for fossil fuel reduction needs for 2°C and (what would presumably be higher rates at) 1.5°C.	Government of Jamaica, Meteorological Service Division
11376	20	15	20	18	Could it be differentiated regionally (or between country groups, incl. some conclusions on the role of gas as "transition fuel" in different economies)?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11984	20	15	20	18	C.3.2: It is highly problematic that the necessary reductions for coal, gas and oil are averaged over pathways that limit warming to 1.5°C and 2°C. Especially with the Glasgow Climate Pact and its emphasis on 1.5°C, and the fact that at COP26, phasing out fossil fuels was at the heart of the high level consultations until the very last minute, policymakers will be looking for information in this regard before, during and after COP27. We urge the authors to provide the reductions separately for 1.5°C as well as 2°C pathways as specified in Chapter 3 Table 3.6 on p75. Otherwise, the much more ambitious fossil fuel phase out needs are masked and averaged numbers could suggest the less reductions are needed compared to what is actually required to limit warming to below 1.5°C (and was communicated in SR1.5). The SPM must be explicit regarding the necessary fossil fuel phaseout for 1.5°C pathways. In addition, these numbers should be accompanied by changes in unabated fossil fuel use, to illustrate that fossil fuels can only remain in the system if they are accompanied by CCS, and the challenges associated with CCS should be added as important context. It should also be highlighted that there is variation across pathways, and that there are trade-offs associated with a slower phase-out of fossil fuels.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12390	20	15	20	18	Different amount of reductions in gas production could be suggested for different groups of countries.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12392	20	15	20	18	Different amount of reductions in oil production could be suggested for different groups of countries.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12570	20	15	20	18	The following statement needs to be removed. Reason: The statement ascribes a specific growth and power sector mix which can be achieved through varying combinations of the mentioned energy sources. This prescribes a specific policy position without acknowledging that different nations would utilise different energy mixes to realise their energy needs depending on availability of natural resources. This statement is completely unnecessary and should be deleted.	Government of India, Ministry of Environment, Forests and Climate Change
12652	20	15	20	18	Delete C.3.2. This bullet picks a limited class of scenarios, whose assumptions are not clarified and purports to provide specific numbers without clarification. Further, the singling out of coal in these scenarios is itself stated to be an assumption. In the absence of other possibilities, singling out one class of assumptions is untenable.	Government of India, Ministry of Environment, Forests and Climate Change
13864	20	15	20	18	Please consider including information about use of CCUS on the remaining fossil fuel use in the scenarios.	Government of Norway, Norwegian Environment Agency
13866	20	15	20	18	Please consider to add information about energy use in different pathways/scenarios addressed, as this is important to understand the resulting differences in emissions and temperature development.	Government of Norway, Norwegian Environment Agency
5584	20	15	20	30	Assume low demand or assume policy to achieve low demand?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
	20	15	18	38	It seems relevant here (C3.2) to mention the use of CCS for coal, gas and oil. This is currently not clearly explained in the next and also not clearly explained in figure SPM6.	WGI Bureau,
14918	20	16	20	16	"Falls" from 2020 levels? From projected levels? Be precise. Insert ", respectively," before "by 2050" and "by 2100". Recommend inserting "across all pathways" (or whatever other subset of pathways "on average" refers to) at the end of the sentence.	Government of United States of America, U.S. Department of State
1282	20	16	20	17	Please provide information on the reference year (for the indicated %-reductions).	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
13650	20	16	20	17	It would be useful to insert "respectively" after "...by about 90%, 25% and 40%" and "...by 90%, 40% and 80%"	Government of New Zealand, Ministry%20for%20the%20Environment

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14920	20	16	20	27	This section is well written but it merits some explanation that the results are modeled. GHG reductions by lowered fossil fuel-related emissions are more feasible or less costly according to the assumptions used in the models. Some explanation of "why" would be valuable to policymakers.	Government of United States of America, U.S. Department of State
4048	20	17		18	Specify which year this assessment is for. Is it for 2100 or an earlier year?	Government of Canada, Environment and Climate Change Canada
11378	20	17	20	17	"no- or low- carbon fuels" should be replaced by "low emission energy sources". Not all energy includes fuels, most renewable fuels are carbon-based and the important factor is (net) GHG emissions, not the involvement of carbon as such.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
672	20	17	20	18	It's stated in the underlying report that "Nearly all electricity in pathways likely limiting warming to 2°C or below is from low or no carbon technologies, with different shares of nuclear, biomass, non-biomass renewables, and fossil CCS across pathways", but the SPM uses "carbon fuels" instead of "carbon technologies", which easily causes misunderstandings. It is suggested to be consistent with the underlying report.	Government of China, China Meteorological Administration
5578	20	17	20	18	From which year is all electricity supplied from no- or low-carbon fuels? Please could the year be added?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5580	20	17	20	18	Suggest being more specific about the level of electrification of energy demand. Presumably not all demand is electrified, but the text reads this way.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11380	20	17	20	18	"Electrification of energy demand" needs further clarification. An indication of the degree of electrification assumed would be useful.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13560	20	17	20	18	The sentence states that "almost all electricity is supplied from no- or low-carbon fuels..." - what point in time does this refer to?	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13868	20	17	20	18	It is not clear if the sentence refers to 2050 or 2100, please consider adding this information. Furthermore, the second part of the sentence is somewhat vague - and can be understood to imply that all this electricity is available in the electricity system. Please consider adding some information about the scale of electrification on energy demand and need for capacity in production and grid/transmission lines. Please consider to add information to what extent this will require additional investment in electricity production, grids and transmission.	Government of Norway, Norwegian Environment Agency
14922	20	17	20	18	Recommend specifying degree of electrification in these scenarios. There is some electrification of energy demand already. Maybe "significant electrification"?	Government of United States of America, U.S. Department of State
1284	20	18	20	18	Please provide an indication of the extent of electrification.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
1286	20	18	20	19	The sectors that undergo significant electrification could be mentioned, for useful information.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
5586	20	19	20	20	I don't understand the "medium confidence" attached to this statement: "At the point of global net zero CO2 emissions, total gross emissions from some sectors in the range 3-8 GtCO2 are compensated by net negative emissions in other sectors (medium confidence)." By definition of net-zero, the gross positive emissions must be _exactly_ balanced by the negatives, so surely this must be a statement of fact and not only have medium confidence.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
222	20	19	20	23	C.3.3: The statement discusses only two warming levels. Required action: rewrite to include other warming levels.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20the%20Petroleum%20and%20Mineral%20Resources

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224	20	19	20	23	C.3.3: The statement is written as based on measured data. Required actions: Clarify that these are based on projections from model predictions.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
12654	20	19	20	23	Delete C.3.3. These scenarios that have drastic policy consequences are presented without any qualification whatsoever or acknowledgment of the assumptions that are in-built.	Government of India, Ministry of Environment, Forests and Climate Change
13870	20	19	20	23	In part C.3 it is written about net-zero and how to reach it. Here it is stated, among other things, that the AFOLU sector must reach net zero before other sectors (C3.3). Please consider to highlight how forests play a role in this; e.g. does this mean larger forest areas in the future, and if so, could this be quantified? (figure 3.27, page 65 in chapter 3).	Government of Norway, Norwegian Environment Agency
11986	20	20	20	20	C.3.3: Please specify these other sectors with net negative emissions.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13872	20	20	20	22	This sentence does not give much information on its own without figure SPM 6, and figure SPM 6 is a very comprehensive figure. Please consider referring to the relevant panel of figure SPM 6 so the information is easier to access, and if appropriate, please consider elaborating more in the text as well.	Government of Norway, Norwegian Environment Agency
14924	20	20	20	23	The discussion of timing of mitigation from different sectors is not very clear, based on Figure SPM.6.	Government of United States of America, U.S. Department of State
6958	20	22	20	22	It could be helpful to explain what the "demand sectors" are.	Government of Jamaica, Meteorological Service Division
11382	20	22	20	22	Clarify what is meant by "AFOLU and energy supply sectors" reaching net zero CO2. Does it mean that AFOLU (more correctly LULUCF) would compensate energy emissions? Or the two sectors would achieve it independently of each other? If the latter, it should be explained how energy supply can achieve net zero. It presumably involves BECCS, but then the interaction with AFOLU (the significant land demand assumed, which is counted towards the energy sector, and thus no longer AFOLU) should be clarified.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12444	20	22	20	22	... energy supply sectors reach net zero CO2 emissions earlier than the demand sectors	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
11384	20	22	20	23	the concepts of "supply sector" and "demand sector" need clarification	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12436	20	24	20	27	It is not clear here whether net zero gas emissions are in terms of actual total emissions or in terms of a percentage of gross domestic product (GDP). In general, we think that an increase in GDP can increase the demand for energy. It is not clear whether or not or to what extent the target of reducing energy supply and demand can reduce or affect the rate of GDP growth.	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
1288	20	24	20	24	Could a range be provided also for the 74%?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
14926	20	24	20	24	What about CH4 and N2O? How does the stabilization of these gases interact with statements on CO2?	Government of United States of America, U.S. Department of State
674	20	24	20	26	The percentages of global GHG emission are inconsistent with the underlying report. This paragraph describes contributions of various sectors to emission reduction at global net zero GHG emission level, but fails to specify the emission pathways that lead to the results. The recommendation is to check the underlying report and keep the data consistent, and at the same time, to specify pathways if any or make it clear that the percentages are not subject to any pathway.	Government of China, China Meteorological Administration
13876	20	24	20	26	Please consider to indicate what sectors the reductions of non-CO2 emissions are achieved in, if possible. Also, it would help if you could refer to the relevant panel of figure 6.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14928	20	24	20	26	Clarify whether this is emissions reductions (i.e., exclusive of intentional interventions for CDR), or emissions reductions + CDR. Especially for AFOLU, it would be helpful to clarify the activities that lead to emissions vs. what is assumed to be intentional CDR intervention (setting the baseline for AFOLU CDR is extremely difficult so this clarity is important for metrics development).	Government of United States of America, U.S. Department of State
226	20	24	20	27	C.3.4: The statement is written as based on measured data. Required actions: Clarify that these are based on projections from model predictions.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1022	20	24	20	27	What is the energy demand sector? is it heat? transport? Would it not be easier/clearer to say heat, cooling and transport?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1290	20	24	20	27	If the ranges in (j)s are likely ranges - section A, page 2, line 4 is not clear on this - please provide a clarification here.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
1292	20	24	20	27	If also CDR plays a role, it should be mentioned how much it is assessed to contribute (included in the 74% and in the 13%?).	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
4050	20	24	20	27	Do the illustrative mitigation pathways consider any energy efficiency assumption other than a low energy demand through high carbon/fuel pricing? If so, this important assumption can be indicated somewhere in this subsection.	Government of Canada, Environment and Climate Change Canada
12656	20	24	20	27	As in C.3.2 and C.3.3, delete C.3.4.	Government of India, Ministry of Environment, Forests and Climate Change
13874	20	24	20	27	In our view the text gives the impression that the percentages given here are valid for all the IMPs at the point of net zero GHG. Please consider if this is the case, and if not, please explain which of the IMPs this para relates to.	Government of Norway, Norwegian Environment Agency
14930	20	24	20	27	This point should be connected to Figure SPM.11 on page 42, which shows the relatively tiny amount of investment going into mitigation in AFOLU compared to other sectors, and how this investment would need to be amplified by 10-29 times in order to achieve the available mitigation potential by 2030. These multiplication factors for scaling up are quite a bit larger than those in other sectors, even though the absolute scale of investment (and mitigation) is smaller.	Government of United States of America, U.S. Department of State
11386	20	25	20	25	Consider replacing AFOLU with LULUCF, if it is limited to CO2. Alternatively, eliminate references to LULUCF throughout the SPM and use consistently AFOLU-CO2. It is confusing to see mixed terminology.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11988	20	26	20	26	C.3.4: Please specify main sectors from which these reductions in non-CO2 emissions would come.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13652	20	26	20	26	It might be helpful for the policy-maker to know which sectors are covered in "the reduction of non-CO2 emissions".	Government of New Zealand, Ministry%20for%20the%20Environment
4052	20	27	20	27	While mentioning about the mitigation through non-CO2 gases, do the modelers incorporate avoidance of any potential food security issue in the absence of alternative technologies? If the modelers have introduced alternative technologies that helped to reduce non-CO2 from agriculture and livestock without having any food concern, this dimension should be included in this subsection.	Government of Canada, Environment and Climate Change Canada
2850	20	28	20	28	This claim is paradoxical: it is not clear what measures are needed for a pathway with a lower demand. Carbon pricing is a driver of a lower demand for fossil fuels	Government of France, Ministère de la Transition écologique et solidaire
11388	20	28	20	28	please add pressure on sea as well to read 'pressure on land and sea'.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14932	20	28	20	28	Recommend starting this finding with "Among pathways that limit warming to 1.5°C with no or limited overshoot, or are likely to limit warming to 2°C ..."	Government of United States of America, U.S. Department of State



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9486	20	28	20	29	While BECCS will make pressure on land, DACCS will have small pressures on land. Therefore, it would be better to change from "dependence of CDR" to "dependence of land-based CDR."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9488	20	28	20	29	If we assume lower demand, it is clear that carbon prices are reduced without debates. Rather the important point is how to be reduce demands without large costs. Without great technological and social innovations in demand side, the costs reducing demands can be higher. Please also address how to reduce demands or how to achieve shifting development pathways towards sustainability.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
232	20	28	20	30	The following statement in C3.5 "Mitigation challenges, dependence on CDR, pressure on land, and carbon prices are significantly reduced in pathways that assume lower demand or shift development pathways towards sustainability" There is no specification of the pathways used or the number of pathways observed. The statement needs to be amended in a clearer way that offers specificity of the pathways used/observed.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1294	20	28	20	30	"Significantly" is rather imprecise and more quantitative information would be appreciated, this would also further clarify the role that more efficient energy- and material use, and more sustainable consumption can have.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
3416	20	28	20	30	In terms of the logical flow of this sentence, for a better understanding, it would be useful to invert the two sections, in order to be more conclusive about why this is policy relevant : pathways that assume lower demand or shift development pathways towards sustainability significantly reduce/lower mitigation challenges, dependence on CDR, pressure on land and carbon prices. Furthermore, paragraph C.3.5 should include "and biodiversity" behind "pressure on land", so as to read "[...] pressure on land and biodiversity, [...]". This inclusion is important in order to be consistent with the Executive Summary of Chapter 3 which explicitly notes: "A stronger emphasis on demand-side mitigation implies less dependence on CDR and, consequently, reduced pressure on land and biodiversity. {3.4, 3.7}". Section 3.7.6.2 (p. 3-108) provides further support for this, stating: "Scenarios based on demand reductions of energy and land-based production are expected to avoid many such consequences [deleterious impacts on biodiversity from some climate mitigation and CDR land-based measures], due to their minimized reliance on BECCS (Grubler et al. 2018; Conijn et al. 2018; Bowles et al. 2019; Soergel et al. 2021a). Stringent mitigation that includes reductions in demand for animal-based foods and food-waste could also relieve pressures on land-use and biodiversity (high confidence), both directly by reducing agricultural land requirements (Leclère et al. 2020) and indirectly by reducing the need for land-based CDR (van Vuuren et al. 2018)."	Government of France, Ministère de la Transition écologique et solidaire
11390	20	28	20	30	Could you be more specific what "shifting development pathways towards sustainability" means in practical terms?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11392	20	28	20	30	The sentence is rather cryptic. What is it trying to say?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11990	20	28	20	30	C.3.5: Information contained in this bullet should be elevated to the headline statement C.3 given the negative effects described in this bullet, and the fact that they are significantly reduced by for example the shifting of development pathways towards sustainability. Much more prominence should be given to these sustainable pathways.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13878	20	28	20	30	Please consider if section C.3.5 could include some more information about differences between all pathways by also including less sustainable or high demand pathways. Please also consult with the authors of SPM of AR6 WGII which also deal with these issues.	Government of Norway, Norwegian Environment Agency
13882	20	28	20	30	This message is highly policy relevant, please keep. You may also consider to add a qualifier connected to carbon prices, as it is written now it can either be understood that carbon prices are significantly reduced or that the significant reduction is connected to the whole list, including mitigation challenges. Please consider if a clarification is needed.	Government of Norway, Norwegian Environment Agency
13884	20	28	20	30	Please consider to provide quantification of the need for CDR in different pathways in this SPM, e.g. here in C.3.5.	Government of Norway, Norwegian Environment Agency
14934	20	28	20	30	Define "sustainability". Suggested rewrite: "... shift development pathways towards sustainability, including improved services for well-being". Recommend replacing "sustainability" with "decarbonization" (or other more precise language).	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13880	20	28	30	20	C3.5 is important to keep as it refers to pressure on land. It would be helpful if this finding is elaborated with information from figure 3.27 or 3.28, page 65-66 in chapter 3 about afforestation, less land use for crops and grazing (while grazing areas with large amount of carbon captured in the soil should not be converted to forest), and trade-offs on land use and food systems.	Government of Norway, Norwegian Environment Agency
5588	20	29	20	29	I think the clause "...or shift development pathways towards sustainability..." requires additional explanation; given that it is presented as an alternative to "...pathways that assume lower demand..." to what does it refer?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6960	20	29	20	29	This states that mitigation challenges etc are reduced in pathways that assume "lower demand" - lower demand for what? It would be helpful to specify.	Government of Jamaica, Meteorological Service Division
11394	20	29	20	29	"lower demand": for what?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13252	20	29	20	29	Change "sustainability" to "sustainable development". See overall and general comment on the use of that terminology.	Government of Switzerland, Federal Office for the Environment FOEN
14936	20	29	20	29	The phrase "shift development pathways towards sustainability" is vague and merits some explanation. From a current technologies/policies trajectory, what is different that makes them more "sustainable"? Otherwise, the phrase has no meaning for decisionmakers.	Government of United States of America, U.S. Department of State
3300	21	0	21	0	This figure includes 6 sub-figures. Part of panel a is a scheme with year of net-zero emissions. Light blue is explained in the legend, but not dark blue. Panel d presents a partition of CO2 emissions per sector for 2019 and for five IMPs which correspond to different times of net-zero CO2 emission (x-axis). However, there are no values on the x-axis.	Government of France, Ministère de la Transition écologique et solidaire
3302	21	0	21	0	The black curve in Panel b showing historical CH4 emissions must be extended until 2019 or 2020. The legend of the black curve is missing.	Government of France, Ministère de la Transition écologique et solidaire
3304	21	0	21	0	The black curve in Panel a showing historical CO2 emissions must be extended until 2019 or 2020. It is a very policy-relevant information since it would show the difference between the assumptions and the actual situation. The legend of the black curve is missing.	Government of France, Ministère de la Transition écologique et solidaire
3306	21	0	21	0	Please separate Policies pathways and Illustrative Mitigation pathways: having a mixture of color scheme and patterns make the figure difficult to read.  It might be valuable to add on the righthand side of panel a) the temperature range resulting from those pathways	Government of France, Ministère de la Transition écologique et solidaire
3308	21	0	21	0	The color used for C3 scenarios in the sub-figure of panel a is darker than the corresponding color in the legend	Government of France, Ministère de la Transition écologique et solidaire
3314	21	0	21	0	In the figure SPM6, the meaning of negative emissions for energy supply should be explained in more details.	Government of France, Ministère de la Transition écologique et solidaire
3316	21	0	21	0	In the figure, a graphic with the global GHG emissions (in MtCO2eq) would be an interesting additional piece of information.	Government of France, Ministère de la Transition écologique et solidaire
5590	21	0	21	0	It's difficult to see the overlapping areas on panels a, b and c. Perhaps the overlapping areas could be shaded in a different colour to the other areas.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5596	21	0	21	0	For methane (fig b) why is red line (current policies) outside of the range of current policies (shaded)? Also for figure on year of net zero, what do dark blue bars represent?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5600	21	0	21	0	The label "renewables" for IMP-REN in Figure SPM.6 suggests renewables are not important in other scenarios. An adjective is needed to set the renewable characteristics apart here (e.g. "widespread renewables"?).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5602	21	0	21	0	It would be very useful to have a figure of global GHG emissions combining all GHGs, like Figure SMP.5, but to 2100. This would show the spread of net zero GHG among scenarios. Such a figure was missing from the SR1.5 report, and this omission has led to a lot of misunderstanding of what it means to set net zero CO2 or GHG targets, and the implications of picking one over the other. The practical result is that many have interpreted net zero CO2 and the date needed for net zero GHG.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2338	21	0	21	4	Figure SPM.6, panels a-c: suggest clarifying the difference between the shaded areas and the lines, especially for the red shaded (current policies) and red line (current policies) in panels b and c. The legend indicates the line is a central estimate and the shaded area is the range; however, the two do not intersect in panels b and c. Should there be a shaded area for the orange and green lines?  Suggest clarifying the 'moderate action' scenario compared with the 'gradual strengthening of current policies'. As it is, the graph suggests that the 'moderate action' scenario results in less reduction than 'gradual strengthening of current policies' - this may suggest that current policies are stronger than 'moderate action'.  The 'scenarios below 1.5 with little or no overshoot', the 'extensive use of net negative missions', and 'gradual strengthening' pathways become negative' emissions pathways post~2050, post~2060 and post~ 2075 respectively. It may appear to readers that 'Scenarios below 1.5 with little or no overshoot' and 'gradual strengthening' do not include negative emissions, whereas all of them include the use of negative emissions to greater or lesser extent.  Panel d is difficult to understand. It seems to be trying to show the relative contributions of emission sources and sinks 'at time of net zero CO2' of the scenarios shown in panels a-c. Suggest labelling panels d and e as 'CO2-eq' rather than 'CO2'.	Government of Australia, Department of Industry, Science, Energy and Resources
3310	21	0	32	0	What do the triangle marks in this box-plot represent in the left bottom panel ?	Government of France, Ministère de la Transition écologique et solidaire
11992	21	1			Figure SPM.6: The figure might be even more clear if panels (d) and (e) showed timeseries instead of the bars, specifically those from Chapter 3 Figure 3.7. Also, what exactly is "energy supply (negative)"? Please at least add an explainer to the figure caption. Also, this figure could show more clearly which IMPs belong to which warming category. For example, those that limit warming to 1.5 with low/no overshoot should be clearly indicated. Otherwise readers need to cross-reference. It looks like the legend box has arranged pathways by their warming category, but this isn't entirely clear.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
240	21	1	21	1	Figure SPM.6: Required action: rewrite title to indicate that the presentation is based on projection and remove the language that is leaning towards policy-prescription (involve deep ...).	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
242	21	1	21	1	Figure SPM.6: The title is written as based on measured data. Required actions: Clarify that these are based on projections from model predictions.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
1296	21	1	21	1	The lower subpanel ("Year of net emissions") in panel a has blueish colours also for "likely below 2oC", while the legend to its right has a grey colour, please adjust as appropriate.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
1298	21	1	21	1	Subpanel (d), the heading... "compared to" may give a wrong characterisation as the 2019 emissions are shown in addition to/for reference/in comparison. Actual "compared" is not done. Please adjust as appropriate.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
1300	21	1	21	1	Subpanel (e), the colour of the 2019 total emissions could be some other than black, as black is also used to mark "direct emissions" in the breakdowns to the right. (The 2019 total emissions are of course for the direct emissions as it is the total, but confusion may still arise.)	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
1302	21	1	21	1	Subpanel (e), it is not readily clear why the error bars (whiskers) are so much outside the bars that denote median emissions reductions. Is this a graphical presentation choice or a statistical aspect?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
1304	21	1	21	1	In Subpanel (e), does the AFOLU include the sectors CO2 emissions only? If so, why is it not included in the "contributions by sector"?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2074	21	1	21	1	It is hard to understand why the line for current policies (b, c sub-sections) is off the red-shaded box	Government of Republic of Korea, Korea Meteorological Administration
2460	21	1	21	1	in lower part of panel a it is not entirely clear what the dark blue bar represents, legend missing?	Government of Denmark, Danish Meteorological Institute
4054	21	1	21	1	Figure SPM.6: As per our general comment, we encourage the authors to consider adding a panel here to show net GHG emissions for the selected emission pathway categories. It is hard to understand why so many low emission pathways do not reach net zero GHG emissions this century without this visualization. Also, and again as per our general comment, there is inconsistency in the title to this figure and in the legend in how category C3 pathways are described (limiting warming TO 2C or to BELOW 2C). Finally, two small technical comments: 1. we assume this is just a graphic design error, but the colour shading for C3 pathways in the panel showing the year of net zero emissions does not match the colour in the legend; 2. please explain what the downward pointing arrows are in the panel showing the timing of net zero emissions.	Government of Canada, Environment and Climate Change Canada
4056	21	1	21	1	Figure SPM.6: it is very hard to see the faint dotted line representing the IMP-low demand pathway. Recommend engaging designers to distinguish the various pathways more clearly.	Government of Canada, Environment and Climate Change Canada
5592	21	1	21	1	Panel e: why focus on Net Zero GHG emissions in this figure given that only a minority of the scenarios (even in C1 category) reach this threshold?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5594	21	1	21	1	suggest reordering to "rapid, deep and sustained" as that is the order that they happen	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5604	21	1	21	1	Ref the Mitigation Pathways figure, in particular panel a, the Year of net-zero emissions diagram under the line graphs. Due to the size or similar colouring of the small arrows, it is difficult to identify the different net-zero years. Could these arrows be adapted, or the figure enlarged to aid visibility?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6130	21	1	21	1	Figure SPM.6: in panel a), the readability of the lower subpanel (year of net zero, which is important) could probably be improved. A legend for the symbols which are used in this subpanel should be added.	Government of Belgium, Belgian Science Policy Office - Belspo
6502	21	1	21	1	Figure SPM.6 Panel c: We expect that IMP-Neg imply a high amount of BECCS and are wondering of such low N2O emissions (much lower than the other IMPs except IMP-SP). Is it possible that IMP-Neg does not include the emissions of fertilizing? Or are there other CDR technologies used?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6504	21	1	21	1	Figure SPM.6, graphics in sub-panels b and c: it does not get clear, why the ranges for the projected development of emissions under current policies (light red) are below the red line for current policies for the same type of emission (CH4, N2O). In case this is not a mistake in the graphic, an explanation would be helpful to understand, which scenarios can be expected under current policies.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6506	21	1	21	1	Figure SPM.6, text for sub-panel d: an explanation why the contribution of the AFOLU sector varies substantially between the Imp-GS and the Imp-NEG scenario would be helpful for the reader. Without an explanation, the graphic might be misleading and allow for the interpretation that the potential of the AFOLU sector can be raised at good will (e.g. by applying the same amount of AFOLU reductions under the Imp-NEG scenario as under the Imp-GS scenario), reducing the need for decarbonisation of other sectors.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6508	21	1	21	1	Figure SPM.6: Please consider to rephrase: "net negative emissions" are not "extensively used", they are intended to be achieved. According to paragraph C.3.1. the description of IMP-Neg "extensive use of CDR" could be used instead.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6510	21	1	21	1	Figure SPM.6., panel d: please explain what is meant by "Energy Supply (negative)". BECCS? If it is only BECCS we request to be more specific and name BECCS.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9490	21	1	21	1	The lower sub-panel of Figure SPM.6a is not fully described for what is indicated by the horizontal bar extent, the location of the triangle marker, and their colors.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs

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11396	21	1	21	1	Figure SPM.6 panel d. The title says "Net zero CO2 emission systems,...." but the bars seem to include also non-CO2. Should it not be "GHGs" instead of "CO2" in the title?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12658	21	1	21	1	All scenarios must be included in the figure. Displaying only the extreme scenarios is misleading.	Government of India, Ministry of Environment, Forests and Climate Change
13886	21	1	21	1	Please consider to clarify that both panel d) and e) treats anthropogenic emissions, e.g. by including "anthropogenic" in the second subtitle. Otherwise the figure can be misunderstood to also include natural sinks, that are dealt with in other parts of the report.	Government of Norway, Norwegian Environment Agency
14240	21	1	21	1	Please include/take into account nuclear in the 1,5 degrees C with no or limited overshoot scenario.	Government of Romania, National Meteorological Administration
14938	21	1	21	1	In Figure SPM.6a (lower sub-panel), what is the dark blue bar for? Scenario below 2°C? The legend uses gray for scenario below 2°C. Does the light blue in lower panel use the same legend to the right? What do the arrows mean? The legend or caption needs to explain.	Government of United States of America, U.S. Department of State
14940	21	1	21	1	In Figure SPM.6b, the range of baseline emission pathways range for current policies is much lower than the red CurPol line and the range and the line do not overlap. Does the Current Policies range (in red) include Moderate Action (ModAct) policies as well? It is not clear.	Government of United States of America, U.S. Department of State
14942	21	1	21	1	In Figure SPM.6e, it is not clear what the solid and hatched bars represent. Assume that the solid bar represents end-use energy emissions and the hatched bar represents waste energy emissions. The definition of direct and indirect should be clarified for panel e.	Government of United States of America, U.S. Department of State
14944	21	1	21	1	Revise or eliminate Figure SPM.6e. The representation in terms % of 2019 emissions when negative emissions are involved and the treatment of AFOLU and non-CO2 is unclear and misleading.	Government of United States of America, U.S. Department of State
14946	21	1	21	1	Figure SPM.6a,b,c do not communicate a lot and are very complex. Suggest deleting so the messages of Figure SPM.6d,e come through more clearly.	Government of United States of America, U.S. Department of State
14948	21	1	21	1	The heading to Figure SPM.6 should appear near the very front of the SPM. It is a critical take-home, much more policy-relevant than the precise rates of GHG emissions over the past decade.	Government of United States of America, U.S. Department of State
14950	21	1	21	1	Figure SPM.6e emphasizes only CO2, and therefore obscures the critical nature of non-CO2 reductions. Second, it is difficult to understand how land sinks factor into this figure. Third, other forms of negative emission CDR technology are not clearly identified. For these reasons, this figure creates significant challenges in messaging and interpretation. There are several potential solutions. First, at a minimum, the non-CO2 contributions should be labeled co-equally with their own gray box, and potentially broken out by gas. Second, treatment of negative emissions from land use sinks and CDR technologies should be explicitly included (these are necessary in addition to any fossil + CCS being more clearly labeled). If these cannot be accommodated, suggest deletion of Figure SPM.6e.	Government of United States of America, U.S. Department of State
5606	21	1	21	2	Should the text at the bottom of panel d read "At time of net zero ..." or something similar?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6512	21	1	21	2	This is a very useful and understandable illustration for the target audience of this report. Please keep it and improve it (like all illustrations) by using larger font sizes and line weights. For boxes b and d in the legend, please add headings for the three principally different emission pathways for methane and for the seven illustrative mitigation pathways used. Also, the colours for "scenarios likely to be below 2°C" and for "scenarios likely to be below 1.5°C" in panels b and c are not clearly distinguishable. Please improve this.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9860	21	1	21	2	panel 6a: in the lower sub-panel is difficult too read and it is unclear what is the difference between the dark and light blue colours (dark blue does not have a match in the legend under panel 6b. Also unclear what the little arrows/triangles mean.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
9862	21	1	21	2	In panel 6e better for clarity to delete the first bar '2019' and switch the order of 'contribution by sector' and 'total direct and indirect'.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
13654	21	1	21	2	In panels d and e, the key for GHG emissions lists both "AFOLU" and "Non-CO2". It is not clear if non-CO2 GHGs are included in AFOLU, or if these non-CO2 emissions are included in Non-CO2. Please clarify what is included where. The use of the sector "AFOLU" continues to not be particularly relevant in a policy context.	Government of New Zealand, Ministry of the Environment

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13894	21	1	21	2	In figure SPM.6 panel e), please consider adding an explanation below the two bars for AFOLU and non-co2 to the far right in the panel, since an explanation is given below the other bars.	Government of Norway, Norwegian Environment Agency
13896	21	1	21	2	This is an important and good figure. However, we find it difficult to understand the link between the mid and right panel of panel e). The solid and hatched bars in the mid-panel does not sum up to the solid hatched column in the right panel. Please consider to explain the indirect use a bit clearer.	Government of Norway, Norwegian Environment Agency
13898	21	1	21	2	In our view the legend for the two lowermost panels (d) and e)) is somewhat confusing. Please consider to split the legend into four parts, that are matching the design of panel e), one for 2019, one for sectors, one for direct and indirect emissions and one for AFOLU and non-CO2.	Government of Norway, Norwegian Environment Agency
13900	21	1	21	2	In panel a), b) and c) it is difficult to see the difference between the blue and the grey color? Please consider to make the difference clearer.	Government of Norway, Norwegian Environment Agency
13902	21	1	21	2	SPM.6 Panel a): The colours used in the "Year of net-zero emissions" figure are not clearly explained in the legend. Is this representing 1,5 and 2 degree scenarios?	Government of Norway, Norwegian Environment Agency
14952	21	1	21	3	Figure SPM.6d lists time on the x-axis, but does not specify the years.	Government of United States of America, U.S. Department of State
5598	21	1	21	4	Could remove ModAct pathway here, as it's not making any key points	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6514	21	1	21	4	Figure a "Global CO2 emissions": Please add the explanation of the darker 'pigeon blue' bar in the lower sub panel "Year of net zero emissions".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9492	21	1	21	4	According to Box TS.5 Table.1 of the Technical Summary (page TS-40), the categories of scenarios and their relationship to CMIP6 scenarios and illustrative mitigation pathways (IMPs) are described. In Figure 6, the CMIP6 scenario (SSP) should be added to each scenario.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11398	21	1	21	4	Some explanation is needed regarding comparison between the pathways in this figure and those in Figure 5. While Figure 5 has immediate action vs delayed action (NDCs until 2030), Fig 6 introduces concepts such as "gradual strengthening" (which nevertheless seems to be more rapid reduction than NDCs to 2030) and "Moderate Action" - which is not explained. What does "moderate" mean? The scenario does not appear to moderate the temperature. It would be more useful to replace this scenario with the NDC scenario from Figure 5 (if it is possible to disaggregate the NDC emissions in different gases).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11400	21	1	21	4	Panel a, lower sub-panel. The arrows need to be explained.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11402	21	1	21	4	Panel d contains some counterintuitive results regarding both total and sectoral emissions. Would it be possible to explain these in a panel or in the text? * IMP-Neg does not appear to use any more negative emissions than IMP-GS (although a lower share of it is AFOLU). Why is this? * Why does IMP-Ren have higher non-CO2 emissions?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11404	21	1	21	4	Panel e: add "upstream" after indirect to give more clarity on the meaning in 'indirect' before having to read the legend.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11406	21	1	21	4	In panels d. and e., AFOLU should be disaggregated into "agriculture" and "LULUCF", so that their magnitudes (and presumably opposite sign) are made clear. If a chart contains only CO2 (as suggested by titles and labels), then only LULUCF should be used, but then the grey "non-CO2" bars should be removed or explained.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11408	21	1	21	4	In Panel e, "indirect" emissions for AFOLU are missing, although they are very substantial both for agriculture and LULUCF (not entirely clear how that is interpreted in the figure). It should either be included, or mentioned why it is missing for this sector.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13888	21	1	21	4	Figure SPM 6 panel a) is a good figure in general, but it would be helpful if you could clarify whether the green line is in accordance with the scenarios 1.5°C or 2°C , or none of these.	Government of Norway, Norwegian Environment Agency
13890	21	1	21	4	Figure 6d – "Energy supply (negative) seems to be a new name for BECCS (BIOCCS). It would increase the readability to use BECCS as a name for the column in the legend, since we are now familiar with that name from previous reports. If Energy (negative) is not the same as applying BECCS, this should be clarified.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13892	21	1	21	4	6e – it is difficult to understand, if one is not familiar with it already, that the AFOLU sector has to reduce emissions and go from net emissions to net uptake/storage. Does the blocks reflect the whole change from + 6-7 Gt (emission) to -5Gt?	Government of Norway, Norwegian Environment Agency
13904	21	1	21	4	Please consider to change the title of panel d) to "Net zero CO2 emissions in Illustrative Mitigation Pathways compared to 2019 emissions."	Government of Norway, Norwegian Environment Agency
2076	21	2	21	2	Is there any reasoning to determine the order of pathways? For instance, the upper part of the figure has a shifting pathways at last while the bottom part has the same pathway in the second last.	Government of Republic of Korea, Korea Meteorological Administration
6516	21	2	21	2	Figure SPM.6 Panel d and e. We do not understand and find it reasonable to separate the emissions sector-wise and in CO2 and Non-CO2. It could be perceived as if non-CO2 emission are another sector separated from the others. As we learned in the SRCCL about 44% CH4 and 81% of N2O can be attribute to AFOLU. Panel e, where AFOLU and non-CO2 are grouped and sum up to about 25% of the 2019 emissions, is in particular misleading. In Panel d however, more than 25% are non-CO2 emissions. This does not add up. We strongly request the authors to rethink the grouping of emissions as it will lead to confusion.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11410	21	2	21	2	panel d: what values are associated with the 'time of net-zero CO2'?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13906	21	2	21	2	In figure SPM.6, panel d), below the bars, the tag on the x-axis reads: "Time of net zero CO2". Therefore, it seems like each individual bar may be tagged with the specific year the IMP is expected to reach net zero CO2 (Eg., we suggest "2060" for the IMP-Neg bar, in accordance with the IMP-Neg curve in panel a). Please add to the x-axis the year in which individual "emission systems" reach net zero CO2.	Government of Norway, Norwegian Environment Agency
14954	21	2	21	2	In Figure SPM.6b, for CH4 and N2O, explain why the average lines lie outside the ranges.	Government of United States of America, U.S. Department of State
14956	21	2	21	2	For Figure SPM.6d, the text discusses timing to reach net zero for different sectors. Does information in this figure support this statement? If yes, timing should be provided. In addition, consider changing the legend to "time of net zero CO2" or "time at net zero CO2".	Government of United States of America, U.S. Department of State
14958	21	2	22	19	Figure SPM.6 portrays every AFOLU scenario switching from a source to a sink. It is unlikely that there is scientific justification for this complete switch of the AFOLU sector. There will (very likely) always be emissions associated with the AFOLU sector and this figure implies that the AFOLU sector will accomplish net-zero emissions (or better) under the entirety of emission scenarios. The green bars of the AFOLU sector would be more accurately represented as straddling the x-axis of zero with some emissions above the x-axis (sources) and some sequestration (sinks) below. Figure SPM6d provides an incorrect representation of the AFOLU sector. AFOLU will always have some sources and some sinks and not be entirely a net-zero sink for the foreseeable future.	Government of United States of America, U.S. Department of State
3312	21	3	21	3	A reference to Fig. TS.10 could be added (see page TS-45)	Government of France, Ministère de la Transition écologique et solidaire
13254	21	8	21	14	Abbreviations do only make sense if they are used later in the text, in a frequent matter. This argument does not hold true for the ones in the figure, please delete.	Government of Switzerland, Federal Office for the Environment FOEN
4058	21				Figure SPM.6: Panel d shows negative emissions from AFOLU and from energy supply (presumably BECCS). Is clear air carbon capture and storage considered in these scenarios? If so, it is not clear that it would fit into either of these categories.	Government of Canada, Environment and Climate Change Canada
4060	21				Currently, the black line in panels a,b and c is not explained in the caption. This appears to be historic CO2 emissions. Assuming this shows total CO2 emissions, why is the amount in 2019 less than reported in Figure SPM.1? If instead the black line shows FFI CO2 emissions only, this needs to be mentioned in the caption, especially as panel d does show AFOLU emissions; therefore, readers would expect panel a to also include AFOLU emissions. Additionally, we are puzzled by the seeming discrepancy between year 2019 emissions shown in panel d and year 2019 emissions from Figure SPM.1. FFI CO2 emissions (top of dark blue bar) appear to be less than the 38.3 GtCO2/yr figure reported in Figure SPM.1. Total CO2 emissions also appear to be less than 44.6 GtCO2/yr (from SPM.1).	Government of Canada, Environment and Climate Change Canada
5608	21		21		Figure 6e: The labels 'Contributions by sector' and 'Direct and indirect' are confusingly placed as the sectors are also split into direct and indirect.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14962	22	1	22	19	In the Figure SPM.6 caption, it would be helpful to explicitly refer to the Chapter 3 discussion of IMPs.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
4062	22	1	22	2	The lower panel of panel (a) does not appear to show the timing of net zero emissions by source. The text here in the caption should be corrected to be consistent with what is shown in the panel.	Government of Canada, Environment and Climate Change Canada
14960	22	1	22	2	Clarify what "and timing of when emissions from different sources reach net zero CO2 and GHG emissions" means. Is this an assumption? A model result? Or maybe add "under the illustrative, modeled pathways" at the end? As it stands, the sentence seems incomplete. Add "modeled" before "development". These are counterfactual and illustrative.	Government of United States of America, U.S. Department of State
1180	22	3	22	4	"<scenarios below 1.5oC.." and "<scenarios likely below 2oC pathways" Either remove < or "scenarios < 1.5oC" and "sceanrios < 2oC"	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
13414	22	3	22	4	It is not clear what "<scenarios" means in these lines	Government of Kenya, Kenya Meteorological Service
14964	22	5	22	11	Explain "high" emissions. Relative to what? How likely or plausible is "high"? Why is CurPol described as "high"? Just say "current policies" if that is what this represents. Same with ModAct. Why is that "high"? Compared with what?	Government of United States of America, U.S. Department of State
14966	22	8	22	8	After "... policies.);" add "Different assumptions would yield different model results."	Government of United States of America, U.S. Department of State
13656	22	8	22	9	The use of "space" (in the phrase "explores a wide scenario space") is jargon which should always be avoided. Could easily be replaced with: "explores a wide range of scenarios"	Government of New Zealand, Ministry%20for%20the%20Environment
6518	22	9	22	10	This is the first time the difference between IP and IMP is explained, but the various abbreviations are already used in various preceding places in the report. Please ensure that the abbreviations are explained in context when they are used for the first time (e.g. in Table 1). We suggest to just use IP, since it all seven are illustrative. This will reduce confusion.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11412	22	12	22	12	The reference to panel d should probably refer to GHGs and not "CO2".	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13908	22	12	22	14	Please consider to reformulete since there are no significant removal of non-CO2 emissions. E.g. "...respective sectoral composition of CO2 emissions sources and sinks and non-CO2 emissions."	Government of Norway, Norwegian Environment Agency
1306	22	13	22	13	The "compared to" gives a wrong impression s the 2019 emissions are shown in addition to/for reference/in comparison/are also shown. Actual "compared" is not done. Please adjust as appropriate.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
14968	22	15	22	15	Insert "modeled" before "contributions" (which should be plural).	Government of United States of America, U.S. Department of State
1308	22	15	22	19	Some explanation of why the "sum" of the direct and of the indirect emissions in the middle part of the subpanel do not add to the total direct respective indirect in the part furthers to the right of the subpanel would be useful to include. I.e., the total length of the direct respective the indirect contributions would seem to be longer in the "contributions by sector" than in the "total" part (Due to compensating uncertainties?)	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6520	22	16	22	18	Wording "service sectors" used here to represent transport, buildings, industry. In other parts of the document, for the same sectors "demand sectors" is used. Please assure consistency throughout the SPM.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6522	22	17	22	18	Please define indirect (up-stream) CO2 emissions reduction more clearly for better understanding.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
5610	22	18	22	18	"Up-stream" means different things in different industries. Please be more specific.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13658	22	18	22	19	Similar to the comment on page 21 above (regarding AFOLU and non-CO2 emissions) this sentence needs to be clear about what is included in AFOLU and what sectors are included in non-CO2 emission sources.	Government of New Zealand, Ministry%20for%20the%20Environment



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
1024	22	18	22	24	More detail on transport options and timelines for these is needed.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
13910	22	20	22	20	Please consider to include a table that connects the information from Figure SPM.6 to more concrete information about global indicators that comes out from the Mitigation Pathways. Please look towards the Special report on 1.5C global warming when setting up such a table, and as far as possible it would be desirable that such a table can be used together with the information already provided in Figure SPM.6 on page 21 and Table SPM.1 on page 17. Without such a table, it might be a general need to add more quantification in the SPM text and therefore it could be more efficient to collect such information in a table.	Government of Norway, Norwegian Environment Agency
11994	22	21			C.4: Considering that this is the first bullet which elaborates on the different sectors in more detail, a footnote should be added that clarifies that the following assessments are presented in a general way / with regard to the global level, and cannot go into regional detail, and might not apply in the same way to all regions of the world.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13562	22	21	22	21	C.4 as the start of the sectoral bullets should contain some type of information (as a footnote or possibly also as part of a short chapeau text ahead of these sectoral bullets) that information will be provided mostly at the global level, while the information provided might look different for different regions and context. We understand the need for brevity in the SPM but would welcome more regional-level information in the sectoral bullets, or at least pointers where statements would be different for developed and developing countries. Otherwise some of the findings in these sections appear somewhat developed-country centric.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
1028	22	21	22	22	"reductions in fossil fuel use" is quite a weak summary of the assessment findings. The assessment present evidence that the unabated use of fossil use (as in without carbon and storage or corresponding levels of CDR) will need to be effectively eliminated.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
11414	22	21	22	23	The statement "reductions in fossil fuel use" is too vague, given that Chapter 6.6 states that "Net-zero energy systems will use far less fossil fuel than today (high confidence)". Compare with B7 which makes clear that, globally, current and planned fossil fuel infrastructure (with typical use patterns) is incompatible with 1.5°C.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
248	22	21	22	24	C.4: Required action: rewrite without the verbs that prescribe policy, such as "involve", and specific policy actions, such as reductions in fossil fuel use. Also, the focus shouldn't be on sources but on emissions.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
264	22	21	22	24	C.4: "Transformations" require stringent and rapid actions and human and financial resources in very short time which might not be available at this time for every country. The principle of Common But Differentiated Responsibilities and Respective Capabilities (CBDR-RC) outlined in the United Nations Framework Convention on Climate Change (UNFCCC), recognizes that countries have different duties and abilities to address the negative impacts of climate change. System transitions is more suitable implying the varying levels of resources of different countries. "System transformations" should be replaced with "system transitions".	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
676	22	21	22	24	According Section 6.7 in the underlying report, the statement that current investment in fossil fuel-based infrastructure will bring significant risks to limit warming within 1.5°C, fails to directly draw the conclusion that "locking-in" high emissions. It's suggested to revise it as "The continued installation of fossil fuel-based infrastructure risks leads to limited effects of other mitigation activities.	Government of China, China Meteorological Administration
1030	22	21	22	24	instead of saying involves major energy system transformation - should you not say that limiting warming to 2 or 1.5 involves net zero co2 energy systems which entail...etc. ?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2340	22	21	22	24	Suggest including reference to the role of CCUS in reducing emissions from fossil fuel based energy systems. It is the emissions from fossil fuels, rather than their use per se, that are drivers of warming.	Government of Australia, Department of Industry, Science, Energy and Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
4064	22	21	22	24	Please better emphasize what is new for net-zero strategies that differs from AR5. Is it the transformation? If so, this does not highlight that. It looks more like the list of technologies and approaches from the wedge.	Government of Canada, Environment and Climate Change Canada
5612	22	21	22	24	Heading could include the points made in paragraph C.4.2 & C.4.3 that some low carbon systems are more economically attractive than carbon-intensive systems, and reducing fossil fuel use to limit warming risks stranded fossil fuel infrastructure.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6132	22	21	22	24	It is important to provide a definition of "energy carrier" in the SPM (at least as a footnote). In this specific paragraph, if "energy carrier" is kept in this section, it might be useful to clarify why it is not sufficient to use low carbon energy sources: is it to reduce the fugitive emissions of methane, and/or because low energy carriers are needed to use low carbon energy sources...?	Government of Belgium, Belgian Science Policy Office - Belspo
6962	22	21	22	24	The sector-focussed paras starting with C.4 are clear and give a good overview. Of course the SPM needs to be brief and cannot go into all the differences between regions of the world, but currently it is not clear enough from the paras if the findings apply to "all" regions of the world or just some. Especially for developing countries, the situation may be different. Please clarify where possible which regions the sector-focussed findings apply to, or add a general "disclaimer" on the applicability of the findings to developing and developed regions.	Government of Jamaica, Meteorological Service Division
9810	22	21	22	24	C4: There is no attention at all to the increasing challenge of intermittency of renewable energy sources with increasing shares and the increasing importance of energy storage to deal with that. This needs a separate sub-paragraph.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
13256	22	21	22	24	The lead para is an excellent example that is suitable and accessible for the policy-makers (policy relevant). The language is phrased adequately.	Government of Switzerland, Federal Office for the Environment FOEN
13390	22	21	22	24	C.4 is very clear and concise. We commend the authors for this.	Government of Kenya, Kenya Meteorological Service
12452	22	21	22	30	Limiting warming to 2°C or 1.5°C involves major energy system transformations inter alia: reductions in fossil fuel use, the deployment of low-carbon energy sources, switching to low-carbon energy carriers, and greater energy efficiency and conservation. The continued installation of fossil fuel based infrastructure risks 'locking-in' high emissions	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
2342	22	21	22	43	The underlying assessment indicates that energy storage will be a key enabler of net zero CO2 energy systems. Suggest that the role of energy storage is elaborated on in this section.	Government of Australia, Department of Industry, Science, Energy and Resources
14970	22	21	22	43	Repetitive with C.3. Port relevant content to C.3 and delete C.4 in entirety.	Government of United States of America, U.S. Department of State
14972	22	21	22	43	The use of "low-carbon" vs. "zero carbon" in C.4, C.4.2, and C.4.3 seems inconsistent with earlier statements about decarbonization. Is there a precise definition of "low carbon", and is this operational or embodied?	Government of United States of America, U.S. Department of State
13914	22	21	23	34	Please consider if the description of net zero energy systems in C.4.1., and possibly in C.5.3 in respect to zero emission targets, could include information on how these explained changes will affect the conversion of land, and associated emissions and sinks.	Government of Norway, Norwegian Environment Agency
6964	22	21	23	6	Please clarify how the term low-carbon is understood and defined in this report.	Government of Jamaica, Meteorological Service Division
11996	22	21	23	6	C.4: In this section there is consistent use of the terminology "low-carbon". It has to be ensured that the terminology is consistently used throughout the SPM and also clearly defined in the glossary.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13912	22	21	23	6	Please consider to highlight the role of bioenergy and other biobased options in limiting warming to 2 or 1,5 deg C. We propose to add language, e.g drawing from ES Ch7 (page 6, line 1-5) preferably in C4 to clarify the role of bioenergy and other biobased options in limiting warming to 2 or 1,5 deg C.	Government of Norway, Norwegian Environment Agency
13916	22	21	23	6	Please consider to include more concrete information about scale and time of key developments in the energy system in pathways limiting warming to 2C and 1,5C, as this is policy relevant.	Government of Norway, Norwegian Environment Agency
13918	22	21	23	6	Please consider to include more information about the role of energy efficiency for the future of the energy system.	Government of Norway, Norwegian Environment Agency

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13920	22	21	23	6	Please consider to include more information about the role of balancing technologies such as utility scale batteries, electrolyzers and abated natural gas. Grid requirements and energy market design and scale is also of policy relevance to manage the variability, production site and transmission challenges and uneven distribution of renewable energy between regions. This is relevant because renewable energy to a lesser extent can be stored or transported in bulk and therefore rely more on the electricity grid than fossil fuels. Given that the underlying science is based on scenarios, perhaps some information can be included about different consequences of different choices for the future of the energy system.	Government of Norway, Norwegian Environment Agency
13922	22	21	23	6	Please consider to include concrete information about the use of CCS og BECCS in net zero energy systems.	Government of Norway, Norwegian Environment Agency
13924	22	21	23	6	Please include more information about mitigation options used on the remaining fossil fuel use in the scenarios (ref SPM C3.2).	Government of Norway, Norwegian Environment Agency
260	22	21	24	20	The text in Chapter 13, L23-24, Pg 52, states, "Effective climate change mitigation can cause economic and social disruption where there is transformative change, such as changes in energy systems away from fossil fuels." This text should be reflected in the SPM, as it discusses economic and social implications and disruptions of transitioning away from fossil fuel.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
13926	22	21	27	6	Figure SPM8 lists many mitigation options. As we understand this all the measure could not be implemented at the same time, as there are overlaps and perhaps also competition for e.g. bioenergy. We would appreciate a better description for the connection between mitigation options both in relation to figure SPM 8, but also in the sector part of sections C.4 to C.10. Also a notion of the relative importance of the sector-mitigation should be added to the text. Figure SPM 6 panel e) could be the right place to understand this, but this figure is too complex and deficient to convey this message. Please consider to include co-benefits and trade-offs also in this sector-part of the SPM.	Government of Norway, Norwegian Environment Agency
14974	22	21	27	6	Sections C.4 through C.10 appear to be based on technological feasibility, and not necessarily economic or market feasibility, and not necessarily supported by empirical experience. This should be made clear at the beginning, perhaps with a couple of sentences before Section C.4. It is one thing to surmise or model that technologies can produce a particular result, and quite another to find policies that can induce the technological change in politically and economically feasible ways. These sections have not actually considered the policies necessary to induce those changes (or it is not evident).	Government of United States of America, U.S. Department of State
12660	22	21	22		After "...energy system transformations" insert the words " among other measures"	Government of India, Ministry of Environment, Forests and Climate Change
13928	22	22	22	22	Please define and exemplify low-carbon energy sources and low carbon energy carriers, or/and add to the glossary.	Government of Norway, Norwegian Environment Agency
2132	22	22	22	23	Considering C.4.1 contents, "greater systems integration" would be added to the end of the sentence.	Government of Republic of Korea, Korea Meteorological Administration
13930	22	22	22	23	The difference between low-carbon energy sources and low-carbon energy carriers can be interpreted in several ways. Would it be better and still appropriate to change this formulation to "the deployment of low-carbon energy production and transmission, and switching to low-carbon energy carriers...?"	Government of Norway, Norwegian Environment Agency
2854	22	23	22	23	The three options are put on the same level, which creates an ambiguity. Either this means that it is necessary to use all three options at the same time or that they are substitutes for each other. Adding a " both " would emphasise the need to combine all three options.	Government of France, Ministère de la Transition écologique et solidaire
2344	22	23	22	24	Suggest 'The continued installation of unabated fossil fuel-based infrastructure should be carefully considered, as it risks 'locking-in' high emissions'. Limited new fossil energy installations potentially with CCS, low capacity utilisation, offsets, and/or option for future conversion to renewable fuels such as hydrogen could have a place and even support renewable uptake where it provides flexibility to respond to variable renewable output as reported in section 6.7 of the underlying assessment.	Government of Australia, Department of Industry, Science, Energy and Resources
2852	22	23	22	24	This sentence is relevant for policy makers. In order to be more concrete, it could also reflect the description in C.4.3 of the economic impact of these risks (trillions of dollars) given its potential magnitude and the redistributive problems that could result.	Government of France, Ministère de la Transition écologique et solidaire
4066	22	23	22	24	Suggest adding to the last sentence of this headline the phrase "or conversely, risks stranding fossil-fuel related infrastructure". This is well supported by para c.4.3 and keeps the focus of the headline on the implications of limiting warming to low GW levels.	Government of Canada, Environment and Climate Change Canada

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9908	22	23	22	24	(C.4): Phrasing of concerns over fossil installations is inconsistent with section B7 (see also separate comment): "continued installation" is not necessarily the same as "existing and current planned" installation. Suggest to adopt the latter formulation also here.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11416	22	23	22	24	The continued installation of fossil fuel - based infrastructure risks 'locking-in' high emissions (high confidence). Risk and high confidence do not go well hand oin hand. Please consider replacing 'risks' with 'results in' or 'leads to' or something in the category.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12576	22	23	22	24	If the risk associated with the following statement cannot be adequately quantified, then this statement should be deleted from this section. It should only be retained if concrete numbers related to the level of risk associated can be furnished.	Government of India, Ministry of Environment, Forests and Climate Change
14976	22	23	22	24	The reference to Section 16.4 is not well supported. The discussion of lock-in is better addressed in 16.2 and 16.6, with 13.3 providing additional support. Similar point made in 16.2.2.2, page 16-17. See also 16.6.2.2 (page 16-81) and 13.3.1 (page 13-23, lines 6-11).	Government of United States of America, U.S. Department of State
12662	22	23	22		Insert new sentence after "...and conservation": The immediate reduction of high consumption and profligate energy use behaviour in regions and households above the global average is another major transformation that is essential (Line of sight from Chapter 5).	Government of India, Ministry of Environment, Forests and Climate Change
12664	22	24	22		Delete last sentence. Replace by "Continued use of fossil fuel infrastructure should be limited by restricting cumulative emissions to an equitable share of the remaining carbon budget, based on national and regional circumstances.	Government of India, Ministry of Environment, Forests and Climate Change
11418	22	25	22	25	Consider redrafting from 'limited use of fossil fuels' to 'phasing out of fossil fuels'.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13934	22	25	22	25	Please consider rephrasing to "...: limited use of unabated fossil fuels". Most mitigation scenarios see some use of fossil fuels at the time of net zero (also described i SPM 3.2)	Government of Norway, Norwegian Environment Agency
14978	22	25	22	25	Is "limited use of fossil fuels" precise, or does this mean "limited use of unabated fossil fuels"? Is the finding robust in assuming CCS or fossil conversion with carbon management is available?	Government of United States of America, U.S. Department of State
246	22	25	22	27	C.4.1: Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
678	22	25	22	27	Net zero emissions from energy systems cannot be achieved by industrial methods. It is suggested to change it to: "Net zero CO2 energy systems entail: limited use of fossil fuels; widespread electrification with electricity systems with reducing CO2 emissions, including through the use of CDR; energy conservation and efficiency; greater systems integration; and nature-based solutions for carbon sequestration."	Government of China, China Meteorological Administration
4068	22	25	22	27	Unclear if systems integration includes recycling, light-weighting and other material efficiency measures, which should be mentioned. There also should be mention of reducing overall consumption.	Government of Canada, Environment and Climate Change Canada
13932	22	25	22	27	Please consider if it is appropriate to also include reduced consumption/demand in this paragraph.	Government of Norway, Norwegian Environment Agency
250	22	25	22	30	C.4.1: Net zero CO2 energy systems' can be achieved through other means. The list is not extensive to all the options. The authors should specify that these are some of the means.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2346	22	25	22	30	This paragraph could read as policy prescriptive, suggest revising to 'Net CO2 energy systems could include a combination of:....'	Government of Australia, Department of Industry, Science, Energy and Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5614	22	25	22	30	Suggest deletion of this paragraph. It isn't incorrect, but the discussion of net zero energy systems looks a bit odd when the next paragraph is about low-carbon energy systems, and the references to underlying chapters aren't all relevant; 3.4.2 is about energy supply, not net-zero energy supply, and 3.4.7 is about CDR, but not in conjunction with energy systems. 16.4 doesn't mention net-zero or CDR at all. Looking at section C.3.3, which says "total gross emissions from some sectors .... are compensated by net negative emissions in other sectors", the formulation of sections C.4-C.8 seems a bit odd and inconsistent. C.5 (industry), C.6 (cities) and C.7 (buildings) all refer to net-zero within these sectors, but C.8 (transport) does not refer to net-zero for the transport sector. And it's not obvious why "CDR" is mentioned (row 26) in connection with the energy sector, but none of the other sectors. So recommend that for consistency net-zero is not mentioned in any of these sector-specific sections (C.4-C.8).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5616	22	25	22	30	Helpful to also reference that power generation from (stored) hydrogen (previously produced in no or low carbon method) can also provide system flexibility that complements greater renewables generation. (i.e. rather than turn off wind turbines, we can divert their surplus power to hydrogen production, store that hydrogen, and burn it carbon-free for power generation as and when needed, i.e. during periods of minimal wind/ constrained renewables generation).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14980	22	25	22	30	Section 16.4 doesn't discuss combinations of energy carriers, but rather combinations of innovation policies and how they differ as a consequence of national and regional factors. This line-of-sight callout isn't entirely wrong, but seems misplaced. 13.7 would be more appropriate.	Government of United States of America, U.S. Department of State
13340	22	25	22	36	Too general to be useful for policymakers. More specific information and examples about what has been successful in what context and under what circumstances would be useful. Sections E4.4 and E4.5 are good examples for such exemplary formulations.	Government of Switzerland, Federal Office for the Environment FOEN
1032	22	27	22	27	Explain greater systems intergration, e.g. what, how when?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1200	22	27	22	27	This needs to be caveatted with "Modelled scenarios which result in limiting warming...". Remebering that the model have not considered the full solution space (indeed it is not clear that the models have sampled solutions across the full spectrum of solutions). The scenarios identified "entail" significant emissions reductions of other GHGs including in sectors largely unrelated to fossil fuel consumption. If these parallel reductions in the emissions other GHGs are not achieved, then even more rapid and complete decarbonistaion and larger scale deployment of negative emissions are required to limit warming to 1.5 and 2.0 degrees.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5618	22	27	22	27	"Amenable" suggests technical feasibility is the only factor but what about decarbonising at least cost? "Applications that are harder or more expensive to electrify" would be more consistent.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
680	22	27	22	28	At present, there are conditions limiting the scope of application of nitrogen oxides as energy carriers. If ammonia, which is also toxic, is recommended to be used as a mainstream energy carrier, it is suggested that conditions and restrictions of the application be clearly given as well.	Government of China, China Meteorological Administration
4070	22	27	22	29	The balance of electrification and other energy carriers is very key to these transitions. This does not tell us anything that we don't already know. Can this be unpacked?	Government of Canada, Environment and Climate Change Canada
2856	22	28	22	28	Are we sure that all these energy carriers have a positive carbon balance? Or a positive energy balance between their production and end use?	Government of France, Ministère de la Transition écologique et solidaire
5620	22	28	22	28	Text says 'energy carriers such as hydrogen, biofuels and ammonia...'; more accurately it should say 'low carbon energy carriers such as low carbon hydrogen, biofuels and low carbon ammonia...'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11420	22	28	22	29	"fuels produced with net-zero co2": here and elsewhere in the report, it would be clarified how the GHG impacts of processes, sectors or technologies are interpreted (system boundaries, scope). Does it include only direct production processes? Or also the source of energy, and the manufacturing of equipment, all transport involved, etc? How are circular assumptions avoided (e.g., fuels are produced with net zero CO2 because all inputs assume the use of fuels that are produced with net zero CO2, etc.)? Policy makers should know how to get to that situation from today, when the production of all fuels involve at least some CO2 emissions. Sequencing would be important.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11998	22	28	22	29	C.4.1: Defining a carbon-based fuel as having net zero CO2 emissions means that any lifecycle emissions from the process of developing the fuel would need to be balanced by removals. Is this sentence referring to fuels that truly have net zero CO2 emissions, or is there alternative terminology that could be used?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
5622	22	29	22	30	Would anticiate the mention of sectoral variation as a circumstance which could impact the "the most appropriate combinations" for energy mixes due to the technical limitations of some fuels in certain processes - could authors please clarify?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13258	22	29	22	30	Add "... depend on national and regional circumstances and governance frameworks."	Government of Switzerland, Federal Office for the Environment FOEN
14982	22	29	29	30	"The most appropriate combinations depend on national and regional circumstances" is too vague to be useful.	Government of United States of America, U.S. Department of State
1310	22	31	22	31	The "in some circumstances" is somewhat vague. Additional information on this would be useful.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
244	22	31	22	32	C.4.2: " transitioning to low- carbon energy systems is now in some circumstances as economically attractive...". Include details of the mentioned circumstances.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
2348	22	31	22	32	Suggest replacing 'low-carbon' with 'lower carbon intensity' and replacing 'than maintaining carbon-intensive systems' with 'maintaining the carbon intensity of the existing energy systems'. As it is, the phrase suggests a binary of low-carbon versus carbon-intensive rather than a spectrum through which transition can occur.	Government of Australia, Department of Industry, Science, Energy and Resources
2858	22	31	22	32	"in some circonstances" is very vague is it a technology per technology view, or sectoral or national	Government of France, Ministère de la Transition écologique et solidaire
9496	22	31	22	32	It would be appropriate that the 1st sentence of C.4.2 is followed by "with the help of proven policies." It is necessary to clarify whether C.4.2 and C.4.3 are addressing BAU economic markets or markets with political measures.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11422	22	31	22	32	as economically attractive, or more economically attractive' needs more granularity in terms of adaptation costs, first mover advantages, etc. Also, what does 'in some circumstance' mean? If the statement refers purely to the isolated cost of the mitigation action, it needs to be spelled out as it is quite different if the economic cost of late mitigation and high adaptation needs to be factored into the picture. (Minor point: grammar could be improved.)	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13564	22	31	22	32	It is our understanding that the statement only refers to the costs of low-carbon vs carbon-intensive systems, while the avoided costs of avoided climate change impacts, in low-carbon scenarios, do not even factor into this statement. If this is correct, this information should be added to this bullet, or even the conclusion revised based on how the situation would look if avoided impacts were factored in.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
15642	22	31	22	32	The statement is unclear on whether the presented assessment was made including taking into account the avoided climate impacts in a world with low-carbon energy systems. This would of course have significant effects on the conclusion made, and should be transparently reported here.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
6966	22	31	22	33	Any such statements comparing the benefits of low-carbon vs carbon-intensive systems must make clear whether this also takes into account benefits from avoiding climate impacts? And if that has not been accounted for for this statement, the situation would be different? Please clarify and reword.	Government of Jamaica, Meteorological Service Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12000	22	31	22	33	C.4.2: It's important to note here that the assessment that low carbon energy systems can be economically more attractive than maintain carbon-intensive systems does not take potential co-benefits or the benefits of avoided climate change impacts into account.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
262	22	31	22	34	This text should reference underlying chapters that discuss dilemmas associated with meeting SDGs and the importance of considering wider impacts on development in order to do so for fossil-dependent developing countries and non-producers who rely on fossil fuel because of its low cost and availability compared to alternatives. Required action: Include this in the SPM.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1034	22	31	22	34	The word "now" is redundant in this sentence. The phrase"...in some circumstance as economically attractive, or more economically attractive.." is very vague, and does provide insight to policy makers as to which systems may be exhibiting this change in economic outlook. Need to use more direct language. I take section to mean some existing FF energy infrastructures can be replaced with low-carbon technologies at zero or negative cost.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
9494	22	31	22	34	Expressions like "economically attractive" and "economical attractiveness" should be avoided because they are ambiguous and sound associated with a certain value judgement. If the "economical attractiveness" means amount of energy produced per unit cost, it should be expressed as such.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
5624	22	31	22	36	The economic attractiveness of low-carbon technologies also depends on the extent to which future costs are discounted (6.7). This could be mentioned here.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12456	22	31	22	36	Malaysia seeks further clarification in terms of long term mitigation costs involved particularly for policy design and implementation revolving the developing countries	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
12666	22	31	22	32	Delete first sentence.	Government of India, Ministry of Environment, Forests and Climate Change
4072	22	32	22	32	Economically attractive is not clearly or universally understood. Is it cost-effective or do the benefits outweigh the costs?	Government of Canada, Environment and Climate Change Canada
2860	22	32	22	33	"Cost reductions in key technologies, particularly in electricity and light-duty transport" leads to confusion. Electricity and light-duty transport costs are highly relative and depend on policy designs. It would be more precise to mention "Cost reductions in key technologies, particularly in batteries for electric vehicles"	Government of France, Ministère de la Transition écologique et solidaire
5626	22	32	22	34	Useful to clarify here if the the statement about cost reductions for electricity is for specific electricity generation technologies as grid electricity prices remain relatively expensive.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5628	22	32	22	34	C4.2 – 'cost reductions in key technologies, particularly in electricity and light-duty transport, have increased the economic attractiveness of near-term low-carbon transitions.' Electricity is still expensive and that cost is a key barrier to companies implementing these kinds of technologies. The high cost of electricity is not noted here.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6524	22	32	22	34	The notion "Electricity" is opaque. Electricity is not a technology. The sentence -although correctly transferred from the underlying report- does not make sense. It should be spelled out which technologies are being referred to or add something along the lines: "technologies deployed in the electricity sector."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6526	22	32	22	34	The notion of "light-duty transport" -although correctly transferred from the underlying report- appears strange in the context here. "Light-duty transport" obviously encompasses all kinds of electric vehicles that are non-heavy duty ( for which the underlying report notes e.g. trucks, buses, ships, and trains). The notion of "electric vehicles" could be better suited here and seems more adapt to the level of the statement.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14984	22	33	22	33	Consider clarifying the cost reduction aspects with "particularly in electricity generation" if pertaining to "energy storage". Or simply state "costs to produce electricity have decreased".	Government of United States of America, U.S. Department of State
2350	22	34	22	34	Suggest clarifying the meaning of 'long-term mitigation costs are not well understood...' Is this suggesting that the pathway to net zero is not clear for the hardest to abate sectors?	Government of Australia, Department of Industry, Science, Energy and Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11424	22	34	22	34	Long-term mitigation costs are not well understood: please clarify. Does it mean they are uncertain?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
1036	22	34	22	35	Very vague. What aspects are not understood? Discount rate, consideration of costs of environmental and economic harm. Market response to action/inaction. need clarity or else this is just a open statement which may induce delay in policy development.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2862	22	34	22	35	Please consider clarify if it is at the national level	Government of France, Ministère de la Transition écologique et solidaire
12002	22	34	22	35	C.4.2: Wouldn't long-term costs of fossil fuels also be unpredictable to a certain degree? How do uncertainties with regard to future low-/no-emissions technology costs compare to those of fossil fuel ones?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
5630	22	34	22	36	How do long term costs depend on policy design? If it means that well designed policy can reduce (long term or short term?) costs, and so can deployment itself, this is a key point to make	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9498	22	34	22	36	Definitions of near-term and long-term should be clearly stated somewhere in SPM. In the current form of SPM, it is sometimes suggested that near-term means "until 2030" (e.g., p.14, L.7-8) and that long-term means "up to 2100" (e.g., p.3, L.6)but it is still vague whether that applies elsewhere in the text.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11426	22	34	22	36	The sentence suggests that policy and technology costs are the only cost factors, when in fact others can also be very important, such as price of raw materials and biomass, as well as the cost of land and labour, especially when competition is increased for these.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12668	22	34	22		Insert new sentence in line 34 before sentence beginning "Long term mitigation...": However, such economic attractiveness does not take into account key factors such as land availability, technology access, energy security including import dependence, grid infrastructure costs, and cost of large scale storage systems.	Government of India, Ministry of Environment, Forests and Climate Change
2864	22	35	22	35	"Availability" does not necessarily imply the issue of access, especially equitable access.The technology may exist, be available, but inaccessible to some people or countries. Adding access to availability would provide a stronger link to sustainability and just transition.	Government of France, Ministère de la Transition écologique et solidaire
12670	22	35	22		Insert new sentence: These include, inter alia, issues surrounding recycling, or waste management of solar panels or batteries, and availability of critical minerals used in these technologies, which also need to be analysed to get the true costs especially given the timescales considered in climate modelling.	Government of India, Ministry of Environment, Forests and Climate Change
12672	22	37	22		Delete C.3.4 and rewrite clarifying that all of these are modelling results and remarks on coal and coal technologies are assumptions without singling out coal and taking a balanced approach towards all fossil fuels.	Government of India, Ministry of Environment, Forests and Climate Change
5632	22	37	22	39	The 20% today vs 30-60% risks giving the impression we might not be far off - but I think 30% relies on some combination of high CCUS /extensive H2 or other carriers and lower energy demand? So would be good to make clear that we're not close to the scenario represented by 30% electrification	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9812	22	37	22	40	C4.3. This is an unclear statement: fossil fuel use dropping only substantially by 2050 does seem an understatement: better quantify. Moreover there is no direct relationship between fossil fuel use and enhanced electrification as electricity can also be generated by fossil fuel use.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
258	22	37	22	43	The statement only takes into consideration two pathways. Re-write to account for other scenarios.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11428	22	37	22	43	"This will leave fossil fuel resources unburned and risks stranding fossil -related infrastructure. The combined economic impact could amount to trillions of dollars. Coal assets are most at risk of being stranded through 2030. " It is important to point out that there are both positive and negative consequences of this (leaving aside the climate benefits). While there are significant risks for the financial sector globally, funds divesting from fossil fuel producers implies freeing up sources of capital that become available for green assets. There is an important link with chapter 15 here. Furthermore, low carbon economies are just as capable of creating employment opportunities as fossil-based systems (albeit with different skill requirements and regional concentrations). Elements of the underlying report on Just Transition should be referred to (e.g. Box TS.4)	Philippe Tulkens, European Union (EU) - DG Research & Innovation
254	22	37	23	1	C4.3: The paragraph language is policy prescriptive. The measures describe the scenarios. The authors should re-write and use policy neutral language.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
256	22	37	23	2	The statement C.4.3 discusses the impact on fossil-related infrastructure, CCS is recognized as a technology solution and should be included in this statement. The statement from Chapter 6.7 and included in the Technical Summary Page 53 Lines 25-26 "CCS can allow fossil fuels to be used longer, reducing potential stranded assets." Should be included in the paragraph.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
252	22	38	22	38	C.4.3: "Substantially": this is an unquantifiable term in the scientific sense. Rewrite more precisely or deleted.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2058	22	38	22	38	(Basis) making consistent with p.3(line 16) of executive summary of chapter 6(energy) (present) "electricity supplying 30% to over 60% of final energy globally (change) "electricity supplying 48~58% of final energy globally"	Government of Republic of Korea, Korea Meteorological Administration
11430	22	38	22	41	"... Of final energy globally in 2050, ...": shouldn't this be 2030 since you refer to 2050 below?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2352	22	40	22	40	Suggest inserting 'global' prior to 'coal consumption' to reflect different national circumstances will lead to different reduction in coal consumption.	Government of Australia, Department of Industry, Science, Energy and Resources
4074	22	40	22	40	There is one mention of CCUS (carbon capture, utilization and storage) but all other are CCS (carbon capture and storage). Please refer to these terms consistently and differentiate as needed.	Government of Canada, Environment and Climate Change Canada
5634	22	40	22	40	Text says '...(CCUS) drops...', it would be more accurate to say '...(CCUS) must drop....'.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6134	22	40	22	40	CCUS (carbon capture, utilisation and storage) is not in the glossary anymore and has been replaced by CCU and CCS. It seems to us that this sentence concerns only CCS and not CCU. The term CCUS should thus be replaced by carbon capture and storage (CCS). If this is not the intention, please explain.	Government of Belgium, Belgian Science Policy Office - Belspo
6968	22	40	22	40	Figure SPM.8 clearly shows that of all the mitigation options assessed, CCUS is not only the most expensive one but also the one with the lowest potential contribution to mitigation by 2030. This assessment has to be clearly and explicitly reflected in this bullet.	Government of Jamaica, Meteorological Service Division
13330	22	40	22	40	It would be useful to qualify the use of CCUS: with which percentage of carbon capture and storage is this assumption made? Assuming not all CCUS technologies are equally successful. Alternatively, we suggest removing the reference to CCUS in this sentence.	Government of Switzerland, Federal Office for the Environment FOEN
682	22	40	22	41	It is inconsistent with the coal consumption reduction (67%-82%) on page 3 and page 117 in Chapter 6, with an error of nearly 10%. It is suggested to check and revise.	Government of China, China Meteorological Administration
2060	22	40	22	41	(Basis) consistent with p.3(line 12) of executive summary of chapter 6 (present) "coal consumption without carbon capture, utilization and storage(CCUS) drops by roughly 70-90% by 2030" (change) "coal consumption without carbon capture, and storage(CCS) drops by roughly 67~82% by 2030"	Government of Republic of Korea, Korea Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6528	22	40	22	41	Please add absolute numbers on the level of CCUS currently deployed. Otherwise it is not possible for policy makers to understand the relevance of CCUS. We also wonder, how much CCS is assumed since CCUS is not yet deployed at significant scale at this stage. Please specify.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13936	22	40	22	41	Please consider to quantify the development of other fossile energy sources and carriers in addition to unabated coal consumption. Perhaps this is best presented in the form of a table.	Government of Norway, Norwegian Environment Agency
14986	22	40	22	41	CCS is introduced on page SPM-9 and now CCUS is added. Suggest consistent and precise use of terms. Define CCUS for policymakers. For example, was "utilisation" modelled and, if so, what does it entail? Does the term/analysis include enhanced oil recovery or not? If utilization was not included in the models, then encourage use of "CCS" instead with a clear definition. It's useful to emphasize that CCUS will be needed if coal continues to operate, but how much coal with CCUS will be deployed in 2030 and mid-century? What about natural gas with CCUS? In what regions? Deployment amounts are directly relevant to this discussion about fossil fuel resources and assets.	Government of United States of America, U.S. Department of State
2354	22	40	22	42	Suggest adding 'Without extensive deployment of CCUS' prior to 'This will leave fossil fuel resources...' to emphasise role of CCUS in reducing likelihood of stranded assets.	Government of Australia, Department of Industry, Science, Energy and Resources
4076	22	41		42	The phrasing here suggests that reducing coal consumption may be undesirable. Note that the only scenarios which would not 'leave fossil fuel resources unburned' would be ones with large projected increases in emissions and very strong warming.	Government of Canada, Environment and Climate Change Canada
14988	22	41	22	41	Add ", based on input assumptions" after "overshoot."	Government of United States of America, U.S. Department of State
6530	22	41	22	42	Probably all pathways will leave some fossil fuels unburned, otherwise there will be global warming beyond the temperature levels discussed in this report (beyond 5°C). Hence, to point out that only 1.5°C or 2°C pathways will leave fossil fuels unburned is a very one-sided information. We strongly request its deletion or add more information to make it more balanced. In addition, the SOD's B.6.3 provided highly policy-relevant information which should be reinserted please.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14990	22	41	22	42	This sentence seems tacked on and out of place. While the point may be valid, it is unclear to what it is referring. Maybe clarify by replacing "This" with "A decrease in uncontrolled coal consumption ...". There is no timeframe attached to the previous sentence; if the decrease were to occur over a long period, the risk of stranding coal-related infrastructure would be lower than if it were to occur earlier, and lower if current and planned investments from now were curtailed. Add "Continued investments in coal and other fossil fuel assets would increase the risks of stranding assets and economic losses in the future under these pathways." The sentence about "combined economic impact" (of what?) and "trillions of dollars" is unclear. Would these losses increase if continuing investments are made? If so, add "and would grow with further fossil fuel investments. Many, however, may become uneconomical to operate should the capital costs of wind, solar, and other no-carbon technologies continue to decline as over the past decade; in recent years, many coal-fired power plants have been retired before their anticipated lifetimes because they become uncompetitive, especially when pollution is controlled. Oil and gas facilities are likely to remain competitive longer than coal facilities." It would be informative for policymakers to understand whether the analysis assumes action (or no action) is taken to mitigate impacts. For example, did the analysis of fossil assets/infrastructure consider possible re-purposing of these assets (e.g., retrofitting for carbon management, CO2 or hydrogen transport or storage, etc.)?	Government of United States of America, U.S. Department of State
13566	22	41	23	1	Please consider adding text on how to lower these risks of stranded fossil fuel assets? This may be obvious, but could be worth spelling out.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
14992	22	41	23	1	Consider stating C.5 conclusions here and removing text that is there, as progressing towards net zero GHG emissions from industry can still involve employing CCS for remaining CO2.	Government of United States of America, U.S. Department of State
1038	22	42	22	42	Surely, the scale of change indicated is evidence that this has gone beyond risk, and is now a certainty for a large proportion of the FF sector.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
1040	22	42	22	42	The continued use of the term fossil fuel "resources" would seem misleading in the context of stranded assets. If they cannot be used, they are not a resource. Attempts to utilise them becomes a liability on the economy "reserves" or "deposits" might be a better term. To what extent does the current asset value placed on fossil-related infrastructure rely on continued utilization of these "resources" and are contingent on successful deployment of CC(U)S	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2866	22	42	22	42	We suggest to add after "...infrastructure" " unless planned investments are retired." (technical report, p 26)	Government of France, Ministère de la Transition écologique et solidaire
4078	22	42	22	42	The use of "risk" is inconsistent with use in WG2.	Government of Canada, Environment and Climate Change Canada
13660	22	42	22	42	Insert "fuel" after "fossil" towards the end of the sentence: "...and risks stranding fossil fuel-related infrastructure"	Government of New Zealand, Ministry of the Environment
1042	22	42	22	43	This seems somewhat emotive in tone and reflective of a narrow scope of the potential economic impact of mitigation. The combined economic impact of unabated utilization of these resources is also in the trillions and the economic impact of transition in many sectors may be positive.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1044	22	42	22	43	If not appropriately managed. This needs to be balanced against estimates of the cost of excessive climate change.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1312	22	42	22	43	This is a rather imprecise sentence, stating "could amount" - under what conditions? - and "trillions of dollars" - could a relevant range be given instead? Also, significant caveats viz. the conclusion should be mentioned as well as the net outcome when economy-wide benefits, alternative investments and so on are factored in.	Government of Sweden, Swedish Meteorological and Hydrological Institute
5636	22	42	22	43	This statement requires a confidence statement and is unbalanced with respect to the evidence. As currently written, it is unclear what action policymakers could take as a result of this statement. To provide more balance, suggest elevating text from Box 6.13 which puts information about stranded assets in the broader context and highlights how policymakers can reduce the risk: "Stronger near-term mitigation will reduce premature retirements of fossil infrastructure, because more rapid mitigation will decrease new builds of fossil infrastructure that might later be stranded (high confidence). For example, if likely warming is limited to 2°C, strengthening the NDC pledges beyond their 2015 levels could decrease stranded electricity sector assets by more than 50%." (from Chapter 6, p.116, lines 34-38). Similar, from Chapter 6, p.15 line 27, "Continued coal builds, mostly in developing countries, will increase the risks of stranded assets". It should also be put in the wider context of the economic impacts of climate change.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9500	22	42	22	43	It would be appropriate that "The combined economic impact could amount to trillions of dollars" is followed by "without effective policy measures." It is necessary to clarify whether C.4.2 and C.4.3 are addressing BAU economic markets or markets with political measures.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
10316	22	42	22	43	It is stated that "The combined impact could amount to trillions of dollars". It would be useful to know the timeframe for this statement.	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
13568	22	42	22	43	"The combined economic impact could..." - it would be worth clarifying what the impact is of. The combined economic impact of stranded assets?	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
14994	22	42	22	43	"The combined economic impact could amount to trillions of dollars" should include a confidence statement.	Government of United States of America, U.S. Department of State
14996	22	42	22	43	Recommend using a different term than "risks stranding" since some fossil assets will definitively have to be stranded to meet these pathways. Perhaps "will entail stranding"?	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13260	22	42	23	2	These sentence focuses on potential risks/costs for phasing out coal and oil. In the preceeding paragraph the authors state that the mititgaion costs depend on future costs and the availability of technologies and are not well understood. This paragraph makes assumptions to how much it could cost ("combined economic impact COULD amount to trillions of dollars"). It also assesses the negative impacts from phasing out coal and gas: please assess if the literature justifies to balance this information against the assessment of low-carbon energy systems? --> Delete the sentences "This will leave fossil ... toward mid-century".	Government of Switzerland, Federal Office for the Environment FOEN
4080	22	43	22	43	When is the trillion dollars occuring? Is it cummlative over a scenario to 2100 discounted to a present value? Or is trillion dollars in a future period? Or annually?	Government of Canada, Environment and Climate Change Canada
9502	22	43	23	1	Oil and gas are more at risk toward mid-century "but continue to be a significant energy sources for the society to keep sustainable energy transformation. Thus carefully designed transitional supply plan is necessary to avoid unexpected supply shortage, which world is experiencing in late 2021. Therefore, the importance of realistic energy transition should also be mentioned.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9670	22	43	23	1	Regarding the description of stranding risk for coal, natural gas, and oil, since stranding risk exists for coal assets and oil and gas for which no emission reduction measures have been taken, the word "unabated" should be added in front of "Coal assets" and "oil and gas" respectively, in order to accurately reflect the Chapter6 page 6-4, line 8-12.  Chapter6 page 6-4, line 8-12 Limiting warming to well below 2 degrees will strand fossil-related assets, including fossil infrastructure and unburned fossil fuel resources. The economic impacts of stranded assets could amount to trillions of dollars. Coal assets are most vulnerable over the coming decade; oil and gas assets are more vulnerable toward mid-century. CCS can allow fossil fuels to be used longer, reducing potential stranded assets. (high confidence) {6.7}	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
1054	23	1	23	1	The timeline for risk of stranding oil assets is significantly more near term than the risk to natual gas assets. Separate statement on each may be more useful. Otherwise the text may communicate an underestimate of the potential rate of decarbonisation in oil dependent sectors.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1026	23	1	23	5	Budiing section could be clearer detail on timing would be useful:	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
10318	23	3	23	3	Please explain the concept of "fugitive emissions"	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
684	23	3	23	4	The confidence level is not consistent with the underlying report (lines 30-31, page 9 to line 1, page 10, and lines 5-8, page 43, Chapter 6), in which it is not reported as medium confidence. The authors are requested to check and keep the confidence consistent with the underlying report.	Government of China, China Meteorological Administration
278	23	3	23	5	C.4.4: Required action: rewrite without the specifying sources. The focus should be on emissions and not sources.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1046	23	3	23	6	Reduction in fossil fuel consumption would also see fugitive emissions fall as production decreased in response to demand.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1056	23	3	23	6	It would be useful to include a value for the proportion of total anthropogenic methane emissions associated with fossil fuel production, distribution and use.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5666	23	3	23	6	Is 18% the percentage of the overall volume of GHGs from that sector, or in some way GWP-indexed to give an indication of the percentage contribution to the overall warming? I'm guessing it's the former - but with methane being such a potent warming species in the shorter term, should this be pointed out?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
3398	23	4	23	4	Please specify "GHG emissions". This is not obvious as formulated.	Government of France, Ministère de la Transition écologique et solidaire
686	23	5	23	5	Since data sources of these two references supporting emission reduction costs in Box 6.5 are essentially the same, and the actual engineering cost data supporting the literature are limited, it is suggested to replace "high confidence" with "medium confidence".	Government of China, China Meteorological Administration
804	23	5	23	5	Please, clarify the year of which USD is. E.g., USD 2019 = in USD prices of 2019	Government of Russian Federation, Institute of Global Climate and Ecology
13392	23	5	23	5	USD50 tCO2-eq-1' - '/' is missing USD50/tCO2-eq-1 to mean usd 50 per tonne...	Government of Kenya, Kenya Meteorological Service
14998	23	5	23	5	Specify the \$ reference year.	Government of United States of America, U.S. Department of State
12674	23	5	23		Delete "at less than USD50 tCO2-eq-1". Reason: High confidence misplaced, extremely limited literature cited in support and only justified by modelling.	Government of India, Ministry of Environment, Forests and Climate Change
280	23	7	23	11	C.5: The statement uses the term (net zero), which is defined differently in different contexts. Required actions: rewrite to remove the confusing use of the terms "net zero" and "zero emissions" that have high potential to create confusions for policy makers. Follow the terminology as stated in the glossary.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
9798	23	7	23	11	C.5. Add finding from TS: Without reductions in material demand growth and a very rapid scale-up of low-carbon innovations, the long lifetimes of industrial capital stock risks locking-in emissions for decades to come.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12458	23	7	23	11	Effective emission reductions from industry entail coordinated action throughout value chains to promote demand management, energy and materials efficiency, and circular material flows. Progressing towards net zero GHG emissions from industry also necessitates entails the adoption of new primary processes using low to zero GHG electricity, fuels, hydrogen and carbon feedstocks, and employing CCS for remaining CO2 (high confidence).	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
13570	23	7	23	11	This headline statement requires information, at least in a footnote, pointing to the potential caveats of employing CCS for remaining CO2.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
5638	23	7	23	16	There are many gaps in our knowledge about the potential of demand management and circular material flows in industry. Could authors clarify whether the high confidence statement is associated with the "underestimation of their mitigation potential"?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
4086	23	7	23	34	Items under demand management, material and energy efficiency, and circular material flows have varied time for implementation depending on the extent of change needed. It would be worthwhile to make this clear in this section, of how the timeframe of implementation plays a role in achieving effective emission reductions from industry.	Government of Canada, Environment and Climate Change Canada
11432	23	7	23	34	Section C.5 (and the whole SPM) fails to reflect on emissions (and mitigation needs) associated with raw material extraction (primary sectors). All references to materials seem to begin with processing (like steel and concrete), but not mining and other raw material extraction activities.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12004	23	7	23	34	C.5: A statement on the feasibility of CCS at the scales required to achieve the described emissions reductions would be needed here and throughout the section C.5.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13476	23	7	23	34	Material substitution is not well discussed. SRCCCL talks about biomaterials, using long-lived sustainably harvested wood products. Certainly the substitution effect has a role to play here. Please add and link to C9.	Government of Estonia, Estonian Meteorological & Hydrological Institute
13938	23	7	23	34	The report could benefit from reflecting on the development of the concept "multiple source - single storage". This has given a new momentum to CCS. The concept of access to a flexible transport system and common storage of CO2 as a service, leaves the CO2 emitting bodies to focus on carbon capture at their sites. Project in UK (Teesside- <a href="https://www.netzeroteesside.co.uk/project/">https://www.netzeroteesside.co.uk/project/</a> ), Netherland (Porthos - <a href="https://www.porthosco2.nl/en/project/">https://www.porthosco2.nl/en/project/</a> ), Denmark (Greensand - <a href="https://projectgreensand.com/">https://projectgreensand.com/</a> ) and Norway (Longship - <a href="https://ccsnorway.com/the-project/">https://ccsnorway.com/the-project/</a> ) are relevant cases for this concept "multiple source - single storage". We would appreciate if these developments could be described in the SPM.	Government of Norway, Norwegian Environment Agency
13940	23	7	23	34	Please consider to include concrete information about CDR in the industrial sectors.	Government of Norway, Norwegian Environment Agency
15000	23	7	23	7	Indicate whether the emissions reductions referred to here are GHG or just CO2	Government of United States of America, U.S. Department of State
266	23	7	23	8	C.5: Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
4082	23	7	23	8	Is effective defined in the text - presuming that is it a multi-dimensional evaluation? If so, can there be a footnote here?	Government of Canada, Environment and Climate Change Canada
4084	23	7	23	8	This first sentence needs a confidence statement.	Government of Canada, Environment and Climate Change Canada
13942	23	7	23	8	We are pleased to read in SPM C.5 about materials efficiency and circular material flows. Please keep the following sentence: "Effective emission reductions from industry entail coordinated action throughout value chains to promote demand management, energy and materials efficiency, and circular material flows".	Government of Norway, Norwegian Environment Agency
13944	23	7	23	8	Please consider to add "materials efficiency" to the glossary.	Government of Norway, Norwegian Environment Agency
13946	23	7	23	8	In order to further explain materials efficiency and circular material flows, please consider to add the following text about circular economy to the SPM (from TS, page 102, line 20-25): "Circular Economy (CE) is a mitigation approach that can help deliver human well-being by minimising waste of energy and resources. While definitions of CE vary, its essence is to shift away from linear "make and dispose" economic models to those that emphasize product longevity, reuse, refurbishment, recycling, and material efficiency, thereby enabling more circular material systems that reduce embodied energy and emissions".	Government of Norway, Norwegian Environment Agency
12676	23	8	23		Insert after "change to...": "to curb high resource consumption and waste in keeping with equity and regional and national circumstances"	Government of India, Ministry of Environment, Forests and Climate Change
9504	23	8	23	8	Industrial emission reduction through demand management must be carefully considered and implemented because it may put the limit on free market economy, allow control of demand by governments and destroy modern efficient economy system. The costs and social risks associated with such demand control and restrictions on choices by people may bring larger damage than climate change. If demand management must be mentioned, it should be stated such as "demand management, which will provide sufficient utilities with affordable options" .	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11434	23	8	23	8	Circularity is an important and highly policy-relevant concept and should be elaborated in more detail. Its potential should be clarified (e.g., what is assumed in the scenarios used?), as well as its limitations (e.g., the limits and energy cost of recovery).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2356	23	9	23	10	Suggest clarifying whether industry is aiming for net zero GHG emissions, or net zero CO2 and deep cuts to other gases, as described in the overarching temperature scenarios. Net zero CO2 and net zero GHG are used interchangeably through the report when the emissions pathways do not reach net zero for all individual gases, methane specifically is used in industrial processes and pathways suggest that methane emissions are reduced by 50% in pathways consistent with 1.5 and 2°C. This may not provide a clear picture for sectoral action.	Government of Australia, Department of Industry, Science, Energy and Resources
15004	23	9	23	10	The sentence refers to "adoption of new primary processes" but couldn't this also entail moving from one "existing" primary process to another such as using EAFs instead of BF-BOFs in steel? If this is not the authors' intent, perhaps "primary processes" should be defined.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5640	23	9	23	9	Alongside primary (industrial) processes, secondary (manufacturing) processes are also relevant. Suggest referring to either 'primary and secondary processes' or 'industrial and manufacturing processes'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5642	23	9	23	9	Is it confusing to characterise all these processes as 'new'? Perhaps 'adapted' or 'new and adapted' (i.e. will the original primary process be broadly the same but changed to be low carbon or will it be an entirely new process – suspect a combination?)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15002	23	9	23	9	Replace "also necessitates" with "is feasible through". "Necessitates" is not objective.	Government of United States of America, U.S. Department of State
12678	23	9	23		Delete "Progressing towards net-zero GHG emissions in industry" and insert "Keeping the cumulative emissions from industry in line with the remaining carbon budget, according to equity and regional and national circumstances, also necessitates...."	Government of India, Ministry of Environment, Forests and Climate Change
688	23	10	23	10	"Carbon feedstocks", which is a technical term, is suggested to be explained in the glossary.	Government of China, China Meteorological Administration
6532	23	10	23	10	This list of necessities for new primary processes spans energy ("electricity" + "fuels") as well as "feedstock" plus "hydrogen" (without specifying whether this is used for energy or as feedstock). Some of these necessities apply to many industrial processes, others are rather process-specific (cement/steel industry?). Since headline statements should be able to stand alone (without the reader having to consult the following paragraphs), please re-phrase in order to clarify.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13416	23	10	23	10	What does the statement "low GHG electricity" mean?	Government of Kenya, Kenya Meteorological Service
6970	23	11	23	11	Please make sure that the statements on CCS here and in the following sub-bullets are balanced between the potentials and constraints of CCS. We would like to receive further information on the latter in this section.	Government of Jamaica, Meteorological Service Division
11436	23	11	23	11	"CCS for remaining CO2" should be clarified. Does it refer to "remaining fossil fuel use"? CCS surely cannot be applied to all CO2 emissions, such as from LULUCF or biomass use (most of it is in the form of food).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13948	23	11	23	11	Please delete "...for remaining CO2".	Government of Norway, Norwegian Environment Agency
15006	23	11	23	11	The SPM sentence states that it will be necessary to employ many options including "CCS for remaining CO2 (high confidence)", but the underlying discussion of CCS in the industry chapter (pages 11-35 to 11-38) contains many statements regarding uncertainties and unknowns related to CCS, including: "widely varying", "uncertainty", "challenge", and "highly unpredictable". Given the uncertainties in overall industrial GHG emissions that need to be mitigated as well as the uncertainties associated with estimating the potential role of CCS, can the confidence that CCS will be employed really be "high" based on the literature? Would it be possible to include some indication of the uncertainties around CCS in this SPM sentence?	Government of United States of America, U.S. Department of State
15008	23	11	23	11	Suggest removing CCS reference due to impracticality (but OK to keep in C.5.2, C.5.3, and C.5.4).	Government of United States of America, U.S. Department of State
2868	23	12	23	12	The term "demand management" is vague and may be replaced by "drastically reduce the extraction of materials".	Government of France, Ministère de la Transition écologique et solidaire
272	23	12	23	14	C.5.1: Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15010	23	12	23	15	The second sentence cites "such options" which seems to refer to demand management, materials efficiency, and more circular material flows as listed in the first sentence, saying that these options are "not well represented in top-down modelling, leading to underrepresentation in some models." The underlying text in the industry chapter, however, states "Key climate mitigation options such as materials efficiency, circular material flows and emerging primary processes, are not well represented in climate change scenario modelling and integrated assessment models ..." (page 11-4) and "An increasing body of research proposes deep decarbonisation pathways for energy intensive industries including mitigation options such as materials efficiency, circular economy and new primary processes. These options are underrepresented in climate change scenario modelling and integrated assessment ..." (page 11-102). Thus, the list in the SPM includes demand management which is not included in the underlying text and the underlying text includes new primary process which is not included in the SPM. Should these be better aligned? Also, should "top-down modelling" be replaced with "climate change scenario modeling and integrated assessment models" to be more precise?	Government of United States of America, U.S. Department of State
13950	23	12	23	16	Please consider to mention that wood used in construction may reduce emissions associated with steel and concrete production (See Ch 7, page 6, line 12-13).	Government of Norway, Norwegian Environment Agency
13952	23	12	23	16	Please consider to include information about baseline demand, and quantify what "substantially reduce emissions" means in that context. Figure SPM 7 seems to imply that this potential is rather limited over the next decades.	Government of Norway, Norwegian Environment Agency
13954	23	12	23	16	Please consider to include some information about the relative size of the different emission sources in the industry sector, as well as baseline projections for their development.	Government of Norway, Norwegian Environment Agency
2358	23	12	23	24	Aluminium is raised as another material that is emissions intensive and has similar opportunities for low emissions production as steel in sections 11.2 and 11.4 of the underlying assessment. Suggest that aluminium is added to these sections.	Government of Australia, Department of Industry, Science, Energy and Resources
2870	23	13	23	13	The use of wood products allowing carbon storage and substitution (to fossil fuels for the production of materials) could be mentioned	Government of France, Ministère de la Transition écologique et solidaire
2872	23	13	23	13	The term "more circular material flows" leaves room for flexible interpretations, for example by recycling materials a little more, which is not enough. It should be more precise as "decreasing and fully circular material flows".	Government of France, Ministère de la Transition écologique et solidaire
13262	23	13	23	13	Delete "more" in "... and more circular material flows ..."	Government of Switzerland, Federal Office for the Environment FOEN
13264	23	13	23	14	Add "currently" in "... but are currently underutilised in policy..."	Government of Switzerland, Federal Office for the Environment FOEN
15012	23	14	23	14	"Underutilized" is subjective against some norm. Reword the sentence to say something like "there are technologically feasible opportunities to ..."	Government of United States of America, U.S. Department of State
1048	23	14	23	16	under estimation of technical potential at least.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
11438	23	15	23	15	It is unclear why the imperfect representation in models would lead to an underestimation of the potential. If some of the benefits are underrepresented, then probably so are some of the costs. E.g., higher recycling rates could save emissions related to producing more primary raw materials (a sector not mentioned in the SPM), but also involves energy use and other emissions that are probably also not represented. Given the high confidence assigned to this statement, it should be possible to substantiate it in more detail.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5670	23	17	23	17	The term "basic materials" ought to be defined here. Are the authors mentioning the materials mostly contributing to industrial footprint (i.e. steel, cement and chemicals)? In which case, this could be explained in the starting sentence of the paragraph.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11440	23	17	23	17	What is meant by "basic materials" and what would be involved in the "processes" referred to? E.g., if the "basic material" is steel, do the processes involve the mining and transport of iron ore, or "only" smelting?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11442	23	17	23	18	Which basic materials are meant? Also why will there be no final product cost increase?	Philippe Tulkens, European Union (EU) - DG Research & Innovation



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
1050	23	17	23	19	It's not scale up but rather "these processes" will often increase production costs. Scale up of the processes would lead to cost reductions *in* those processes.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5644	23	17	23	19	The sentence on scaling up increasing production costs is misleading - it risks confusing (i) what happens to unit costs of low carbon option over time, with (ii) total costs vs BAU technology. Scaling up can and has reduced unit production costs, whereas I think what it means here is adopting these options is currently estimated to increase costs vs high carbon option	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
274	23	17	23	22	C.5.2: Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2360	23	17	23	24	Suggest replacing with: 'Scale up may often increase near term production costs, but translate into small cost increases for final consumers. Technology advancement and increased deployment in these processes will help reduce costs and scale up deployment.' For steel-making, in addition to hydrogen direct reduction, we also note increased recycling, use of renewable energy, and improved beneficiation of iron ores, among others, are viable near term approaches to reduce emissions. A number of countries, including Australia, have policies to reduce the cost of zero emissions steel and aluminium to achieve cost parity with existing methods.	Government of Australia, Department of Industry, Science, Energy and Resources
6136	23	17	23	24	Chapter 11, page 58, states that "Material Economics (2019) shows that with deep decarbonization, depending on the pathway, steel costs grow by 20–30%; plastics by 20–45% (...)". We understand that these costs can be mild in end products, however we wonder if, given these costs, the technologies can be at "near-commercial stage". Could you check this paragraph?	Government of Belgium, Belgian Science Policy Office - Belspo
9506	23	17	23	24	<ul style="list-style-type: none"> <li>• Many low- to zero- GHG production processes may be at pilot stages, near-commercial stage may only a very small part of the production process, and there are many issues in order to mass-produce.</li> <li>• Scale up will improve manufacturing efficiency and reduce production costs, so "scaling up is often increasing manufacturing costs" cause a misunderstanding. An increase in manufacturing costs are provided by replacing production infrastructure and purchasing external energy such as hydrogen, needed for shifting to the production process of low GHG to zero GHG. In addition, significant increase in manufacturing costs results in an increasing cost for final consumers, that are not "small".</li> <li>• Although it's said that "For steelmaking, near-commercial processes include hydrogen direct reduction", it may be possible in the area of rich in renewable energy infrastructure, but developing and implementation of hydrogen direct reduction technology in the world will take at least several decades.</li> <li>• For the above reasons, we propose an amendment; "For basic materials, many low- to zero- GHG production processes are at pilot stage. Changing production process will often increase production costs, so take note of the translate into cost increases for final consumers. For steelmaking, developing of hydrogen direct reduction is conducted for commercialization in a limited area of rich in zero-GHG energy infrastructure, but developing and implementation innovative technology take at least several decades in order to shift the production process of low GHG to zero GHG in the world."</li> </ul>	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11444	23	17	23	24	Which are the most problematic sectors? Where are most investments needed?	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13956	23	17	23	24	Please take notice: In the previous governmental review (SOD) we provided comments to the underlying chapter 11, related to a probable misinterpretation of findings from a scientific reference (Material Economics (2019)). This possible misinterpretation might influence how assessed relevant findings are reflected in higher layers (TS and SPM). We are concerned that a possible misinterpretation of this study, and especially to how the description about use of CCS in the industry sector is represented in scenarios and pathways. We would appreciate if you take a thorough check for consistency on how this is reflected in Ch. 11 page 58 (line 11-15), where it is stated that CCS is included in pathways, and on page 72 (line 4-18, including lack of CCS in Table 11.5), where it is stated that the authors of the Material Economics (2019) has not included industrial CCS as a mitigation option. These two statements are currently contradicting each other, and we believe that industrial CCS are used in the scenarios from Material Economics (2019). We are aware that we are not meant to comment on the underlying chapter during this FGD review. However, since we don't see that our previous comment during the SOD review has had effect, we take the liberty to draw you attention once again to this issue.	Government of Norway, Norwegian Environment Agency
15014	23	18	23	18	Replace "will" with "may".	Government of United States of America, U.S. Department of State
1058	23	18	23	19	The vagueness is distracting. It would be useful to provide insight into proportional increase in production cost, which sectors or types of goods are impacted, market conditions for these and likely demand response. Past experience has been that when new technologies, processes and practices reach deployment phase, costs reduce significantly. Has this precedence been considered during the formulation of this statement.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5664	23	18	23	19	Mention of transition to Hydrogen Direct Reduction discusses production cost increases but perhaps downplays the significant upfront capital costs involved in investment in electric arc furnaces. It would be useful to mention the capital costs explicitly.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6534	23	18	23	19	This is not intuitive as scale normally also leads to a decrease in production costs per item. Or do you mean that there is an increase in absolute production costs as new factories needs to be build? We find this information not useful and suggest only to talk about relative costs here as this is the important number in the end.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15016	23	18	23	19	The SPM text states that "scale-up will often increase production costs but will translate into small cost increases for final consumers" but the underlying text in the industry chapter also includes this statement: "Fast growing economies, which are adding new industrial capacity, can provide opportunities to pilot, demonstrate and scale-up new technologies, as shown by the rapid expansion of electric vehicle and solar panel production in China, which contributed to driving down costs ..." (pages 11-90 to 11-91). As such, perhaps the SPM sentence could be modified to state: "Depending on the technology, scale-up might increase production costs but this will translate into small cost increases for final consumers."	Government of United States of America, U.S. Department of State
12680	23	18	23		Delete the sentence: "Scale up will often increase..." Reason: No basis for the statement. Speculative.	Government of India, Ministry of Environment, Forests and Climate Change
690	23	19	23	19	If the hydrogen direct reduction is described as "near-commercial", it may lead to the following problems: 1. It is inconsistent with the text of the underlying report. And the maturity description of hydrogen direct reduction technology in the underlying report is inconsistent, as 11.4.1.1 (line 42, page 44) reads "already commercialized", while 11.4.2.2 (line 11, page 71) reads "not be a fully mature technology before 2030". 2. The SPM and Section 11.4.1.1 of the underlying report both do not reflect the status quo worldwide in a balanced way, because the technology is currently commercialized or nearly commercialized only in Germany and other individual developed countries, not at the global level. It is suggested to change it into: For steelmaking processes include hydrogen direct reduction.	Government of China, China Meteorological Administration
2092	23	19	23	19	(Basis) For countries with large crude steel production, such as Korea and Japan, it may take longer to secure commercialization of Hydrogen Iron Reduction technology. Korea aims at commercialization in 2040 after completing demonstration process during 2030~2040. So please check the word commercialization again.	Government of Republic of Korea, Korea Meteorological Administration
5646	23	19	23	19	Suggest read "near-commercial processes include hydrogen direct reduction and with electric arc furnace technology"	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5668	23	19	23	19	To me, it is unclear why the particular process "hydrogen direct reduction" is mentioned - is this one of the most promising solutions? Potentially a few more solutions should be mentioned, or at least this solution's commercial readiness level should be more clearly characterised (e.g. technology would be ready for widespread adoption by XXX)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11446	23	19	23	19	The sentence "For steelmaking, near-commercial processes include hydrogen direct reduction" is not presented in a clear and understandable way for the reader, as it is not clear what was in mind regarding "... hydrogen direct reduction".	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13960	23	19	23	19	Please consider to revise the sentence about steelmaking to reflect the broader portfolio of mitigation options described in the underlying chapter 11, page 11-44 to 11-45.	Government of Norway, Norwegian Environment Agency
6536	23	19	23	21	As energy related emissions can be avoided in the cement production process, please add: [...] cementitious material substitution and CCS "for process-related CO2 emissions of cement" until new chemistries are mastered.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11448	23	19	23	21	Reduction of cement process emissions relies not on only "cementitious material substitution", but also there are research on the integration of other materials in the cement as different fibrous materias integration which before was waste and is utilised in concrete production. Therefore the integration of these materials does not substitute cementitious material by its properties, but utilising them allows the use of less % of cement in the concrete production. Not only research, but also necessary mature TRL (technology readiness level) is achieved.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13958	23	19	23	21	Please consider to add reuse of cement as another option to reduce cement production emissions (circular economy).	Government of Norway, Norwegian Environment Agency
15018	23	19	23	21	Statement is inaccurate re the need for CCS in the cement industry. There are commercial low-carbon cement options available today (e.g., pozzolanic cement, CO2 infused cement, and others). The sentence on cement process emissions lists the use of "cementitious material substitution" which is neither at the pilot or near-commercial stage (it is fully commercial). Since the previous sentences talk about pilot or near-commercial stage technologies, this is confusing. Also, in the underlying industry chapter text, there is the statement that "Process emissions from cement production can be captured and stored or used as feedstock for chemicals and materials" (page 11-103). Perhaps the SPM sentence should be: "Reducing cement process emissions will rely on already commercialized cementitious material substitution combined with CCUS until new chemistries are mastered."	Government of United States of America, U.S. Department of State
6138	23	20	23	22	Could CCU be added here, in addition to CCS (both appear relevant)?	Government of Belgium, Belgian Science Policy Office - Belspo
13266	23	21	23	21	Currently under the UN Environment Assembly the discussions have matured towards taking the issue of global plastic pollution towards establishing a global treaty (potential decision at UNEA5.2, Feb 2022). In general, we are no longer talking about recycling of plastics alone, but put the whole life cycle of plastics production and consumption at the center of the deliberations. Here: please correct the sentence towards: "... need to relate on a whole life cycle approach of plastics, ..."	Government of Switzerland, Federal Office for the Environment FOEN
6538	23	21	23	22	As energy related emissions can be avoided in the chemical industry, please add: [...] along with CCS "for process-related CO2 emissions".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
5672	23	22	24	6	C.6 - I think integrating statements on adaptation in other places would be beneficial. For C.6, it may be appropriate to reference to D.1.3. (adaptation in urban areas).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5648	23	23	23	23	Examples of low GHG fuels would be helpful - for example, insert after low GHG fuels (e.g., low carbon hydrogen, biofuels)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5674	23	23	23	23	Electrification and low GHG fuels seem to cover the supply side of industrial emissions, but the section does not refer to demand side reductions. Is this because the authors assume efficiency improvements would yield less significant emission reductions? I would think mentioning the effectiveness of demand side reduction measures in comparison would be helpful here for policy-makers.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15020	23	23	23	23	Unclear what these low GHG fuels are.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5650	23	25	23	25	Worth clarifying that low carbon energy sources could also move to the location of existing GHG-intensive industries. The following could add balance: "In addition, low carbon energy carriers such as hydrogen may be transported to the location of existing GHG intensive industry."	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15022	23	25	23	25	Change "targets" to "policies and incentives", as it is not the targets themselves that result in change.	Government of United States of America, U.S. Department of State
268	23	25	23	26	C.5.3: Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
286	23	25	23	26	The following statement in C5.3 "Zero emission targets may reshape the location of GHG intensive industry and organization of value chains." does not have a confidence level associated with it. It needs to be amended as such as it is based on an assumption.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
288	23	25	23	26	The use of the term "may" in C5.3 "Zero emission targets may reshape the location of GHG intensive industry and organization of value chains." is not quantified. It should be replaced with a scientifically quantifiable term and/or indicate that is a projection.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1052	23	25	23	27	Can be stated more clearly. E.g. a zero emission global economy may...	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
692	23	25	23	28	Chapter 11 of the underlying report {Box 11.1} focuses on "hydrogen in industry", emphasizing the importance of hydrogen rather than only hydrogen could reshape "zero emission targets". In addition, the term "In the context of net zero emissions" in {Box 11.1} is different from the term "Zero emission targets" in the SPM. It is suggested that the description of hydrogen here be presented with examples.	Government of China, China Meteorological Administration
694	23	25	23	28	Regions where fossil energy is co-located with CCS storage capacity have the potential to serve as an export area or exporter of hydrogen-based chemicals and other materials processed with hydrogen. It is suggested to replace "natural gas" with "fossil fuels".	Government of China, China Meteorological Administration
2874	23	25	23	28	We suggest to also mention the issue of carbon leakage: regions enforcing zero emission targets may face displacement of GHG-intensive industries towards regions with less ambitious enforcement. (the geographical impact of zero emission targets is not just about regions with solar/wind resources)	Government of France, Ministère de la Transition écologique et solidaire
5652	23	25	23	28	This paragraph focuses on opportunities for industrial development in new regions. The section in general does not consider the key policy issue of carbon leakage when emission regulations are applied in some places but not others.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9508	23	25	23	28	The sentence "natural gas co-located with CCS storage capacity, have the potential to become exporters of hydrogen-based chemicals and other materials processed with electricity and hydrogen" specifies natural gas as a source of hydrogen while excluding coal, but any fossil fuel with CCS can produce carbon free hydrogen. "natural gas co-located with CCS storage capacity" should be corrected to "natural gas or coal co-located with CCS storage capacity"	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
13572	23	25	23	28	The statements made on hydrogen should be carefully revisited. Some forms may in fact be associated with high (CH4) emissions, while being expensive and not well developed and not capturing enough carbon.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
15024	23	25	23	28	Nuclear energy should be included as a zero emission resource for GHG intensive industry and organization of value chains given existing demonstrations of hydrogen production at existing nuclear power plants.	Government of United States of America, U.S. Department of State

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9510	23	25	23	34	C.5.3 suggests that there will be a massive scale relocation of production process of chemicals and other materials including steel to the countries/regions with high geographical potential for green hydrogen/electricity supply. C.5.4 also suggests that transition process of industry requires international cooperation associated with policies including compensation for early facility retirement. This means massive scale cross border transfer of wealth and employment is necessary for the transition process. This may be one of the most difficult barrier for the transition to occur.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
2878	23	26	23	26	We suggest to add "or nuclear power" before "natural gas co-located with CCS"	Government of France, Ministère de la Transition écologique et solidaire
2876	23	26	23	27	Suppress "storage". The sentence should read: "or natural gas co-located with CCS capacity" (or co-located with CO2 storage capacity, but it is better to say CCS capacity)	Government of France, Ministère de la Transition écologique et solidaire
12006	23	26	23	27	C.5.3: There is increasing evidence that blue hydrogen produced with natural gas + CCS has high GHG emissions (and high fugitive methane emissions in particular) and is not comparable to green hydrogen. In addition, it faces hurdles such as high costs, low technological development and lower than expected capture rates. This statement should not imply that regions with gas+CCS capacity could become hydrogen exporters in a net zero world.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
9664	23	26	23	28	We support the sentence 'Regions with abundant solar and wind resources, or natural gas co-located with CCS storage capacity, have the potential to become exporters of hydrogen-based chemicals'. We understand such the hydrogen-based chemicals include carbon neutral methane which is made from directly air captured carbon and green hydrogen. We see, however, the following sentences regarding natural gas in Chapter 10 aren't consistent with the above mentioned aspects:  'natural gas-based fuels are likely inadequate to meet stringent decarbonisation goals for these segments' on lines from 16 to 17 of page 10-5, and 'As a result, natural gas as a transition transportation fuel may be limited due to better alternative options being available and due to regulatory pressure to decarbonise the transport sector rapidly' on lines from 20 to 22 of page 10-25.  We would like to propose to add a sentence 'Natural gas can be a transition fuel between heavy fuel oil and carbon neutral methane' after each of them in order to describe the potential of natural gas, because natural gas isn't drop-in fuel and we would like to stress that the only specially constructed vessels can use natural gas as a transition fuel.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12682	23	26	23		Add after "value chains", "with, however potential negative consequences for equity, depending on national and regional circumstances." {4.5}	Government of India, Ministry of Environment, Forests and Climate Change
15026	23	27	23	27	Green hydrogen may have future potential, but it is not viable now.	Government of United States of America, U.S. Department of State
5654	23	29	23	29	Surprising that subsidies and fuel switching aren't highlighted? E.g. "government support to lower the cost of low carbon fuels and measures to encourage fuel switching to reduce GHG emissions".	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5656	23	29	23	29	Not clear on what is meant by "gradual expansion of policies to fully cover all GHG emissions", this seems like a catch all for the above. Instead would suggest explicit mention of the use of schemes for cap and trade of carbon credits and carbon pricing and carbon border adjustment mechanisms.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5660	23	29	23	29	"Integrating transport and power infrastructure could allow developing countries to leapfrog fossil-based transport systems with co-benefits for air quality" - I'd argue this should be upfront as a key point	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
270	23	29	23	30	C.5.4: Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability Advisor to the Ministry of Petroleum and Mineral Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
284	23	29	23	30	C.6: Policy Prescriptive "Industry transitions are enabled by international cooperation along with government and industry ambition to achieve net zero GHG emissions". Rewrite without prescribing policy or delete.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
11450	23	29	23	30	The "International Cooperation" is not at the right level. There may be very good cooperation examples, but they mainly target something very narrow and specific, and these "cooperations" do not see an overall picture. One of examples is the case, presented per BBC news, then the coal is extracted in Canada, later shipped to China, later Solar PV collectors produced in China, later these Solar PV collectors are shipped back to Canada, and Canada use these Solar PV collectors and declare that it produce green electricity. Individually every chain may be very effective, but the overall approach may be wrong. Therefore the international cooperation should focus on the Holistic approach.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2094	23	29	23	32	(Basis) For Korea, the use of CCS is limited and there are concerns about whether the waste resources needed in the steel, petrochemical, and cement industry will be sufficiently supplied. So please check CCS in effective policies	Government of Republic of Korea, Korea Meteorological Administration
15028	23	29	23	33	Compensation implies "buying out" for early retirement vs. innovative financing solutions to support (examples include off balance sheet bonds that recapitalize and assure full repayment, with retirement).	Government of United States of America, U.S. Department of State
696	23	29	23	34	This statement is not accurate. According to the underlying report, Section 11.6 focuses on policy measures and pathways that can promote industry transitions to net-zero GHG emissions, while government-level net-zero GHG emissions targets are beyond the scope of industry. It is suggested to change it to: "Industry transitions to net zero GHG emissions are enabled by international cooperation along with government and industry ambition and policies/strategies."	Government of China, China Meteorological Administration
5658	23	29	23	34	Can this say what form and type of international collaboration is needed alongside policies? It could also talk about progressing from R&D to demo to market creation and pull policies here - it's a bit of a list without showing how they fit together otherwise	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6140	23	29	23	34	We suggest adding carbon pricing, which is missing as a relevant policy for industry transitions. For example, chapter 11, page 85, states that "Internalizing the cost of GHG emissions in consumer choices and producer investment decisions has been a major strategy promoted by economists and considered by policy makers to mitigate emissions cost-effectively and to incentivize low GHG innovations in a purportedly technology neutral way". Moreover, in the SPM "government and industry ambition" are vague terms, could you be more precise?	Government of Belgium, Belgian Science Policy Office - Belspo
6540	23	29	23	34	What about the durability of products? Wouldn't longer durability also decrease emissions? How about policies that regulate e.g. longer warranties or increase reliability and maintainability? We request the authors to add information also on these issues from the underlying report.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11452	23	29	23	34	The effective policies mentioned are hard to find in the text. Figure 11.15 contains most (but not all) policies mentioned in the SPM. The sections of Ch.11.6. following Figure 11.15 do not discuss all policies mentioned in the Figure. This makes it hard to say whether the SPM is supported by the main text.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13962	23	29	23	34	Please consider to refine this paragraph. As stated in C5.2 many options are currently in the R&D stage, or are not yet mature enough to compete in the market. Over the next decade they need to see the same development as wind, solar PV, and batteries has done over the last 15-20 years, as described in section B4. IEAs 2021 World Energy Outlook states that one of four key short term priorities for holding 1,5 alive is to drastically increase the support for the development and early deployment of such climate mitigation technologies. Most of the literature assessed in the underlying chapter have similar conclusions. This information is very policy relevant, and we would appreciate if it could be reflected here (and also in section E).	Government of Norway, Norwegian Environment Agency
13964	23	29	23	34	Please include information about bridging solutions, costs and timing in this para.	Government of Norway, Norwegian Environment Agency
12684	23	29	23		After "international cooperation", insert ", provision of finance, technology transfer and capacity building support based equity and in keeping with regional and national circumstances, along with government incentive to restrict cumulative emissions to their fair share of the global carbon budget"	Government of India, Ministry of Environment, Forests and Climate Change
13966	23	30	23	30	Please include "Material efficiency" in the Glossary. In Ch 11.3.2 it is defined as "the delivery of goods and services with less material". Looking at the figure 11.7 we do not think the word "delivery" covers fully the term as it can be read as transporting materials, while this is about everything from design to recycling.	Government of Norway, Norwegian Environment Agency
15030	23	30	23	30	Delete "net zero" and replace it with "substantially reduce". The specific target of "net zero" is not necessary for policies and incentives to transform these industries.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15032	23	30	23	31	This sentence needs improvement. For example, what kind of energy needs to be expanded using which "effective policies"? What does "expanded CCS" mean? Expanded from zero? What about CCUS?	Government of United States of America, U.S. Department of State
2362	23	30	23	33	Suggest emphasising the importance of investment in emerging technologies.	Government of Australia, Department of Industry, Science, Energy and Resources
11454	23	30	23	33	Please clarify the sentence. E.g., it is unclear whether "expanded" refers only to energy (then what is "expanded energy"?) or to "infrastructure" (in that case: CCS infrastructure would be "expanded" compared to what?). Why would "infrastructure" be a "policy"?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15034	23	30	23	33	The wording of this sentence is off. First, most of what is listed in the sentence is not policy, but technology or a kind of change that might be induced by policies (or economics or other factors). Second, whether a policy would be ""effective"" in making those changes is unknown and should be deleted. Perhaps reword the beginning of the sentence to say: ""Targets of policies to reduce industrial GHG emissions could include: ..."" Yes, materials efficiency policies is sort of policy but it's also extremely unclear what that policy would be. It seems more like an objective than a policy. Also, ""expanded energy"" is unclear here. CCS is far from economic viability. Specify what is included in ""all GHG emissions"" in this case; ""emissions of all GHGs"" (i.e., including non-CO2s) or ""GHG emissions from all sources"" (i.e., both energy and non-energy process emissions)? Recommend striking ""gradual"" unless the recommendation actually precludes a step-wise increase in policy coverage.	Government of United States of America, U.S. Department of State
4088	23	30	23	34	Line 31 mentions "early facility retirements" as an option to become more energy-efficient and carbon-neutral. This is somewhat surprising and in contradiction with many other statements e.g., C.5.1. (and the underlying chapter 11.6) that stress the importance of a circular economy. Cycle Assessments show that the embodied energy that exists in existing buildings is significant and tearing down these existing less-efficient facilities (containing lots of carbon) and rebuilding (with all the involved GHG emissions to erect these) does not actually reduce overall GHGs.	Government of Canada, Environment and Climate Change Canada
6542	23	30	23	34	As material demand management is an important measure to reduce emissions, as stated in chapter 11.3.1, and not necessarily included in the understanding of material efficiency please add [...] material efficiency "and demand management" policies.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2880	23	31	23	31	Could the term "expanded energy" be explained? It's not very understandable by policymakers	Government of France, Ministère de la Transition écologique et solidaire
4090	23	31	23	31	Unclear what is meant by 'expanded energy'. A definition should be provided.	Government of Canada, Environment and Climate Change Canada
9512	23	31	23	31	"expanded energy" is not clear. Need clarification. This may be intended to be a hydrogen infrastructure, but it is not understood by the reader.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
13268	23	31	23	31	Currently under the UN Environment Assembly the discussions have matured towards taking the issue of global plastic pollution towards establishing a global treaty (potential decision at UNEA5.2, Feb 2022). In general, we are no longer talking about recycling of plastics alone, but put the whole life cycle of plastics production and consumption at the center of the deliberations. Here: please correct the sentence towards: "... a life cycle approach to plastics, ..."	Government of Switzerland, Federal Office for the Environment FOEN
13968	23	31	23	31	What is the meaning of "expanded energy"? Is this a common term or do you mean that industry needs energy from more suppliers? Please consider to explain, reformulate or change the wording to increase the readability. It is not very intuitive to understand what it means in this very important sentence. It would also be helpful to have in the glossary.	Government of Norway, Norwegian Environment Agency
1060	23	31	23	32	On the face of it this type of policy may not be not very progressive, depending on who is being compensated. Insight from analysis on the scope and targetting of such policies should be provided.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
9814	23	32	23	32	add before "materials": "feedstock and ", and after "materials", "e.g. by setting minimum standards for renewable and recycled content,"	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
10320	23	32	23	33	Please explain the concept of "transparent embodied GHG measurement"	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica

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1062	23	33	23	33	Explanation is required as to why the expansion of policies to cover all GHGs would be gradual?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2882	23	36	23	36	We suggest to mention both a multi-network issue that is not limited to energy and transport (and includes water and information and communication technologies) to achieve sustainable cities. As well as the underlying sanitary and economic co-benefits in terms of improved air quality (and not just reduced greenhouse gas emissions).	Government of France, Ministère de la Transition écologique et solidaire
276	23	36	23	37	C.6: Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
9514	23	36	23	37	The 1st sentence seems to lean to positive side. There are full of warnings of the risk sides on urbanization in chapter 8. Adding the following two headlines from the executive summary would make a well-balanced summary: p8-5 I20-21 "The construction of new, and upgrading of, existing urban infrastructure through 2030 will result in significant emissions."; p8-5 I27-29 "Given the dual challenges of rising urban GHG emissions and future projections of more frequent extreme climate events, there is an urgent need to integrate urban mitigation and adaptation strategies for cities to address climate change and withstand its effects."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
13972	23	36	23	37	We are pleased to read about resource efficiency in SPM C.6. Please keep the following sentence: "The growing concentration of people and activities in urban areas creates opportunities to increase resource efficiency and decarbonize at scale". And, please consider to add "resource efficiency" to the glossary.	Government of Norway, Norwegian Environment Agency
282	23	36	23	39	C.6: The use of the verb "decarbonize" in line 37 implies the need for policy development without carbon-based sources/materials. The focus should not be on sources rather on emissions.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
290	23	36	23	39	C.6: "Transformations" require stringent and rapid actions and human and financial resources in very short time which might not be available at this time for every country. The principle of Common But Differentiated Responsibilities and Respective Capabilities (CBDR-RC) outlined in the United Nations Framework Convention on Climate Change (UNFCCC), recognizes that countries have different duties and abilities to address the negative impacts of climate change. System transitions is more suitable implying the varying levels of resources of different countries. "System transformations" should be replaced with "system transitions".	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
698	23	36	23	39	The conclusion may be credible for most cities in developed countries, but for many developing countries, per capita carbon emissions in cities are higher than those in rural areas due to low-quality urbanization, low use of low-carbon energy, lack of green and blue infrastructure, and dense distribution of urban slums (Maraseni et al., 2016; Heinonen & Junnila, 2011). It is therefore suggested that the conclusion should be expressed in terms of developed and developing countries, or reduce the confidence level. References: 1. Maraseni, T.N., Qu, J., Yue, B. et al. Dynamism of household carbon emissions (HCEs) from rural and urban regions of northern and southern China. Environ Sci Pollut Res 23, 20553–20566 (2016). <a href="https://doi.org/10.1007/s11356-016-7237-5">https://doi.org/10.1007/s11356-016-7237-5</a> 2. Heinonen, J.; Junnila, S. A Carbon Consumption Comparison of Rural and Urban Lifestyles. Sustainability 2011, 3, 1234-1249. <a href="https://doi.org/10.3390/su3081234">https://doi.org/10.3390/su3081234</a>	Government of China, China Meteorological Administration
1064	23	36	23	39	Assume this applies to existing "mature" cities as well has rapidly growing urban areas.  A note of caution may be required with respect to any growth in suburbanization and sprawl which can undermine sustainable development.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division



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15036	23	36	23	39	Overly optimistic slant on increasing urbanization, which may also have negative impacts on mitigation as well as adaptation when not planned and regulated well. Section C.6 summarizes interesting findings about urban centers that lend themselves to policymaking. Identifying role of the agriculture sector and local food systems in pathways of urban transformation would be helpful for agriculture policymakers to more easily identify next steps. Sections C.6 and C.7 need to say something about the importance of individual and cultural preferences and behaviors, in the acceptability and effectiveness of urban patterns. More than in other sectors, preferences and behaviors would have a strong effect on acceptability, feasibility, and effectiveness.	Government of United States of America, U.S. Department of State
4092	23	36	24	20	Links from urban centres to rural communities and settlements should be addressed in this HLS.	Government of Canada, Environment and Climate Change Canada
6544	23	36	24	20	We appreciate the emphasize on cities in this report. However, we are not sure if it is intuitive to place its headline section C.6 as one section between the 5 sectors (energy, industry, transport, AFOLU, Buildings). We feel it would make more sense to put C.6 after all sector subsections (i.e. after C.9) as it includes cross-cutting and cross-sector issues.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12008	23	36	24	20	C.6: Please add information on the potential of urban areas for advancing resource efficiency and decarbonisation for different regions of the world, because these potentials surely are not the same for urban areas in many developing countries without sufficient governance or capacities to design urban growth in sustainable low-carbon ways? This is already indicated in C.6.4 but needs to be specified and included at C.6 headline statement level.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13970	23	36	24	20	If possible, please consider providing an assesment of GHG emissions from urban areas (based on available territorial emission reporting), preferably quantified and as a share of consumption based emission (CBE) estimates from urban areas.	Government of Norway, Norwegian Environment Agency
5662	23	36	25	28	Sections C.6-C.8 emphasise options that are applicable for regions under development with time frames that appear rather long (for example, urban form and new building regulations). In countries with established cities and aging infrastructure, many levers are not available and rapid action will need to be taken in retrofitting existing infrastructure and landscapes. These three sections could acknowledge the different levers and give a sense of priorities as a function of existing legacy.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15038	23	37	23	37	"At scale" is jargon but doesn't literally make any sense. At what scale? At commercial scales that could be effective or more cost-efficient to achieve GHG reductions? Either drop or replace with something meaningful.	Government of United States of America, U.S. Department of State
2462	23	37	23	39	Is transport included in the current formulation? Could transport be mentioned specifically?	Government of Denmark, Danish Meteorological Institute
6546	23	37	23	39	We find the last sentence quite vague and are wondering about the role of transport and buildings. Transformations in these sectors would also significantly reduce emissions in cities. To not consider these sectors but e.g. energy systems is misleading. Also, what are infrastructures exactly? Is it public transport and public buildings, water system, etc.? Why is the energy system not part of the infrastructure? Please be revise this statement considering our questions.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2884	23	38	23	38	"and urban metabolism", could be added after "form and infrastructure" which concerns all the flows that pass through cities and whose processes must be completely transformed.	Government of France, Ministère de la Transition écologique et solidaire
4094	23	38	23	38	The use of words like system, systemic, and systematic should be standardized to aid in joint understanding.	Government of Canada, Environment and Climate Change Canada
13270	23	38	23	38	Add "... form and infrastructure, more sustainable consumption and production patterns, energy systems, ..."	Government of Switzerland, Federal Office for the Environment FOEN
12690	23		24		Suitable caveats may be inserted in C 6 and C 7. Compact cities would mean much taller buildings packed in a dense manner. This has trade-offs even if transport-related demands/emissions reduce. First, taller buildings need more energy intensive materials like steel per m2. Second, increased space cooling demand due to urban heat island effects. Third, increased operational energy for elevators, water pumping etc. And finally, reduced potential/space for RTPVs. Low-carbon construction materials with better thermal properties and better planned/ventilated buildings could instead be the focus in developing countries.	Government of India, Ministry of Environment, Forests and Climate Change
15664	23	3	23	3	cite methane emissions from other sectors (agriculture, wastes)	Government of Algeria, Ministère de l'Enseignement supérieur et de la Recherche Scientifique

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2890	24	1	24	1	"Generated" may be ambiguous. Are the emissions located within the urban areas ? If not, we would recommend the use of the term "are responsible for". Also, it would be useful to indicate the share of the population that lives in "urban" areas, with the same definition of "urban" (which is also somewhat ambiguous (is a community of 500 people considered as "urban" ?)	Government of France, Ministère de la Transition écologique et solidaire
6548	24	1	24	1	Urban agriculture / gardening management (Ch. 7 P 28 L.11) relies frequently on high fertilisation rates (most likely high N2O emissions), frequent grass-cut and grass export (low C sequestration) and soil redistribution (low local C sequestration) and little promotion of hard greening with trees (low C sequestration) may be carefully included in view of C6.1 "Urban areas generated between 67–72%".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
294	24	1	24	2	C.6.1: Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
700	24	1	24	2	The statement is not consistent with the underlying report. It's stated in Chapter 8 (page 4) that "Total urban emissions based on consumption-based accounting were estimated to be 24.5 GtCO <sub>2</sub> -eq, or 62% of the global total in 2015, excluding aviation, shipping and biogenics, and increased to an estimated 28.5 ± 0.1 GtCO <sub>2</sub> -eq in 2020", but in the SPM "28.5±0.1GtCO <sub>2</sub> -eq" is not mentioned, and the data is based on "the production and consumption of goods and services". It is suggested to delete "production" and add "28.5±0.1GtCO <sub>2</sub> -eq".	Government of China, China Meteorological Administration
2888	24	1	24	2	We suggest to mention the share of urban areas in global population and global GDP, if information available	Government of France, Ministère de la Transition écologique et solidaire
12586	24	1	24	2	Delete "C.6.1 Urban areas generated between 67–72% (~28 GtCO <sub>2</sub> -eq) of combined global CO <sub>2</sub> emissions in 2020 through the production and consumption of goods and services." Add "C.6.1 Urban areas generated between 67–72% (~28 GtCO <sub>2</sub> -eq) of combined global CO <sub>2</sub> emissions in 2020 based on consumption-based accounting." Reason: There is no mention of 'production' in the source chapter regarding emissions from urban areas. Reference: 8.3.3	Government of India, Ministry of Environment, Forests and Climate Change
13974	24	1	24	2	Please consider replacing "areas" with "systems" in this sentence. The territorial emissions (TA) generated by urban systems are in general just a fraction of the consumption based emissions (CBE), and it should be made very clear to the reader if emission numbers refer to TA or CBE .	Government of Norway, Norwegian Environment Agency
310	24	1	24	4	C6.1: The "emissions projections increase": specify under which scenarios.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1314	24	1	24	4	Here, it should be made clear that this is consumption-based accounting and that "urban areas generated" is different from the sectorial characterisation of emissions. Enduse of energy and products does of course to a large extent occur in urban areas, but it does not mean that emissions would have been (directly) generated there.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
11456	24	1	24	4	"driven by a growing population" sure, but have you also considered the urbanisation trend in evaluating the rise of emissions from urban areas? It is not clear from the sentence	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11458	24	1	24	4	The reference base of this paragraph is rather strange. Why can't emissions from the food system consumed in urban areas be added? It is also likely that emissions from aviation and shipping connected to urban areas are much higher than those connected to rural areas.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2886	24	1	34	2	Please consider replacing "combined global CO <sub>2</sub> and CH <sub>4</sub> emissions" by "global GHG emissions (including CO <sub>2</sub> and CH <sub>4</sub> )" as it is mentioned in 8-36, line 39	Government of France, Ministère de la Transition écologique et solidaire
1070	24	2	24	2	It should be made clear that this includes waste management.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division

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11460	24	2	24	2	Footnote 18: "Excluding emissions from aviation, shipping and biogenic sources". Please explain which biogenic CO2 sources are excluded and why. Is it just CO2 from combustion (the third "memo item" next to aviation and shipping, assuming that they refer to "international" bunker fuels) or also biogenic CH4 sources, like all CH4 from organic waste, wastewater, rice cultivation, livestock? Are they excluded both from the urban emissions and global totals equally (i.e., does the % figure compare like with like)?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13272	24	2	24	2	In the rest of the document, the reference year for current emissions is 2019. Why are we speaking to the year 2020 in this para? Harmonize.	Government of Switzerland, Federal Office for the Environment FOEN
15040	24	2	24	2	Not clear from the footnote whether this is just FFI or inclusive of all emissions, including AFOLU.	Government of United States of America, U.S. Department of State
6550	24	2	24	4	Which scenario/pathway is implied here with "moderate to no mitigation effort"? Please maintain the good scenario language within the SPM and relate the increase to a scenario set from SPM table.1. Also, what is the influence of growing cities and growing absolute population and other socio-economic factors on this emission increase by 2050? We guess that this is the main reason for this huge range. If so, please add some information on this dependency. Otherwise the reader might think e.g. that only a different deployment of mitigation options influences the emission of cities.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
1182	24	3	24	3	Add 'between' to be consistent with first line of paragraph "projected to rise to between 34–65"	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1066	24	3	24	6	This sounds like a criticism of urban living whereas in developed countries it is a more carbon efficient lifestyle. Perhaps these percentages could be compared against the %s living in urban areas or the % of goods and services that urban areas produce.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1068	24	3	24	6	The co-benefits should be mentioned e.g. public and environmental health.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2892	24	4	24	4	"Urban emission have increased with much inter region variation in the magnitude of the increase. Most future urban population growth will occur in developing countries" {8.1}	Government of France, Ministère de la Transition écologique et solidaire
11462	24	5	24	20	The confidence levels for sections C.6.2 to C.6.4 seem too optimistic.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
298	24	5	24	9	C.6.2: The statemnt is policy prescriptive as it prscribes to policy makers the stragies to reduce emissions. Rewrite to avoide policy prescriptive language	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1072	24	5	24	9	Waste management is omitted from this set of effective emissions reductions measures. Needs to be included.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1074	24	5	24	9	A point on sentence structure, the sentence can be read as saying only blue infrastructures lead to multiple co-benefits. I do not think this is the intent. But neither do I think the intent is to imply that all strategies lead to multiple co-benefits. SUGgest use of shorter, more concise and focused sentences would improve clarity.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6552	24	5	24	9	Additionally to referring to green and blue infrastructure in C.6.3, it would be also useful to point to the role of the umbrella concept of nature-based solutions in urban areas (see chapter 8, p. 23, line 8f), as the concept is used more and more in urban settings as well as in rural landscapes (e.g. in chapter 7).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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12584	24	5	24	9	While the statement on cities achieving net zero emissions through deep decarbonisation has very high confidence, the broad strategies themselves carry "medium evidence, high agreement". This should be retained in the SPM. (Reference: Chapter 8, Page, 8-5, Lines 35-40) "C.6.2 Effective emissions reductions can be achieved in cities by implementing three broad strategies concurrently: (1) reducing urban energy consumption across all sectors, including through compact and efficient urban forms and supporting infrastructure, (2) electrification and switching to low-carbon energy sources, and (3) enhancing carbon uptake and storage through green and blue infrastructure, which offers multiple co-benefits (medium evidence, high agreement). (Figure 5.7, Table SM5.2, 8.2, 8.4)"	Government of India, Ministry of Environment, Forests and Climate Change
13976	24	5	24	9	This para bring interesting perspectives. However, in the description of the first of the broad strategies we believe "supporting infrastructure" is a bit abstract, please consider if it could benefit from more concretization (e.g. smart electricity grid). In addition we believe that insulation of new and existing buildings should be considered mentioned. In the second broad strategy, electrification could also benefit from more concretization (e.g public and electric transport systems). In the last strategy we are not sure how large this potential for carbon uptake and storage are compared to the other examples we have mentioned in this comment.	Government of Norway, Norwegian Environment Agency
2894	24	6	2	7	It is not necessarily valid for all cities. Compact city forms take a long time to develop due to the low renewal rate of urban spaces. Moreover, they can be the source of opposition from the inhabitants and leads to questions of governance. It may presents forms of increased vulnerability and maladaptation effects. (ex: And they are not always suitable for high temperatures) One solution could be to be to limit it to efficient urban forms is less questionable and avoids a bias which should be more clearly stated or presents the side effects of compact cities which can be better taking into account in the governance questions. The following sentence from the Technical Summary pp. 65-66 might be interesting to add to the SPM, to better describe the cobenefice : "Compact cities with shortened distances between housing and jobs, and interventions that support a modal shift away from private motor vehicles towards walking, cycling, and low-emissions shared, or public, transportation, passive energy comfort in buildings, and urban green infrastructure can deliver significant public health benefits and lower GHG emissions."	Government of France, Ministère de la Transition écologique et solidaire
13274	24	6	24	6	Add "(1) reducing urban energy and material consumption across all sectors, ..."	Government of Switzerland, Federal Office for the Environment FOEN
15042	24	6	24	7	For strategy (1), the discussion can be expanded. Cities present great potential for social innovation, in addition to urban and land use planning, to reduce energy consumption. Here, the discussion can be placed in a socio-technical system context and point out the potential of digitalization, network effects, social and behavior change that can play roles in solutions. Recommend clarifying what "supporting infrastructure" entails with a "such as ...". Distribution system infrastructure? Hardware and software? Whether electrification in urban areas reduces GHG emissions depends on the source of the electricity, and this should be noted, as electrification does not suffice alone. Yes, there could be efficiency gains in electrification (or not) but that would go under efficiency.	Government of United States of America, U.S. Department of State
2898	24	6	24	9	The two first (1 and 2) strategies are, indeed, direct strategies to reduce emissions in cities. The third one, about green and blue infrastructure, is not a reduction strategy but a mitigation and adaptation strategy. These solutions are, by the way, detailed in the part about mitigation and adaptation (part D.2 and D.2.1)	Government of France, Ministère de la Transition écologique et solidaire
2896	24	7	24	7	What is « EFFICIENT urban forms and supporting infrastructure » may be made more explicit	Government of France, Ministère de la Transition écologique et solidaire
6554	24	7	24	8	Please clarify which of the listed options are specific to cities: electrification and switching to low-carbon energy will reduce emissions anywhere, not just in cities.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11464	24	7	24	8	The three strategies includes "(2) electrification and switching to low-carbon energy sources". This means that district heating and cooling, including co-generation and trigeneration, which produce energy in most efficient way would be excluded. District energy is a proven technology, which can be a part of overall integrated energy system (electricity, heating, cooling, wind, solar, etc) with consumers and prosumers. Please consider leaving a place for district heating and cooling.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
702	24	8	24	8	The meaning of "green and blue infrastructure" is unclear and it is suggested to give further clarifications.	Government of China, China Meteorological Administration

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1076	24	8	24	8	What is "blue infrastructure"?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2900	24	8	24	8	What is the storage potential of urban green and blue infrastructure? Is it really on the scale of the problem?	Government of France, Ministère de la Transition écologique et solidaire
5676	24	8	24	8	Define "green" and "blue" infrastructure.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9516	24	8	24	8	It would be better to insert some explanations for "green and blue infrastructure", for easier understanding. For instance, in line 15, page 6 of Ch. 8, it is explained that "green and blue infrastructure, including urban forests and street trees, permeable surfaces, and green roofs."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11466	24	8	24	8	"(-3) enhancing carbon uptake": in principle yes, but is it considered by authors of comparable significance as the other two options, for urban areas? Or is it meant to include land-based offsetting in rural areas? The SPM mentions offsetting only once and only in the context of cities, suggesting a special relationship.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13328	24	8	24	8	"green and blue infrastructure" are not commonly agreed terminology. Please use terminology that is consistent with language from multilateral environmental agreements in the realm of biodiversity or from IPBES.	Government of Switzerland, Federal Office for the Environment FOEN
13978	24	8	24	8	Please consider to explain "green and blue infrastructure", based on the information from the glossary.	Government of Norway, Norwegian Environment Agency
15044	24	8	24	8	The header refers to green and blue infrastructure needed in urban settings, but there is no discussion of this throughout the rest of Section C. It is however discussed in D.2.1, but without referencing back to C.6. A footnote would be helpful here.	Government of United States of America, U.S. Department of State
15046	24	8	24	8	Policymakers and the public don't necessarily know what "green and blue infrastructure" is. State more clearly and maybe give some examples or a list.	Government of United States of America, U.S. Department of State
12588	24	8	24	9	Confidence level mentioned as "very high confidence" is not supported by any level of confidence in most of the text mentioned in the referred sections 8.2 or 8.4. However, as stated in the referred cross-reference chapter 8, section 8.4, sub-section 8.4.4.1. (line 8 to line 12) where it is mentioned as medium agreement with limited evidence, for mitigation co-benefits for urban trees. Also, coming to sub-section 8.4.4.2- "Benefits of green roofs, green walls, and greenways", it mentions "low evidence for emissions reductions from urban NBS mitigation measures in terms of soft solutions such as improving green connectivity for cycling."	Government of India, Ministry of Environment, Forests and Climate Change
2902	24	9	24	9	This important idea should be added, following this paragraph in Technical Summary p. 65 "Given the regional and global reach of urban supply chains, a city cannot achieve net zero GHG emissions by only focusing on reducing emissions within its administrative" boundaries	Government of France, Ministère de la Transition écologique et solidaire
2904	24	9	24	9	For a document intended for policymakers, the co-benefits should be specify. In line with chapter 8 pp.63-65, it would be interesting to replace the term "co-benefits" with the expression "co-benefits (mitigation benefits, adaptation benefits, sustainable development Goal)	Government of France, Ministère de la Transition écologique et solidaire
2906	24	10	24	10	the idea of "packages" is too vague.It is not clear whether this refers to a set of measures applied simultaneously or to cross-cutting actions. It seems that the idea here is rather to have a global and cross-cutting strategy, which integrates the different sectors. Siloed and compartmentalised interventions should be avoided. It could be specified as "complementary, intersectoral, inter-territorial and coordinated interventions between stakeholders".	Government of France, Ministère de la Transition écologique et solidaire
2908	24	10	24	10	For the term "individual", a distinction must be made between actions aimed at people (individuals) and one-off measures, which are often sectoral and localised (contrary to the idea of going beyond the administrative boundaries of the city).	Government of France, Ministère de la Transition écologique et solidaire
296	24	10	24	12	C.6.3: Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
300	24	10	24	15	C.6.3: The statemnt is policy prescriptive as it prescribes a timeline and certian levels to policy makers. Rewrite to avoide policy prescriptive language	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
9910	24	10	24	15	(C6.2): The text does not address potential conflict between "compact urban forms" and "enhancing carbon uptake and storage through green and blue infrastructure". Suggest to add a sentence like: "This requires careful planning and implementation to balance potentially contradictory concepts.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
2910	24	12	24	12	We suggest to add after "...boundaries." add : " Urban land use, urban form and infrastructure orientations have significant implication for future carbon lock-in. Integrated spatial planning ..." {8.4}	Government of France, Ministère de la Transition écologique et solidaire
2912	24	12	24	12	It is not clear whether it is urban growth or economic growth. The wording can be criticised because it gives the impression that urban growth is an irreversible fact and a goal in itself.	Government of France, Ministère de la Transition écologique et solidaire
15048	24	12	24	12	Insufficient recognition of the administrative, political, and enforcement barriers for integrated spatial planning beyond city administrative boundaries. The small range of potential reduced urban energy use (23-26%) seems unrealistic.	Government of United States of America, U.S. Department of State
11468	24	12	24	13	"reduce urban energy use in 2050 by 23-25%": "reduce" compared to what? Today's level or a 2050 counterfactual without "integrated spatial planning"? In either case, the range of reduction given is extremely narrow, suggesting an accuracy of estimation that hardly seems feasible, especially coupled with "very high confidence". Please revise.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13980	24	12	24	14	What does "transit-oriented development" mean? Please consider to explain this term, reformulate or change the wording to increase the readability, if it is considered to be important. And if appropriate, could efficient public transport systems be included? We believe it is broader than just a focus on transit.	Government of Norway, Norwegian Environment Agency
6556	24	12	24	15	How relevant is integrated spatial planning for established cities featuring no or only little growth? If this is in particular relevant for cities with high growth rate, please include similar mitigation options that are relevant for cities with no or only little growth rate. Also, what is "transit-oriented development"? Please add some explaining remarks. Also, it would be interesting to understand information on recent trends e.g. regarding home office, delivery of goods and other recent developments also due to the COVID19-pandemic. Please add information based on the underlying report as appropriate.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11470	24	12	24	15	Besides more compact cities, should we mention to re-use and refurbishment old buildings rather than building new buildings that implies land use change, urban sprawling (longer distances in transport) and more concrete (more emissions from industry)?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
10322	24	13	24	13	Please explain the initial year for the statement "could reduce urban energy use in 2050 by 23-26%".	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
704	24	14	24	14	There should be limits to the density of human habitation in cities to ensure healthy living. It is suggested to change "co-location of higher residential" to "co-location of suitable residential".	Government of China, China Meteorological Administration
2464	24	14	24	14	Does transit-oriented mean transport-efficient? Could another term be used, it is not entirely clear.	Government of Denmark, Danish Meteorological Institute
5678	24	14	24	14	Suggest clarifying the meaning of "transit-oriented development".	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15050	24	14	24	14	Consider adding to co-location, by including "essential services" and also "compact neighborhoods".	Government of United States of America, U.S. Department of State
1080	24	16	14	20	Additional uncertainty as to the insight being provided in this section.Strategies developed at local/city level must be consistent with national and global objectives, otherwise conflicting and misaligned actions might emerge. An extreme example might be where city authorities decides to avoid local disruption of services and infrastrucutre development and decide to purchase offsets (at lower cost and less inconvenience).	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1078	24	16	24	20	Not sure what finding is being presented here. The question is not whether targets can be set, but rather whether they can be achieved and which the criteria and indicators are useful in developing policies towards this end.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
4096	24	16	24	20	Sub-bullet C.6.4 does not inform new information nor on the implications for mitigation.	Government of Canada, Environment and Climate Change Canada
13342	24	16	24	20	Specific examples for success factors in specific contexts and circumstances should be mentioned to make it more accessible for policymakers.	Government of Switzerland, Federal Office for the Environment FOEN
15052	24	16	24	20	Here it can be useful to note that strategies that meet multiple objectives (e.g., financial, sustainability, environmental, and social well-being) can deliver win-win, sustainable, and attractive solutions for cities that also help achieve sustainable emission reductions and climate resilience.	Government of United States of America, U.S. Department of State
2914	24	17	24	17	We suggest to add "by including collective decision-making processes" to counterbalance the top-down effect of this sentence.	Government of France, Ministère de la Transition écologique et solidaire
2916	24	18	24	18	Indicate whether the targets "net zero GHG emission target" are for local emissions, or also including externalities (ie imports)	Government of France, Ministère de la Transition écologique et solidaire
12010	24	18	24	18	C.6.4: It would be helpful to specify if this trend of cities setting net zero targets is global, or specific to certain regions (or developing / developed countries). This language on net zero targets for cities could be more carefully written, as currently it could be read as implying that a net zero target is a comparable target, when different cities and other entities have very different net zero targets. Can anything be said about the variability between these and what they mean?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
15054	24	18	24	18	Insert "or other" after "net zero".	Government of United States of America, U.S. Department of State
15056	24	18	24	19	Consider adding "and other units of local government".	Government of United States of America, U.S. Department of State
5680	24	18	24	20	This sentence combines targets that are both within and beyond administrative capacities, and involving offsets. It is unclear which is the key message of the two in the sentence. Are those targets beyond administrative capacities dependent on offsetting (which can be highlighted as low in the hierarchy of carbon reduction), or are both those within and beyond administrative capacities dependent on offsetting? I'd suggest splitting the sentence into two to clarify which the difference in carbon reduction targets.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2918	24	19	24	19	This sentence could be made more precise by adding "with new positive interdependent relationships with their hinterland".	Government of France, Ministère de la Transition écologique et solidaire
11472	24	19	24	19	What does "environmental footprint" include? Would all environmental factors improve simultaneously?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11474	24	19	24	20	Offsets should be better covered, including concerns about their integrity, and go well beyond cities	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11476	24	19	24	20	It is unclear why offsetting is mentioned, and why only here. If authors consider offsetting relevant to scientific assessment, then it should be addressed horizontally, including the many related issues and caveats. No reason to link it to urban strategies only.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
308	24	22	24	22	C.7: Required action: use a definable (quantifiable) adjective instead of "decent" to qualify the standard of living.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
5682	24	22	24	22	'decent' standard of living is not quantifiable or measurable, could become ambiguous to policy makers trying to set a standard of new buildings. Is there an alternative adjective, such as 'comfortable' or 'adequate' that would be acceptable in its place?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15058	24	22	24	22	Change to: "GHG emissions from buildings could yield deep emission reductions globally while ensuring decent living standard ..."	Government of United States of America, U.S. Department of State
1184	24	22	24	23	Add s to standards "while ensuring decent living standards"	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13662	24	22	24	23	Suggest either "...ensuring a decent living standard...." or "...ensuring decent living standards....."	Government of New Zealand, Ministry%20for%20the%20Environment
2920	24	22	24	24	If this assertion covers the case of existing buildings, it seems overgeneralisation : it's possible for some buildings, which doesn't mean it's possible for all, and when possible, it's more or less cost effective for some buildings, but it is'nt for all. It might be interesting to add a subparagraph on building renovation and measures that can contribute to the reduction of GHG emission on existing buildings.	Government of France, Ministère de la Transition écologique et solidaire
12578	24	22	24	24	Delete "GHG emissions from buildings could reach net zero globally while ensuring decent living standard for all if mitigation solutions are implemented at the design, construction and use phase of buildings, including by limiting the demand for energy and materials." Add "It is possible to mitigate 8.2 GtCO <sub>2</sub> or 61% of global building emissions in 2050, as compared to their baseline, while ensuring decent living standard for all if mitigation solutions are implemented at the design, construction and use phase of buildings, including by limiting the demand for energy and materials." Reason: The current sentence is vague and does not specify the timeline for net zero. The added sentence makes specific reference to the section 9.6.2 that specifies possible mitigation in building sector by the year 2050 which is the general net-zero target, based on all integrated approaches specified in the chapter. {9.6.2 ; 9.1, 9.3, 9.4, 9.5, 9.6, 9.9}	Government of India, Ministry of Environment, Forests and Climate Change
13982	24	22	24	24	Please keep the following sentence in SPM C.7: "GHG emissions from buildings could reach net zero globally while ensuring decent living standard for all if mitigation solutions are implemented at the design, construction and use phase of buildings, including by limiting the demand for energy and materials (high confidence)".	Government of Norway, Norwegian Environment Agency
13984	24	22	24	24	Please consider to add the following text to SPM C.7 (from TS, page 71, line 32-38): "[...] To allow for adjusting the size of buildings to the evolving needs of households, circular use of materials and repurposing unused existing buildings to avoid using virgin materials and optimisation of the use of buildings through lifestyle changes [...] are among the sufficiency interventions implemented in leading municipalities (high confidence)".	Government of Norway, Norwegian Environment Agency
706	24	22	24	25	Global net zero emissions from buildings cannot be achieved only by mitigation methods (including limiting energy and material demand), and nature-based solutions are needed as well. It is suggested to change it to: GHG emissions from buildings could reach net zero globally while ensuring decent living standard for all if carbon emission reducing solutions and Nature-based Solution are implemented at design, construction and use phases of buildings (high confidence).	Government of China, China Meteorological Administration
5684	24	22	24	25	It would be useful to highlight the health co-benefits of building decarbonisation.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11478	24	22	24	25	The statement also has to include a final life cycle stage "demolition or refurbishment" not only design, construction and use phases	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13422	24	22	24	25	Please consider the whole life cycle of the building including dismantling and demolition phase	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
15060	24	22	24	25	The core claim that "GHG emissions from buildings could reach net zero" does not seem to be supported by the text of Chapter 9 and definitely should not be labeled as "high confidence". C.7.3 only addresses net-zero carbon in the use phase of buildings. It does not state that buildings in the design or construction phases could achieve net zero. This makes it incongruous with this statement in C.7, which does state that buildlings could reach net zero for design, construction, and use phases.	Government of United States of America, U.S. Department of State
15062	24	22	24	25	The disposal/recycling phase of building life cycle GHG emissions should also be included here.	Government of United States of America, U.S. Department of State
2364	24	22	24	39	Suggest including retrofits to existing buildings in this paragraph. While tackling emissions in new buildings will be vital, especially given a lot of new buildings will be constructed in developing and emerging economies, in developed economies such as Australia, retrofiting existing buildings will also be essential as highlighted in the Executive Summary of Chapter 9 Buildings	Government of Australia, Department of Industry, Science, Energy and Resources



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5686	24	22	24	39	C.7 on buildings comes across quite optimistically given the trends on building emissions are very negative. It would be useful to communicate the key challenges associated with decarbonising the existing and future building stock, including capacity within the industry and fuel poverty.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6142	24	22	24	39	Could you add some information concerning obstacles to, and enablers of, reducing GHG emissions from buildings? For example, chapter 9 contains the following: "The decarbonisation of buildings is constrained by multiple barriers and obstacles as well as limited flow of finance (robust evidence, high agreement)." (chap9, p.5, l.33-34) and "Low ambitious policies will lock buildings in carbon for decades as buildings last for decades if not centuries (high evidence, high agreement). Building energy codes is the main regulatory instrument to reduce emissions from both new and existing buildings (high evidence, high agreement)". (chap9, p.5, l.43-48)	Government of Belgium, Belgian Science Policy Office - Belspo
12384	24	22	24	39	According to Ch5.P62-63.L36-5. It can be argued that the benefit of shared accommodation relies in the fact that each individual uptakes smaller space regardless of the sharing nature. In this case, the same outcome can be obtained by smaller housing.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12450	24	22	24	39	As the data is from 2019 (31% of end demand is from Buildings), there is a need to update the projection with recent trends, especially post Covid-19. Work from home is becoming a norm nowadays, thus decentralisation of energy use will be more eminent. Working at the office require a lot of energy for cooling/heating due to centralisation.	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
12260	24	23	24	24	The ambient air pollution causes 8.8 (7.11 – 10.41) million premature deaths per year in the world (Lelieveld et al. 2020). The 8.7 million premature deaths are estimated from air pollution from fossil fuel burning in 2018 (Torjesen 2021; Vohra et al. 2021) exposure to air pollution is estimated to cause 7 million premature deaths.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12362	24	23	24	24	Considering the interactions among air pollution and climate change, as indicated in P24L23 to P24L23 of Section B, the ambient air pollution causes 8.8 (7.11 – 10.41) million premature deaths per year in the world (Lelieveld et al. 2020). The 8.7 million premature deaths are estimated from air pollution from fossil fuel burning in 2018 (Torjesen 2021; Vohra et al. 2021) exposure to air pollution is estimated to cause 7 million premature deaths	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
15064	24	24	24	24	C.7.1, C.7.2, and C.7.3 do not discuss "limiting the demand for energy and materials". It is unclear what part of Chapter 9 discusses this category of mitigation solutions.	Government of United States of America, U.S. Department of State
3418	24	25	24	30	On this paragraph C.4.1, it would be relevant to add a specific reference to CCS in addition to CDR at the end of the first section of the first sentence "including through the use of CDR and CCS", as it relates to a sector for which CCS and CDR do not exactly have the same stakes. This relates to a more general comment throughout the report on the difference between CCS and CDR. The technical summary recalls (p94 line 40 to p95 line 3) that "Carbon Capture and Storage (CCS) and Carbon Capture and Utilisation (CCU) applied to fossil CO2 do not count as removal technologies. CCS and CCU can only be part of CDR methods if the CO2 is biogenic or directly captured from ambient air, and stored durably in geological reservoirs or products". However, there are occurrences in the SPM where the words are used interchangeably when CCS actually refers and applies to specific situations. This is the case, for example, regarding application of CCS to industrial processes and energy production in mitigation strategies. In such instances, it would be relevant to specify the term CCS in complement to CDR (and maybe refer in a footnote to the distinction between the two, referring to the glossary & TS) – there are sufficient references in the chapters to base it from, for example Chapter 12, page 8, lines 8 to 10 regarding application to industry sectors and energy production, or throughout chapter 3, 4 and the technical summary.  Also, the term 'produced with net zero CO2 emissions is not very clear for this application on carbon-based fuels, could the authors precise what they mean by "produced with net zero CO2 emissions" in this context?	Government of France, Ministère de la Transition écologique et solidaire
302	24	26	24	26	C.7.1: Required action: clarify the selection of the year 2019 to the exclusion of others.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
13276	24	26	24	26	What is meant by "final" in "global final energy demand"? Please omit if not necessary.	Government of Switzerland, Federal Office for the Environment FOEN
2086	24	26	24	28	You have to review the value of building(18%) of global electricity demand compared to the SOD report (Basis) (ar6wg3_sod Chapter-9, p.p.7, p.p.15).	Government of Republic of Korea, Korea Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5688	24	26	24	30	Consistency check needed on emissions figures from buildings. This paragraph says 21% of global GHG (when including indirect). But B.2.1 says 6% (direct) rising to 17% (when including indirect).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6558	24	26	24	30	Please check again the numbers and/or references in this paragraph. IEA data for the same year 2019 differ significantly (IEA Energy Technology Perspectives, 2020: "The buildings sector [...] today accounts directly and indirectly for 30% of the final energy consumed around the world, or around 3 100 mega tones, including almost 55% of global electricity consumption. When both the construction and use phases are taken into consideration, it contributes around 37% of today's global CO2 emissions.")	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6560	24	26	24	30	The notion of "embodied emissions" is specific to the buildings sector and should be explained, e.g. in a footnote.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6562	24	26	24	30	This bullet is only providing information on the status quo and not on how GHG emissions from buildings can be reduced. We strongly recommend to include this information within section B, preferable B.2. For C.7, we request authors to provide more concrete information on response and mitigation options for buildings as found in TS.5.4 as well as chapter 9.4 and 9.5.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15066	24	26	24	30	This description of the growth in emissions in residential buildings is traced to statements in Chapter 9, but only refers to the residential sector. Some description of the growth in emissions for other types of buildings is warranted.	Government of United States of America, U.S. Department of State
9864	24	26	24	34	Please reconsider the amount of percentages and other number given in C.7.1 and C.7.2. It complicates the text.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11866	24	27	24	27	After the word "demand", there must be a comma instead of an "and", as follows: "...demand, about 21% of global GHG emissions and 31% of global CO2 emissions".	Government of Chile, Ministry of Environment
15068	24	27	24	27	B.2.1 says buildings accounted for 6% of global emissions in 2019, not 21% as indicated here. One of these statements is wrong and needs to be fixed.	Government of United States of America, U.S. Department of State
15070	24	28	24	28	Clarify which emissions (CO2 or GHG) are referred to in the phrase "of these emissions". Seems like CO2 emissions, but it would be best to be clear.	Government of United States of America, U.S. Department of State
4098	24	28	24	30	This sentence clarifies the different types of emissions associated with Buildings. However, only cement and steel are mentioned as building materials. There are many other materials that have a significant GHG footprint. Are these not included for sake of simplicity or because data is unavailable?	Government of Canada, Environment and Climate Change Canada
808	24	29	24	29	'18% emissions embodied' requires clarification. Any embodied emission depends on the lifetime of a product. Therefore, while writing about buildings, one it is always necessary to separate period of construction and period of many-year operation. Therefore '18% emissions embodied' should be specified by '18% emissions embodied in case of construction and subsequent [50] operation' (evidently that 50 is just an example here).	Government of Russian Federation, Institute of Global Climate and Ecology
13664	24	29	24	29	Insert "of" before "emissions" such that it reads: "...and 18% of emissions embodied in cement....."	Government of New Zealand, Ministry%20for%20the%20Environment
304	24	31	24	31	C.7.2: Required action: clarify the selection of the time period 1990-2019 to the exclusion of others.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
810	24	31	24	31	Over 1990-2019, CO2 emissions from residential buildings: is embodied emission included? Please, clarify.	Government of Russian Federation, Institute of Global Climate and Ecology
1082	24	31	24	31	Suggest including percentage increase to put the emissions value in context.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2922	24	31	24	31	Please specify that these numbers in the paragraph are for annual CO2 emissions.	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9866	24	31	24	31	Unclear what the emission amount given refer to. Increase per year?	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
1316	24	31	24	34	Are these "residential buildings" -related increases over all the components listed in C.7.1? Or did some of the aspects contribute significantly different to the increases? Also, the (about) total is given as 1.9, whereas the net of the components is 1.8. (Rounding up?)	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
4100	24	31	24	34	That the increased floor area per capita was the main driver of increased emissions in residential buildings was very eye-opening. This is the kind of information city planners across the world could act upon. Suggest this kind of information is highlighted in the front page summary if one is prepared.	Government of Canada, Environment and Climate Change Canada
6564	24	31	24	34	This bullet is only providing information on the emission trend and drivers in the building sector and not on how GHG emissions from buildings can be reduced. We strongly recommend to include this information within section B, preferable B.2. For C.7, we request authors to provide more concrete information on response and mitigation options for buildings as found in TS.5.4 as well as chapter 9.4 and 9.5. Please provide also information on costs and barriers.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12580	24	31	24	34	Delete: C.7.2 Over 1990-2019, CO2 emissions from residential buildings increased by about 1.9 Gt CO2. Key drivers were increasing floor area per capita (+2.1Gt) followed by population growth (+1.1Gt) and increased use of carbon-intensive electricity and heat (+0.6 Gt), partly offset by efficiency improvements (-2.0Gt)." Add: "Energy use in residential and non-residential buildings contributed 50% and 32% respectfully, while embodied emissions contributed 18% to global building CO2 emissions. Over the period 1990-2019, global CO2 emissions from buildings increased by 50%. Global indirect CO2 emissions increased by 92%, driven by the increase of fossil fuels-based electrification, while global direct emissions decreased by 1%." {9.3.1, Figure 9.3 (a)} Reason: Mentioning only the residential buildings in trends when they account for only half the total building emissions is unjustified. Hence, the overall trend for all buildings is proposed, followed by the share of residential and non-residential buildings.	Government of India, Ministry of Environment, Forests and Climate Change
6144	24	31	24	39	It seems important to talk about new buildings, but also about existing buildings and the constraints they entail. The underlying report contains relevant information that could be included in the SPM, such as 'In countries with low rate of new construction, it is important to consider mandatory building energy codes for existing buildings,' (chapter 9, p.85, I.6-7)	Government of Belgium, Belgian Science Policy Office - Belspo
12012	24	32	24	34	C.7.2: Please add information on whether the reported trends are global or specific to certain regions (or developing / developed countries), respectively.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
1318	24	35	24	35	This applies (presumably) to new buildings. Could something more be said about the existing building stock, such as retrofitting etc (in addition to what applies in C.7.3 of integration of renewable energy generation and appliances).	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2924	24	35	24	35	Without a more detailed definition with the different elements or attributes that make up the term "integrated approaches", it may not be obvious to the decision maker what it means.	Government of France, Ministère de la Transition écologique et solidaire
5690	24	35	24	35	In the UK, buildings emissions are mainly from heating and mainly from the existing building stock. This bullet could mention options for refurbishing buildings, particularly incentives to lower the cost of heat pumps so that they can compete with gas boilers.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11480	24	35	24	35	What does "zero energy" mean? How could a building be maintained and used without any use of energy? And for how long?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13424	24	35	24	35	Please consider changing the expression of "zero energy" to "nearly zero energy building"	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
13426	24	35	24	35	Please explain the concept of "net zero carbon" in the contest of building	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica

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15072	24	35	24	35	The term "use phase" may be defined elsewhere, but could be explained here by adding the phrase "direct and indirect use of energy by building occupants, distinct from emissions due to the manufacture of construction materials, or as part of the construction and demolition process".	Government of United States of America, U.S. Department of State
292	24	35	24	36	C.7.3: Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
12610	24	35	24	37	Delete first sentence of C.9.1. Reason: Assumptions and uncertainties on the numbers cited are not stated clearly.	Government of India, Ministry of Environment, Forests and Climate Change
306	24	35	24	39	C.7.3: Required actions: clarify "buildings in the use phase" as to whether it means currently-occupied (used)?; The use of the term low-carbon refers to sources and not emissions, which are the target of mitigation and the focus of the PA.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
708	24	35	24	39	1. The first sentence in this paragraph focuses on operation, but the low-carbon building materials mentioned in the measures are not aimed at emission reduction in the operation stage. Thus the present expression may cause misunderstanding. 2. The building sector can reduce energy consumption as much as possible through energy-saving measures. Meanwhile, other measures, such as installing photovoltaic panels, can be adopted to offset energy use, thus achieving zero energy consumption. However, there are many disputes about the accounting method and definitions of zero energy consumption. It is advised that the first sentence should not overemphasize zero energy consumption. 3. In addition to the above-mentioned measures, behavioral mode adjustment, thermal inertia, energy storage, etc. can be used to achieve load flexibility of buildings, which is conducive to safe and stable operation of new power systems in the future. It is suggested to mention related technologies. It is suggested to change it to: "Integrated approaches could make buildings in the use phase zero energy and net zero carbon in all regions. Mitigation options for the full life-cycle at the design stage include buildings typology, form, and multi-functionality; at the construction phase, low-carbon construction materials, highly efficient building envelope, and the integration of renewable energy generation and the use of energy storage; and at the use phase, highly efficient appliances/equipment, and their use (high confidence)."	Government of China, China Meteorological Administration
1084	24	35	24	39	Does not appear to offer much insight for existing building stock, This is the larger problem in most communities dealing with a substantial existing building stock.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
11482	24	35	24	39	The grammar of the first sentence needs attention. Presumably it means that in all regions it is possible for buildings to use zero energy, and emit zero CO2, during their use?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11484	24	35	24	39	Demolition phase is not indicated (as before)	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15074	24	35	24	39	The sections of Chapter 9 in the C.7.3 line-of-sight (specifically 9.4, 9.5, 9.6, and 9.7) do not clearly support the statement that "integrated approaches could make buildings in the use phase net zero energy and net zero carbon in all regions." Section 9.6 brings together the discussion of mitigation options to assess overall mitigation potential. The figures and discussion in this section do not seem to demonstrate a path to net zero for most regions, even in just the use phase of buildings. If evidence for such a claim is present in this section, it is not sufficiently highlighted to properly support a major claim in the SPM. The figures and tables in Section 9.6 detail the potential for significant reductions, but not global net zero. The key tables and figures here are Figures 9-15 and 9-16, and Table 9-4. The summary of literature in Figure 9-15 suggests only Europe has the potential to achieve net zero CO2. Table 9-4 and Figure 9-16 do not present any studies or data that achieve global net zero emissions from buildings.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15076	24	35	24	39	There is no discussion of building materials that serve as carbon sinks, even though this is not new. For example, waste plastics can be incorporated in concrete building blocks, to keep them from being incinerated.	Government of United States of America, U.S. Department of State
15078	24	35	24	39	Recommend including electrification of space and water heating and cooking as a strategy as well.	Government of United States of America, U.S. Department of State
12686	24	35	24		Delete "Integrated approaches...in all regions" Reason: No specific basis for the statement indicated. While a similar sentence appears in 9.4.5 they point to the accompanying figure 9.13 that shows low energy buildings and that too documented only in select regions of the world with the bulk being in Europe and North America. Hence the statement made here has no foundation.	Government of India, Ministry of Environment, Forests and Climate Change
2088	24	35	24	39	What is the 'integrated approaches' ?. Please explain more details about approaches of building.	Government of Republic of Korea, Korea Meteorological Administration
2090	24	35	24	39	Plesase, check the grammer and sentence structure.	Government of Republic of Korea, Korea Meteorological Administration
15080	24	36	24	36	"buildings typology, form, and multi-functionality" is unclear.	Government of United States of America, U.S. Department of State
13986	24	36	24	39	Please consider to include "such as wood" after construction materials. Rationale: wood used in construction may reduce emissions associated with production of steel and concrete materials.	Government of Norway, Norwegian Environment Agency
2926	24	37	24	37	Wood could be mentioned explicitly to illustrate a "low carbon construction materials"	Government of France, Ministère de la Transition écologique et solidaire
12612	24	38	24	38	At the end of the current sentence, add a statement of risks for all the options stated in the current sentence. Chapter 7 provides detailed statement of risks associated with such co-benefits.	Government of India, Ministry of Environment, Forests and Climate Change
6566	24	38	24	39	The last sentence is not clear - is there a redundancy that can be avoided by rephrasing into "and at the use phase, use of highly efficient appliances/equipment."?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11486	24	38	24	39	it is uncelar why the use of appliances (presumably dominated by network electricity) would be considered part of "emissions for buildings". If the energy use by appliances is included, would their manufacturing and disposal also be? And other household goods? What is the scope of "emissions from buildings"?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2928	24	39	24	39	There are problems of consistency with the Technical Sumary p. 71 . Here we should mention the Sufficiency, Efficiency, Renewable Framework and specify what are the sufficiency interventions (density, compacity, shared space, etc.)	Government of France, Ministère de la Transition écologique et solidaire
11488	24	39	24	39	The end of the sentence of the section C.7.3 "...and their use" does not seem to add up. In order to reduce GHG in buildings there is the need to moderate the demand for energy services (heating, cooling, lighting, etc.) to a level that provide a decent living. This means in practice less floor area per capita, less appliances and smaller appliances and less use of them. This is in other words the sufficiency principle. It would seem useful to refer to "sufficiency" (a key element of chapter 9 and a key option to reduce GHG in the building sector and other sectors, e.g. transport), but if authors prefer not to note it in the SPM, the section could end with the following sentence "...and moderate the use of appliances (or provision of energy services) and the demand for floor space to an acceptable level for all."	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15082	24	39	24	39	Sections 9.4, 9.5, and 9.6 repeatedly cite a lack of literature on the subject of carbon reduction potential of building technologies. This, on top of the apparent lack of support for achieving net zero carbon, suggests that the statements in C.7.3 cannot be made with "high confidence".	Government of United States of America, U.S. Department of State
12582	24	39	24	39	Add after line 39: "Actions are needed to adapt buildings to future climate while ensuring wellbeing for all. The expected heatwaves will inevitably increase cooling needs to limit the health impacts of climate change (medium evidence, high agreement). Adaptation measures to cope with climate change may increase the demand for energy and materials leading to an increase in GHG emissions, if not mitigated." {9.7, 9 Executive Summary} Reason: Policymakers should be made sufficiently aware about possible trade-offs with adaptation.	Government of India, Ministry of Environment, Forests and Climate Change
528	25	0	25	0	Chapter 10 on transport provides cost analysis P56 L11-37 which a summary of it should be included in the SPM	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
532	25	0	25	0	"There is considerable literature supporting demand efficiency on all criteria except institutional issues, where such options are not generally given sufficient priority and on the criteria of socio-cultural acceptability where such changes are generally difficult to achieve politically unless presented with a strong set of change tools" Include this statement from Chapter 10 P95 L15 in the SPM This statement must be added to the SPM as to ensure a balanced and inclusive report	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
326	25	0	27	0	The following statement from Ch4 P91 L26-29 "While this may be particularly challenging in developing countries, given large populations still lacking basic needs, previous development paths show that finding synergies in development and climate objectives in the AFOLU sector is possible." must be added to the SPM as it demonstrates the challenges faced by developing countries with relation to the demand for decarbonization.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
328	25	0	27	0	The following statement from Ch7 P86 L7-9 "Land-based mitigation options interact and create various trade-offs, and thus need to be assessed together as well as with mitigation options in other sectors, and in combination with other sustainability goals" must be added to the SPM as it demonstrates that land-based mitigation is not a quick fix, as it also has trade offs that need to be assessed, this should be clearly stated in the SPM as to ensure a balanced and inclusive report	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
12976	25	1	25	1	C.8 The assessment of demand-side and behavioural options is new in AR6, and welcome. In the SPM, nuance is needed to make clear that, for poorer countries and communities, mitigation does not have to require reductions in consumption levels (which are very low), whereas richer people can live well with less material consumption.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
2930	25	1	25	2	The use of low carbon electricity should be mentionned explicitly for electric vehicles; electric vehicles are not a solution when electricity comes from fossil-fuels. It could also be mentionned the ecological cost of electric vehicles: they are low carbon only downstream (when we use them), they generate carbon emission upstream (during their construction) and they could produce carbon emission during recycling. It could also be mentionned the ecological cost of electric vehicles: they are low carbon only downstream (when we use them), they generate carbon emission upstream (during their construction) and they could produce carbon emission during recycling. The consequences on the mining of rare materials, in particular on the exploitation of populations, and on pollution could also be mentioned.	Government of France, Ministère de la Transition écologique et solidaire
6568	25	1	25	28	We wonder about the relevance of public transport (or public transit as it is called here) and shared mobility (as the contrary of individual mono transport). Although that there will be a high emission reduction by the deployment of electric vehicles, urban infrastructures in particular streets and motorways might not provide necessary capacities (mobility and parking). Also, low energy transport modes such as bicycle need more space, too. Public transport and shared mobility are win-win options in this regard. What are the assumptions regarding individual mobility in C1 scenarios? Are there any trends on this topic? What about the material and energy use of electric vehicles compared to strengthening public transport? In addition, there is a different role for cities compared to rather rural areas. Here, there is a strong need to find appropriate solutions, too. We strongly encourage the authors to add these aspects in the discussion here and emphasize the important role of public transit and shared mobility.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11490	25	1	25	28	In the transport sector the "Sharing Economy" plays a very important role, but nothing was said about this. The sharing economy allows a significant decrease in goods/vehicles manufacturing related GHG emissions, as well as a more efficient transport system and urban design (e.g., less space needed for parking and better utilisation factor of infrastructure).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11492	25	1	25	28	"Demand-side options" is rightly mentioned first in the HS, but then it is all but ignored in following paragraphs. Only referred to again in the context of urban settings, but no reference to reducing demand for aviation or shipping.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11494	25	1	25	28	Modal shift is duly mentioned, but rail transport should be given explicit mention. Electrification is mostly highlighted in the context of "electric vehicles", which strongly suggests electric road vehicles.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13280	25	1	25	28	In contrast to C.9 (AFOLU) there is no reference to the costs associated with the technologies in the transport sector. Harmonize across the technologies by portraying the same parameters under consideration, in this case the costs as an assesment factor.	Government of Switzerland, Federal Office for the Environment FOEN
13282	25	1	25	28	Does the literature only speak of improved air quality as a co-benefit or are there other benefits associated with the change to low GHG electricity transport? If yes, please list them here.	Government of Switzerland, Federal Office for the Environment FOEN

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
342	25	1	25	5	C.8: The paragraph provides discussion on low carbon strategies in Transport sector. The discussion should also include barriers to implementation and trade-offs as provided in the underlying chapter. One example is costs of critical minerals needed for batteries.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
320	25	1	25	6	C.8: The use of the term " deep emission reductions" isn't quantifiable and should be replaced with a scientific statement and indicate that is a projection.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
322	25	1	25	6	C.8: The statement is written with focus on sources using language, such as "low carbon" Required actions: rewrite without focus on specific sources by replacing "low carbon", which is source focused, with "low emissions".	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2932	25	1	25	6	This paragraph insists too much on the relation between transport and energy, while the greatest work of adaptation and mitigation proposes a reduction of individual transports, and a better configuration of these transports, as indicated in C.8.2. This C.8.2 should be reintroduced into C.8	Government of France, Ministère de la Transition écologique et solidaire
5692	25	1	25	6	It would be useful to highlight the environmental and health co-benefits of transport decarbonisation at the outset.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5694	25	1	25	6	The heading could include the paragraph C.8.5. point that 'There is an opportunity for developing countries to leapfrog fossil-based transport systems.'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6846	25	1	25	6	<p>As clearly stated in SPM draft paragraph C.4.1, achieving net zero energy systems requires (among other things) widespread electrification with net zero or net negative CO2 emissions. The point is that simply deploying electric vehicles, without providing a clean energy source, is not really conducive to decarbonization. This is also clearly pointed out in Figure SPM.7 (electrification panel). Paragraph C.8, object of this comment, could mislead readers into believing that electrification in light-duty transport alone would be a valid and effective mitigation policy, when it actually puts more pressure over fossil-based electricity sources at the margin, even if emissions from battery production and discarding are not counted (and they should be).</p> <p>There is also no scientific basis for the "advanced" qualification for bio-based fuels, a term that is not defined. While so-called advanced biofuels technologies can increase supply, as informed, for instance, in paragraph C.8.3, the IEA Net Zero Roadmap is one among several projections in which both traditional and advanced forms of bioenergy, coupled with or not coupled with CCS, will be necessary and extremely relevant to meet net zero targets. The potential of bio-based and hydrogen-based drop-in fuels should also be pointed out in providing short-term mitigation gains using current vehicle fleet and fuel distribution infrastructure. Short term mitigation gains are extremely important, because, as stated in paragraph C.1 of this SPM, Global GHG emissions must peak before 2025 in pathways that assume immediate action and limit warming to 1.5°C with no or limited overshoot, or are likely to limit warming to 2°C.</p> <p>Based on the two comments above, a proposed new wording for paragraph C.8 would be, thus:</p> <p>A combination of demand-side options and low carbon technologies can yield deep emission reductions in the transport sector. Electric vehicles offer potential for decarbonizing land based transport, as long as coupled with accentuated decarbonization of the power sector. Bio-based fuels and hydrogen have potential in shipping and aviation, and in other specific land-based contexts. Some of these fuels, as drop-in or in low to moderate blends with fossil fuels, can bring short-term mitigation benefits pending replacement of existing vehicle fleet and fuel distribution infrastructure. Demand-focused interventions can reduce demand for all transport services and support the shift to more energy efficient transport modes (high confidence). 6 {10.2, 10.4, 10.5, 10.6, 10.7}</p>	Government of Brazil, Ministry of Foreign Affairs
15084	25	1	25	8	The EV statement is too broad ("land based transport" includes MEV, HEVs, rail, etc.). Electrified rail with a zero carbon grid also has high potential when/where rail solutions can be deployed.	Government of United States of America, U.S. Department of State
15086	25	1	25	9	C.8 claims that strategies and technologies can yield "deep emissions reductions in the transport sector". C.8.1 is intended to support this overall point, but currently falls short. 2050 emissions reductions are significant, but an upper end reduction of 68% is hardly "deep" decarbonization. Figure 10.17, from which these estimates are taken, suggests that deep decarbonization is possible by 2100. If the authors are comfortable relying on estimates for 2100 to make the claim in the first sentence of C.8, then this sub-point should be edited to say something like "global transport-related emissions fall as much as 80% [insert actual data, estimate is based on viewing Figure 10.17] (50-90% interquartile range) in 2100 relative to 2019." If this is not preferred, then the first sentence of C.8 should use the term "significant" rather than "deep".	Government of United States of America, U.S. Department of State
15088	25	1	27	6	Define what is meant by "demand-side" at first usage in the SPM to provide context for the sections that follow.	Government of United States of America, U.S. Department of State
13278	25	1	29	36	It would be beneficial for the reader to understand the mitigation potential of each of the technologies portrayed in the lead paragraphs in C8 to C11.	Government of Switzerland, Federal Office for the Environment FOEN
15090	25	2	25	2	Consider revision to encompass various EV technologies and acknowledge that modes including bicycle and walking are also critical to ensuring a low carbon transportation system (particularly where people do not have access to a personal vehicle), such as: "Transitioning from internal combustion vehicles to electric and fuel cell electric vehicles with increases in active travel offers the greatest low carbon potential for land based transport."	Government of United States of America, U.S. Department of State
5696	25	2	25	3	Electric vehicles offer the greatest low carbon potential for land-based transport - does this take into account the emissions associated with manufacture of electric vehicles and the premature and rapid replacement of the high-carbon vehicle stock, presumably which (unless production involves minimal GHG emissions) will result in at least a short-term increase of emissions from the sector.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9518	25	2	25	3	"Electric vehicles offer the greatest low carbon potential for land based transport" is not in line with the conclusion of Chapter 10 transport. Chapter 10 says "BEV could be lower life cycle emission if with low carbon electricity. Further efforts to reduce the GHG footprint of battery production, however, are essential for maximising the mitigation potential of BEVs. Growing concerns about resource availability, labor rights, non-climate environmental impacts, and costs of critical minerals needed for LIBs." Without mentioning such conditions and concerns, we should not emphasize the potential, which is almost same as other potions. Transport data of Figure SPM 8 are not in chapter 10, but it also shows the BEV's mitigation potential is almost same as that of fuel efficiency, etc.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11496	25	2	25	3	Electrification of transport and the use of hydrogen only have a GHG reduction effect if they are produced without emitting GHG.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12014	25	2	25	3	C.8: Please add whether the EV potential refers to the global scale, or how it is in different regions (or just differentiated by developed and developing countries).	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12590	25	2	25	6	Delete current sentence starting from "Electric vehicles..." To be rewritten in a nuanced way, currently exaggerated and ignores future technology which may catch up in short order.	Government of India, Ministry of Environment, Forests and Climate Change
11498	25	3	25	3	Hydrogen should be qualified across the document, similarly to electricy. We should talk about low-carbon hydrogen, not any hydrogen	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11500	25	3	25	3	"Hydrogen- and advanced bio-based fuels"... incomplete listing from Chap. 10. There the alternative fuels are refered to as: For aviation, "Alternative biofuels, synthetic fuels, and liquid Hydrogen" [10-60, l.18]; likewise, chapter 10.64. reviews a "variety of feedstocks and energy carriers [...] for shipping", not just H2 and bio-fuels. These two alone are too narrow.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15092	25	3	25	3	Recommend adding "heavy-duty transportation" as an example of hydrogen fuels potential.	Government of United States of America, U.S. Department of State
9520	25	3	25	4	Request: Japan requests to include the supply forecast of biofuel, hydrogen and other fuels made from hydrogen as a feedstock in 2025, 2030, 2040, 2045, and 2050.  Reason: The text 'Hydrogen- and advanced bio-based fuels have potential in shipping' without no evidence data seems strange.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
6570	25	4	25	4	Please give an example for other specific land-based contexts, i.e. "and in other specific land-based contexts like for example hydrogen powered vehicles for delivery purposes, ...".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2934	25	4	25	5	To better reflect the order of paragraphs C8.2 and C8.3 this sentence should be just after the first sentence of this C.8 paragraph. This would also be a logic declination of this first sentence.	Government of France, Ministère de la Transition écologique et solidaire
5698	25	4	25	5	This sentence about 'Demand-focused interventions....' would be better placed as the second sentence in the heading, to reflect the paragraph order.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13988	25	4	25	5	Please keep the following sentence in SPM C.8: "Demand-focused interventions can reduce demand for all transport services and support the shift to more energy efficient transport modes (high confidence).	Government of Norway, Norwegian Environment Agency
13666	25	5	25	5	Replace "for" with "across" such that it reads: ".....can reduce demand across all transprt services....."	Government of New Zealand, Ministry%20for%20the%20Environment
312	25	7	25	9	C.8.1: Required action: rewrite to indicate, explicitly, that pathways rely on model outcomes.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
314	25	7	25	9	C.8.1: 1- Indicate that pathways rely on model outcomes; 2- replace "low carbon", which is source focused, with "low emissions"; remove prescriptions of sources of energy and replace them with emissions-focused alternatives, 3- remove policy prepective language	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
330	25	7	25	9	The following statement in C8.1 "In pathways that limit warming to 1.5°C with no or limited overshoot, global transport-related CO2 emissions fall as much as 59% (40–68% interquartile range) in 2050 relative to 2019 (high confidence) but with regionally differentiated trends." singles out pathways that limit to 1.5 and CO2. It should be rewritten in a way that ensures a balanced representation of all GHGs and pathways.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
332	25	7	25	9	The following statement in C8.1 "In pathways that limit warming to 1.5°C with no or limited overshoot, global transport-related CO2 emissions fall as much as 59% (40–68% interquartile range) in 2050 relative to 2019 (high confidence) but with regionally differentiated trends." Since this is based on a pathway, the term "projected to fall" must be added to the text.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
346	25	7	25	9	C.8.1: The use of 'pathways that limit warming to 1.5' is not accurate and is inconsistent with other working groups reports and with the rest of this report. Replace pathway with 'scenario'.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1086	25	7	25	9	Need more insight as to why decarbonisation of greater than 40-68% is not envisaged by 2050. What are the barriers? Are aviation and shipping are the problem components, what are the decarbonation potential for terrestrial transport systems (road and rail)?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2178	25	7	25	9	The statement mentions that the trends are regionally differentiated. Perhaps some highlights could be raised indicating where the challenges are.	Government of Finland, Finnish Meteorological Institute (FMI)
11502	25	7	25	9	Add information for pathways that limit warming to 2C.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15094	25	7	25	9	In the C.8.1 sentence , should "in 2050" be "by 2050"?	Government of United States of America, U.S. Department of State
11504	25	8	25	8	"global transport-related CO2 emissions fall as much as 59% (40–68% interquartile range) in 2050 relative to 2019"...seems inconsistent with Ch.10, 10-78, 1.16&17: need to decrease "by 47% ...by 2050". Please review and use consistent numbers.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15096	25	9	25	9	Add a sentence saying what the equivalent would be for scenarios likely to limit warming to 2°C and, ideally, some intermediate level between these two benchmarks. It is biased to present information only for one set of scenarios, which may not even be feasible.	Government of United States of America, U.S. Department of State
5700	25	10	25	10	What is meant by 'changes in urban form' in practice? At the moment it seems to be an abstract concept.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13990	25	10	25	12	Please keep the following sentence in SPM C.8.2 and please consider to add "with compact and resource efficient cities": "Changes in urban form [with compact and resource efficient cities], along with investments in public transit and active transport infrastructure, combined with behaviour programs and transport pricing , can reduce travel demand and support the shift to less GHG -intensive transport modes (high confidence).	Government of Norway, Norwegian Environment Agency
2366	25	10	25	14	Suggest explicitly stating that this paragraph only applies to land transport. Consider reordering paragraphs to include this after C.8.3 as it provides more detail than the broader changes possible to all vehicles.	Government of Australia, Department of Industry, Science, Energy and Resources
2938	25	10	25	14	Teleworking and digitization are mentioned as levers for reducing demand for mobility. However, if the state of the art is still at a prospective stage, the possible rebound effect increasing demand should be clarified.	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15098	25	10	25	14	This paragraph should identify (1) that these technical options may be more feasible in areas of new growth than where they would require substantial changes in existing infrastructure, and (2) that consumer and producer habits, preferences, and behaviors are strong factors driving emissions and have posed challenges for policymakers seeking to reduce, for example, congestion or air pollution from vehicles. It could note that consumers are showing growing affinity for electric vehicles, to which some manufacturers are responding with more models and better responsiveness to consumer preferences.	Government of United States of America, U.S. Department of State
1088	25	11	25	11	Need to make clear that travel and transport are not the same thing	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2936	25	11	25	11	We suggest to add "and social" after "behaviour" (for instance : 4-day week, teleworking)	Government of France, Ministère de la Transition écologique et solidaire
6572	25	12	25	12	What is "dematerialisation" in the context of transport? Please add some explanation or use a different term.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11506	25	12	25	12	dematerialisation should be defined	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5702	25	12	25	13	I wonder if it would useful to mention changes in value chains and manufacturing, which could have a knock-on impact of reducing the need for international freight and therefore transport demand (due to AI, 3D printing, etc., though I accept this may be too speculative to include here).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
1090	25	12	25	14	Suggest reference the contingent requirement of a low emission residential sector (space heating and cooling demand/use).	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2940	25	12	25	14	There are consistency problems with Chapter 10 pp. in that this sentence gives the impression that such solutions have a positive impact, which does not seem to be the idea in Chapter 10 pp. 22-23 (for instance "Vehicle automation could have positive or negative effects on emissions"). It would be more accurate to replace this sentence with: 'teleworking, dematerialisation, supply chain management, smart and shared mobility, and vehicle automation have as yet uncertain systemic effects, which may be positive or negative in terms of emissions'.	Government of France, Ministère de la Transition écologique et solidaire
11508	25	12	25	14	These should be presented in a more circumspect manner. Many studies have illustrated how autonomous vehicles could lead to more vehicle km travelled. Teleworking in the short term would lead to less transport activity but that can be more than compensated by higher emissions from the residential and industrial sector. There would be more monitors, and more ambient space to be heated, cooled and lighted along with remaining office spaces.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13992	25	12	25	14	Please keep the following sentence: "Teleworking, dematerialisation, supply chain management, smart and shared mobility, and vehicle automation could further reduce demand and emissions (medium confidence)".	Government of Norway, Norwegian Environment Agency
13994	25	12	25	14	Please consider to add the following sentence to SPM C.8.2 (from T.S-67, line 20-22): [...]. The circular economy, the shared economy, and digitalisation trends can support systemic changes that lead to reductions in demand for transport services or expands the use of more efficient transport modes (high confidence).	Government of Norway, Norwegian Environment Agency
15100	25	12	25	14	This sentence does not track well with the summary findings in Table 10.3. Some of the strategies listed in this sentence are characterized as likely to reduce demand and emissions, specifically teleworking and dematerialisation. But the net impact of supply chain management, smart and shared mobility, and vehicle automation is characterized in Table 10.3 as either "uncertain" or "highly uncertain". It is not appropriate to characterize a statement that these strategies "could further reduce demand and emissions" as having "medium confidence". At best, that statement can be made with "low confidence". Suggest revising this sentence and the associated confidence level to better reflect the summary findings in Table 10.3.	Government of United States of America, U.S. Department of State
12262	25	13	25	21	The role of the historic emissions from the developed countries, before 1990, must also be highlighted.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2944	25	13	25	13	Demand reduction because of vehicle automation is very discussed. The sentence should be corrected to account for this uncertainty (cf Box 10.1 in chapter 10: "autonomous cars could provide access to marginal groups [...] which could in turn increase travel demand" & "they could reduce demand for transit")	Government of France, Ministère de la Transition écologique et solidaire
5704	25	13	25	13	Vehicle automation could also increase demand for transport, as the whole population, including young and old, will have access to transport rather than just those who can drive.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2942	25	13	25	14	"and vehicle automation could rather reduce demand and emissions" is too confident whereas 10-23, Table 10.3 is much more cautious	Government of France, Ministère de la Transition écologique et solidaire
9522	25	13	25	14	The sentence describes that "... vehicle automation could further reduce demand and emissions". From the context this "demand" seems to indicate "travel demand", not "energy demand". But the section 10.2 does not mention that vehicle automation reduce travel demand; rather it states that vehicle automation could increase travel demand. It would be better to delete "vehicle automation" from this sentence.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
5708	25	15	15	20	This para. appears to contain the only reference to rail systems, and infers electrification is the only solution to decarbonising railways. Low carbon hydrogen will play a comparatively small but nonetheless complementary role e.g. in low-utilisation or remote parts of rail networks where electrification is either uneconomic or unfeasible. It would be helpful to reference this either here (i.e. but removing the inference of electric-only solutions) or by a separate, short para addressing rail direct (appropriate given each other transport mode is referenced- shipping, aviation, road).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
336	25	15	25	15	the following statement in C8.3 "Electric vehicles powered by low-carbon electricity can rapidly reduce transport GHG emissions." is not associated with a confidence level. Rewrite with a clear confidence level or delete.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
338	25	15	25	15	The following statement in C8.3 "Electric vehicles powered by low-carbon electricity can rapidly reduce transport GHG emissions." The use of the terms "can rapidly reduce" must be quantified as to ensure scientific accuracy.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
5706	25	15	25	15	by 'critical material risks from battery production' does this mean running out of rare earth materials, for example? Would be better to spell it out plainly. It would also be good to know if enough of a rare earth resource exists globally, in order to be able put batteries in a fleet of electric vehicles large enough to replace the current global, carbon-rich vehicle stock.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6146	25	15	25	15	We suggest defining the term "low carbon electricity" in a footnote of the SPM and/or in the glossary. A short description of low-carbon electricity is given in chapter 6, page 87, line 20 (wind, solar, hydropower).	Government of Belgium, Belgian Science Policy Office - Belspo
11510	25	15	25	15	"Electric vehicles powered by low-carbon electricity can rapidly reduce transport GHG emissions." They can reduce them, yes, but no reference for "rapid" was found in Ch.10. Whether decarbonisation through electrification is faster than with alternative fuels or modal switch remains to be shown.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15102	25	15	25	15	Consider noting, in addition to electric vehicles powered by low-carbon electricity, fuel cell electric vehicles powered by green and blue hydrogen, and also hydrogen vessels and planes, can facilitate transition. Hydrogen is referenced in relation to biofuels; for biofuels, feedstocks are needed.	Government of United States of America, U.S. Department of State
1092	25	15	25	16	A more substantive set of statements on timing and cost of electrification of road transport would be useful	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1104	25	15	25	17	Are biofuels not an option for HGVs?	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6148	25	15	25	17	This is useful information, however it may give the impression that electric vehicles can reduce emissions regardless of the demand (even if it is increasing). Could you consider linking this with the change in demand?	Government of Belgium, Belgian Science Policy Office - Belspo

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
316	25	15	25	20	C.8.3: The statement should provide a balanced discussion on the advantages and implications of electrification of transport as in the underlying chapters	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
5710	25	15	25	20	The last sentence in the paragraph is about battery production, so should come immediately after the first two sentences relating to EV. The sentence about biofuels should be moved to paragraph C8.4 which discusses biofuels.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6150	25	15	25	20	We wonder if the potential role of synthetic fuels (or CCU-fuels, or e-fuels) is sufficiently taken into account here (given the information in chapter 10, pages 10-70 and 71).	Government of Belgium, Belgian Science Policy Office - Belspo
6574	25	15	25	20	In C.8.3, only the environmental footprint from battery production is addressed. Likewise, it would be valuable to hint to the footprint and the boundaries of biofuel use due to potential conflicts on land for the feedstock of biofuels with biodiversity protection and food production (see: chapter 7, Box 7.1.; chapter 10 p. 60f; chapter 10, Box 10.2 "Bridging land use and feedstock conversion footprints for biofuels", p. 25f). In C.8.5 of the SPM, the topic of feedstocks is already mentioned, but very curtly and it might be difficult for readers to make the connection to feedstocks of biofuels without further explanation. A brief discussion on the feedstock of biofuels could Therefore, be introduced in C.8.3 already to prevent misunderstandings.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6848	25	15	25	20	<p>IEA's projected emissions reduction on a well-to-wheel basis from transport vehicle electrification in the (ambitious) EV30@30 Scenario amounts to a mere 535.6 Mt CO<sub>2</sub>eq, out of total projected transport sector emissions of 8.9 Gt CO<sub>2</sub> eq. There is no similar projection available to 2050 (IEA Global EV Outlook 2019). It is questionable, therefore, whether the sentence "Electric vehicles powered by low-carbon electricity can rapidly reduce transport GHG emissions" could be justified, due to lack of evidence and indeed in face of partial evidence to the contrary. The point is that simply deploying electric vehicles, without providing a clean energy source, is not really conducive to decarbonization. This is also clearly pointed out in Figure SPM.7 (electrification panel).</p> <p>Countries with highest shares of renewable power are facing challenges because of intermittency of such sources and increasing challenges for energy storage because of its costs and environmental impacts. Such countries are being pushed to use fossil sources as backup for long periods. Rapid and widespread electrification of transport may accentuate this problem, pushing additional use of electricity towards fossil sources at the margin.</p> <p>As in the proposal for the opening C.8 summary paragraph, a sentence should be included in paragraph C.8.3 to highlight short-term mitigation potential of biofuels when used in current vehicle fleets and infrastructure.</p> <p>Therefore, we propose that paragraph C.8.3 should read as follows:</p> <p>"Electric vehicles offer potential for decarbonizing land based transport, as long as coupled with accentuated decarbonization of the power sector. Advances in battery technologies could facilitate the electrification of heavy-duty trucks and complement conventional electric rail systems, although liquid fuels remain the most efficient energy source for heavy duty transport, and the only low carbon alternative for long range air and sea transport. Biofuels are already deployed in some markets, and advanced biofuels and hydrogen offer additional mitigation potential. Some of these fuels, as drop-in or in low to moderate blends with fossil fuels, can bring short-term mitigation benefits pending replacement of existing vehicle fleet and fuel distribution infrastructure. Energy and material efficiency improvements, including recycling, can reduce the environmental footprint and critical material risks from battery production (medium confidence). {3.4, 6.3, 10.3, 10.4, 10.7, 10.8}</p>	Government of Brazil, Ministry of Foreign Affairs
13996	25	15	25	24	We believe that the summary could benefit from assessing whether biofuels that are imported to some countries, as a climate measure could negatively affect human rights, biodiversity, land-use change, and increased greenhouse gas emissions globally. It would be useful to explain how mitigation related to biofuels can be implemented in a way that work well for both productions and consumption countries. E.g. IPCC indicates in the land report; "the use of land to provide feedstock for bioenergy ... could greatly increase demand for land conversion. ... Widespread use at the scale of several millions of km <sup>2</sup> globally could increase risks for desertification, land degradation, food security, and sustainable development". Ref: IPCC. (2019). Climate change and land. <a href="https://www.ipcc.ch/srcc/">https://www.ipcc.ch/srcc/</a>	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9844	25	15	26	19	replace "significant by "large"; significant underrates the potential contribution of demand side measures that can reduce GHG emissions by 40-70% in 2050.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
2946	25	16	25	16	it is surprising to mention only the solution of electric batteries for the decarbonization of road freight transport as there are other solutions.	Government of France, Ministère de la Transition écologique et solidaire
334	25	16	25	17	The following statement in C8.3 "Advances in battery technologies could facilitate the electrification of heavy-duty trucks and complement conventional electric rail systems." does not have a confidence level associated with it. Rewrite with a specific confidence level or delete.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
352	25	16	25	17	The use of the term "Could" in the following statement in C8.3 "Advances in battery technologies could facilitate the electrification of heavy-duty trucks and complement conventional electric rail systems." It must be quantified as to ensure scientific accuracy.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2368	25	16	25	17	Suggest including the improvements related to electrification and batteries for maritime demands, both for on-ship power demands, as well as shore-based power when at berth.	Government of Australia, Department of Industry, Science, Energy and Resources
13998	25	16	25	18	Please consider if the summary also could mention some of the possible trade-offs linked to biofuels. Increasing demand for biofuels can put a burden on agriculture and food prices.	Government of Norway, Norwegian Environment Agency
1106	25	16	25	20	Clear ststament on CDR requirements would be useful in the policy context would be useful	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
5712	25	17	25	17	Sentence on biofuels fits better at the start of the subsequent paragraph C.8.4 or should specify that this refers to biofuels for personal vehicles	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6576	25	17	25	17	It would be clearer to use the expression "agrifuels", "agrofuels" or "agricultural fuels" instead of "biofuels".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6578	25	17	25	17	The use of the term "conventional" in the phrase "conventional electric rail systems" could be seen as prejudiced and one might want to omit it.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15104	25	17	25	17	Consider adding "compact neighborhoods and transit-oriented development". Authors could also mention co-location of essential services.	Government of United States of America, U.S. Department of State
6580	25	18	25	18	Could you please be more specific about the segments and context of land transport where green hydrogen is the most reasonable mitigation option, ideally from a comprehensive cradle to grave perspective?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15106	25	18	25	18	Recommend specifying what segments and contexts by adding a phrase at the end: "... , such as truck market segments that require long range or fast vehicle fill times".	Government of United States of America, U.S. Department of State
710	25	18	25	20	The expression in this paragraph is not clear. It is suggested to delete or modify this sentence to "Energy and material efficiency improvements, including recycling, can benefit clean and sufficient battery production (medium confidence)."	Government of China, China Meteorological Administration
6582	25	18	25	20	Could you please quantify the potential to reduce the environmental footprint by energy and material efficiency improvements?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9524	25	19	25	19	Though chapter 10 is addressing at least three types of footprint, these footprints are not aggregated in as a total footprint. "Environmental footprint" in this line could sound a new and vague word. In the discussion on production of battery, "CO2 footprint" would be appropriate as referred in p10-72 I34.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
15108	25	19	25	19	Replace "environmental footprint" with "carbon footprint".	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
350	25	19	25	20	The use of the term "can" in the following statement in C8.3 "Energy and material efficiency improvements, including recycling, can reduce the environmental footprint and critical material risks from battery production (medium confidence)". It must be quantified as to ensure scientific accuracy.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
14000	25	19	25	20	Please keep the following sentence in SPM C.8.3: "Energy and material efficiency improvements, including recycling, can reduce the environmental footprint and critical material risks from battery production." Please consider to add the following text in SPM C.8.3 (from TS-69, line 14-16): "There are growing concerns about resource availability, labour rights, non-climate environmental impacts, and costs of critical minerals needed for lithium- ion batteries (medium confidence)".	Government of Norway, Norwegian Environment Agency
1094	25	20	25	30	I don't understand why only "medium confidence" is applied to this set statement. Some elements discussed in this section are virtually certain or indeed already occurring.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2950	25	21	25	21	Here and/or at other places where biofuels are mentioned, it would be important to recall that biofuels produced by intensive agriculture are highly likely to have adverse effects on biodiversity. Surely this is mentioned in the full report, but this notion should appear in the summary, in the same ways as the (unknown) effects of some CDR methods are mentioned P. 29, line 33 " but impacts on ecosystems and biodiversity are not well understood" : here the negative effects are well-known.	Government of France, Ministère de la Transition écologique et solidaire
2952	25	21	25	21	What are we talking about when mention "biofuels and synthetic fuels"? The Energy Return on Investment (EROI) of generation 1&2 of biofuels is really bad and Generation 1 of biofuels compete with food supply.	Government of France, Ministère de la Transition écologique et solidaire
11512	25	21	25	21	It is surprising to see only references to mitigation options based on technology for the aviation sector and not on airline market evolutions (evolution of flying classes, optimisation/decrease of airlines routes or else). The building sector clearly mentions the evolution of use as a significant lever, it should be the same for the transport. Same comment for the figure SPM8 (page 31) where the potential of aviation sector evolution only focuses on technology where other transport means rely on shifts.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15110	25	21	25	21	Statement says: "Mitigation options for aviation include high energy density biofuels and synthetic fuels." Would it be better to simply state: "Mitigation options for aviation include biofuels and synthetic fuels."? Biofuels and synthetic fuels are approved to have similar properties (including energy density) to conventional jet fuels in order to ensure safety and performance.	Government of United States of America, U.S. Department of State
15112	25	21	25	21	Suggest changing "synthetic fuels" to "low-carbon synthetic fuels", or similar.	Government of United States of America, U.S. Department of State
1096	25	21	25	23	This section on aviation can be improved with insight on timing and cost	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
712	25	21	25	24	Only alternative fuels are mentioned here to help reduce emissions, while the main conclusions of the underlying report include optimizing operations and ship design, reducing demand, and improving regulations which are not reflected here. It is suggested to verify and make additions.	Government of China, China Meteorological Administration
2370	25	21	25	24	Unclear why C.8.4 is a separate paragraph. Suggest integrating with the preceding paragraph (C.8.3) to avoid duplication of content.	Government of Australia, Department of Industry, Science, Energy and Resources
2954	25	21	25	24	We suggest to first mention a demand side reduction before adress these solutions	Government of France, Ministère de la Transition écologique et solidaire
5714	25	21	25	24	Please mention explicitly that technological and regulatory (from flight security measures) challenges for aviation are such that a deep decarbonisation from alternative fuels is not foreseen with current knowledge.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5716	25	21	25	24	References to alternative aviation fuels should include hydrogen (alongside biofuels and synthetic fuels)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6972	25	21	25	24	Could information on demand-side management be added here, i.e. increasing incentives for reducing aviation, or more generally, information on mitigation options for aviation and shipping beyond changing fuels? The demand side is covered in C.10, but also already mentioned in headline statement C.8, so it would be worth mentioning here, too.	Government of Jamaica, Meteorological Service Division
11514	25	21	25	24	The treatment of aviation seems unduly limited. The climate impact of (radiative forcing by) aviation is known to be significantly (several times) higher than just resulting from GHG emissions. Options to reduce non-GHG forcing (e.g., by air traffic management) should at least be mentioned. Also, GHG emissions can be reduced through means other than just changing fuels. Demand reduction (in absolute terms or by diverting to rail) should also be addressed, as these have specific aspects for aviation (beyond the cross-cutting generalities in C.8).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15114	25	21	25	24	The inclusion of information about aviation and shipping in the topline is laudable, but this C.8.4 statement should be rated as "low confidence" and/or caveated further. It is true that biofuels, ammonia, hydrogen, and other synthetic fuels exist today, and could be used in aviation and/or shipping. However, the potential for these technologies to serve as mitigation options is highly uncertain and highly contingent on the methods of production. For example, the current state of science supports the statement that hydrogen produced from electrolysis using 100% renewable electricity may be a mitigation option. Current science does not support the statement that hydrogen produced from steam reforming of fossil methane (the current dominant technology) is a mitigation option. However, it is still highly uncertain whether a commercial-scale renewable hydrogen production system can or will materialize. Similar caveats and uncertainties exist for biofuels, ammonia, and other synthetic fuels. Without confidence that the low-GHG versions of these technologies will ever materialize at commercial scale (and, to date, they have not), it is not possible to state their potential as mitigation options with anything more than "low confidence". The potential role of electrification is also highly uncertain. With substantial breakthroughs it could be more than "limited". But such breakthroughs are far from guaranteed. So that statement is also best characterized as "low confidence".	Government of United States of America, U.S. Department of State
12264	25	22	26	5	The role of the historic emissions from the developed countries, before 1990, must also be highlighted.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
15116	25	22	25	22	Will ammonia use increase nitrous oxide emissions?	Government of United States of America, U.S. Department of State
1320	25	22	25	23	Would it be possible to provide some further characterisation of "a limited role... in specific niches". Assumedly, electrification may have important potential in some areas, in which case a comma before "in specific niches" might provide some further clarity. Information on which niches are meant (especially if these can be largely decarbonised by means of electrification) would also be clarifying.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
9526	25	22	25	23	The sentence "Electrification could play a limited role for aviation and shipping in specific niches (medium confidence)." should be replaced with "Electrification could play a certain role for aviation and shipping in specific niches (medium confidence)." According to the page 50 of Waypoint 2050 ( <a href="https://aviationbenefits.org/media/167187/w2050_full.pdf">https://aviationbenefits.org/media/167187/w2050_full.pdf</a> ), which summarizes new CO2 reduction scenarios in the aviation industry by the international industry group ATAG (Air Transport Action Group), short haul with 100-150 seats may be electrified in 2040 and it covers 24% CO2 emissions of the sector. TAG is a coalition for the civil aviation industry to cooperate on long-term sustainability issues, including industry groups such as the International Air Transport Association (IATA) and Airports Council International (ACI), as well as Airbus and Boeing. , Rolls-Royce and other aircraft manufacturers and engine manufacturers are participating.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9528	25	22	25	23	In connection with the basis that the sentence "Electrification could play a limited role for aviation and shipping in specific niches (medium confidence)." is not valid, in Chapter 10 P.60 Line 23-26, the sentence "For shorter ranges, flights of light planes carrying up to 50 passengers may be able to use electric power (Sahoo et al. 2020) but these planes are a small proportion of the global aviation fleet (Epstein and O'Flarity 2019; Langford and Hall 2020) and account for less than 12% of current aviation CO2 emissions." should be referred to the page 50 of Waypoint 2050 ( <a href="https://aviationbenefits.org/media/167187/w2050_full.pdf">https://aviationbenefits.org/media/167187/w2050_full.pdf</a> ), which summarizes new CO2 reduction scenarios in the aviation industry by the international industry group ATAG (Air Transport Action Group), short haul with 100-150 seats may be electrified in 2040 and it covers 24% CO2 emissions of the sector. TAG is a coalition for the civil aviation industry to cooperate on long-term sustainability issues, including industry groups such as the International Air Transport Association (IATA) and Airports Council International (ACI), as well as Airbus and Boeing. , Rolls-Royce and other aircraft manufacturers and engine manufacturers are participating.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15118	25	22	25	23	Recommend changing phrase "Electrification could play ..." to explicitly acknowledge both batteries and fuel cells in this segment. This phrase could be revised to: "Electrification through batteries and hydrogen fuel cells could play ...".	Government of United States of America, U.S. Department of State
15120	25	22	25	24	Should say "direct electrification" as electrification will be part of the supply side for the low-carbon fuels mentioned.	Government of United States of America, U.S. Department of State
15122	25	23	25	23	Recommend providing examples (i.e., "such as X and Y") since it is unclear whether these are use-cases or geographic niches.	Government of United States of America, U.S. Department of State
15124	25	23	25	24	Statement says that "electrification could play a limited role for aviation and shipping in specific niches". This is correct if referring to full electrification of large transport aircraft, but hybridization (partial electrification) is much more likely in propulsion systems of these transport aircraft by 2050. Suggest clarifying whether electrification's limited role in this context is describing full electric power or hybridization.	Government of United States of America, U.S. Department of State
5718	25	25	25	28	Leapfrogging is more likely if the enabling environment and infrastructure is there to support scaling up of electrified transport. Consider including reference to this in this section?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6850	25	25	25	28	<p>Currently, integration of transport and power infrastructure has proven extremely challenging and costly even for rich developed countries, requiring policies with extensive subsidies both for vehicles themselves and for the necessary charging infrastructure and grid upgrades. It is not at all a "high-confidence" statement that leapfrogging by developing countries could happen at current costs.</p> <p>Countries with highest shares of renewable power are facing challenges because of intermittency of such sources and increasing challenges for energy storage because of its costs and environmental impacts. Such countries are being pushed to use fossil sources as backup for long periods. Rapid and widespread electrification of transport may accentuate this problem, pushing additional use of electricity towards fossil sources at the margin.</p> <p>It is suggested that the paragraph be revised to reflect this cautionary note, as follows:</p> <p>GHG emission reductions in the transport sector depend on low GHG electricity, sustainable fossil-replacement fuel feedstocks, and production chains. Integrating transport and power infrastructure could allow developing countries to leapfrog fossil-based transport systems with co-benefits for air quality, as long as costs for electric vehicles, charging infrastructure and power grid improvements are significantly reduced, along with an economic solution to challenges related to integrating high shares of renewable energy in the power mix (high confidence).</p>	Government of Brazil, Ministry of Foreign Affairs
714	25	26	25	27	This description is likely to lead to the ambiguity that "it is very easy to pursue low-carbon development in developing countries". It is suggested to delete this sentence, or amend it to: "Integrating transport and power infrastructure could be useful for developing countries to develop low-carbon transport systems with co-benefits for air quality (high confidence)."	Government of China, China Meteorological Administration
15126	25	26	25	27	It's too late for "developing countries to leapfrog fossil-based transport systems".	Government of United States of America, U.S. Department of State
9912	25	26	25	28	(C8.5): Unclear what "integrating transport and power infrastructure" entails; suggest to reformulate and clarify or drop the sentence.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
318	25	27	25	27	C.8.5: Required action: rewrite in accordance with the Paris Agreement, which focuses on emissions, not sources.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
11516	25	27	25	27	leapfrog fossil-based transport systems with co-benefits for air quality' is real but more can be said; if developing countries achieve, with the help of developed nations, to leapfrog fossil fuel industries (not only transport), it will be a game changer. it is not only 'with co-benefits for air quality'.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
1098	25	27	25	28	The air quality co-benefits are not unique to developing countries. Also may an opportune to mention the contribution of transport to aerosols (esp. combustion) and (cooling) impact on climate.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
4104	25	30		31	The message here appears to be different to that in the AR6 WGII FGD, which included the following assessment "Mitigation measures such as afforestation, bioenergy, carbon capture and storage, and hydropower have potential trade-offs with ecosystem integrity, biodiversity, livelihoods, common resource access, water and food security (high confidence)." Perhaps more cross-working group coordination is needed on this topic.	Government of Canada, Environment and Climate Change Canada
12424	25	30	25	30	More clarity is needed on "Large scale GHG emission reductions"	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
2956	25	30	25	31	This sentence in itself is not balanced as it does not reflect the necessary conditions for this potential to be met. It should be precised that this is in the case of a proper management of trade-offs.	Government of France, Ministère de la Transition écologique et solidaire
11518	25	30	25	31	adaptation/disaster risk reduction benefits should also be mentioned	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15128	25	30	25	31	AFOLU emission reductions are typically much less cost-effective than renewable energy and energy efficiency. Many AFOLU interventions exceed \$50-100/tCO2e while clean energy can cost \$20-25/tCO2e.	Government of United States of America, U.S. Department of State
14006	25	30	25	32	Please consider quantifying the potential, or adding some nuance to this sentence. E.g. by adding "to some extent" or "could potentially substitute parts of" before "(...) substitute for fossil fuels and...". As it stands it sounds like there is potential to substitute for all fossil fuels.	Government of Norway, Norwegian Environment Agency
2958	25	30	25	34	The first sentence of para C.9 is currently unbalanced in its formulation (too optimistic), and should be reformulated in order to better reflect the more nuanced content of Chapter 7.4.2.1 and the Ch 7 Executive Summary.  Three possible reformulations of the 1st sentence of C.9 are: (1) Replace "AFOLU" by "If implemented at appropriate scales and in a sustainable manner, AFOLU options" (drawing from Chapter 7.4.1.2 (p.7-40)) (2) Add after "services" the following: "if these AFOLU mitigation options are implemented at appropriate scales and in a sustainable manner." (drawing from Chapter 7.4.1.2 (p.7-40)) (3) Insert before "AFOLU" the following: "Where carefully and appropriately implemented," (drawing from Chapter 7 Executive Summary, p. 7-4)	Government of France, Ministère de la Transition écologique et solidaire
2960	25	30	25	34	This paragraph C9 lacks an assessment of deforestation and re-forestation modalities (a definition is given in the SCROCC). To take the problem by the need for an "intensification" of agriculture generates a strong contradiction, which must be resolved.	Government of France, Ministère de la Transition écologique et solidaire
4102	25	30	25	34	Confidence statements for all sentences and items. Are they are all high confidence?	Government of Canada, Environment and Climate Change Canada
5720	25	30	25	34	This section could benefit from mentioning adaptation potential from AFOLU and not just mitigation potential, or a link to D.2.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6586	25	30	25	34	Key message C.9 deals with the potential of AFOLU in reducing GHG emissions and barriers to its implementation. We strongly encourage the authors to be more explicit about the impacts of AFOLU on biodiversity in this key message. While some AFOLU-measures can indeed "simultaneously benefit biodiversity", not all AFOLU measures do so. Please change to "Barriers to implementation and trade-offs result from negative impacts on biodiversity, competing demands on land, conflicts with livelihoods, and the impacts of climate change (high confidence)"	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12592	25	30	25	34	Delete lines 30-34 and substitute with the following "In all pathways, AFOLU can only provide less than 13 percent of expected CO2 reduction and in the sector related to the largest fraction of the global population who bear little or no responsibility for global warming and are nevertheless the most vulnerable. The provision of GHG emission reduction and removal from this sector lead to some synergies but significant trade-off. While it can benefit biodiversity and other ecosystem services, these can be offset by exclusion of indigenous and rural people from traditional habitats, displacement on account of conservation and protected areas, loss of livelihood, significant yield penalty in agriculture and the negative impact of global warming. This shift of the AFOLU sector from an adaptation focus to a mitigation focus can lead to serious negative impact on equity." Reference: Bullet C.3.4 of SPM itself.	Government of India, Ministry of Environment, Forests and Climate Change

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14004	25	30	25	34	In our view the options related to protection and restoration of forest and natural ecosystems should be highlighted in the key finding in C.9. It is not obvious that this is covered by AFOLU, since AFOLU is more related to protecting existing carbon sinks and stores. It is also described in the land report how reducing deforestation and forest degradation act as important options.	Government of Norway, Norwegian Environment Agency
15130	25	30	25	34	C.9 highlights "barriers to implementation" and "trade-offs", implicitly setting up a dichotomy between AFOLU productivity and conservation, which is carried throughout the document. Is this dichotomy necessary? Or can productivity be uncoupled from conservation or even assist in conservation?	Government of United States of America, U.S. Department of State
15132	25	30	25	34	While this statement states the co-benefits and synergies of GHG emissions reductions, these terms are not explicitly used, and the last sentence implicitly defines AFOLU mitigation measures as being at odds with land demands, livelihoods, and climate change impacts. Conservation, sustainable production, and mitigation are not necessarily in competition, and may actually yield significant co-benefits, as stated in the underlying chapters. Suggest re-wording the last sentence to: "While barriers to implementation and trade-offs exist due to competing demands on land, conflicts with livelihoods, and the impacts of climate change, there are opportunities to maximize both co-benefits and mitigation and avoid risks (high confidence)."	Government of United States of America, U.S. Department of State
15134	25	30	25	34	The statement here is accurate but lacks the caveats that accompany such statements in Chapter 7. It is recommended that "when carefully and appropriately implemented" be inserted at the beginning of the sentence starting on line 30. When assertions about the mitigation potential and co-benefits from AFOLU measures are made, they should be presented along with the necessary caveats about the uncertainty concerning AFOLU sector projections and potential tradeoffs with other land uses (i.e., potential consequences).	Government of United States of America, U.S. Department of State
12978	25	30	25	40	C.9 This statement does not provide clear information on trends in global sinks. Please provide more detail – are tropical and boreal forests a net sink, and will they remain sinks? This is very important for the 'net' in net zero CO2 .	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
344	25	30	26	13	The section discusses AFOLU GHG emission reduction and removals and the barriers to implementation of mitigation options. It is essential to include in the discussion the discrepancy in accounting for anthropogenic land CO2 fluxes as indicating in the following high confidence statement from the Technical Summary: "There is a discrepancy, equating to 5.5 GtCO2 yr-1 , between alternative methods of accounting for anthropogenic land CO2 fluxes. Accounting for this discrepancy would assist in assessing collective progress in a global stock take (high confidence)." this should be clearly stated in the SPM as to ensure a balanced and inclusive report	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
5722	25	30	26	13	Africa and South America offer by far the greatest opportunities for AFOLU, but realising them would require substantial investment. Please could this be made clear?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11520	25	30	26	13	Just four paragraphs are dedicated to AFOLU does not do justice to such a complex sector, which is responsible for nearly a quarter of global emissions and provides so many opportunities for, and also challenges to, mitigation due to the strong interconnections with other sectors and areas of concern.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11522	25	30	26	13	Chapter 3 (ES page 6) notes that large scale transformation of the land surface is implied by scenarios that limit warming to 2C or lower. It would be worth cross-referencing in this part of the SPM, although the SPM later refers to some of the findings on this issue covered in chapter 3	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11524	25	30	26	13	C9: one of the barriers to AFOLU mitigation that is often raised is the perception that it is a threat to food production. It would be useful if the SPM could state more directly how AFOLU mitigation can occur without threatening food production - or even identify synergies between the two.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11526	25	30	26	13	Somewhere in the SPM (either in C9 or C11) a clear reference to the potential for "blue carbon" or ocean-based mitigation is needed. In the SROCC, the potential mitigation contribution of restoring vegetated marine ecosystems is specified clearly.	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11528	25	30	26	13	<p>Section C.9 is overly general and fails to address issues that are important for policy makers and for the understanding of other parts of the SPM. It would be important to clarify:</p> <ul style="list-style-type: none"> <li>* The relation between AFOLU and LULUCF. They are used variously throughout the SPM, and it would be reasonable to clarify their relationship in the dedicated section, especially because of the critical role of LULUCF in attaining the balance between anthropogenic emissions and removals envisioned by the Paris Agreement.</li> <li>* The relationship between anthropogenic and natural emissions/removals. Whilst mitigation is concerned with only anthropogenic emissions/removals, natural (or indirect human-induced) land sinks have a decisive role in climate scenarios and human action can have an impact on these sinks and sources. It should be clarified how natural and anthropogenic removals are treated in this report and any policy-relevant considerations/assumptions for the future.</li> <li>* It would be important to clarify the interlinkages with other sectors, most specifically energy. The sections on the energy transition make little reference to bioenergy (apart from some biofuels) and almost no reference to its linkages to LULUCF, although scenarios rely very heavily on bioenergy, which is the biggest source of renewable energy.</li> <li>* More specifically, the relationship of "land-based CDR options" (mentioned in this section) and "negative emissions" in the energy sector (like BECCS) should be clarified. C.3.3 makes reference to "net-zero CO2 emissions" in the "energy supply" sector. If that includes reliance on BECCS, that means that some of the removals on land are counted towards the energy sector. It would be important to understand how that relates to the mitigation potential considered under AFOLU.</li> <li>* C.11 includes some (but not all) forestry measures as "CDR" without noting AFOLU (or LULUCF), whilst all such measures seem to be included in C.9 as AFOLU. It would be crucial to clarify the linkages, including how double-counting of mitigation potentials is avoided.</li> </ul>	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13024	25	30	26	13	It is important to highlight that interventions in the AFOLU sector, especially where it involves natural vegetation types or biomes, is mainly about restoring ecosystem functioning and increasing ecosystem goods and services, and that mitigation is only one service offered by these crucially important systems, which contribute to adaptation and the livelihoods of neighbouring communities.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13478	25	30	26	13	Please discuss the risks and side-effects associated with large-scale land-use based mitigation options, biochar etc.	Government of Estonia, Estonian Meteorological & Hydrological Institute
14002	25	30	26	13	Please consider to describe in C9 that biomass also is a crucial factor for CDR technologies like BECCS. E.g. by quantifying the role biomass and BECCS in Gt/yr in providing emission reductions in C9 in order for the reader to understand its importance among the CDR options in the period 2020-2050 (Figure SPM 8 only concern the time frame up to 2030).	Government of Norway, Norwegian Environment Agency
14008	25	30	26	13	We very much appreciate that AFOLU-part in section C. However, we miss the perspective on the global food system, and also the consequences with landuse and forest conservation, restoration and management. Please consider to add information on these perspectives in this part, e.g. from the land-report.	Government of Norway, Norwegian Environment Agency
15136	25	30	26	13	Two of the three supporting points for C.9, specifically C.9.1 and C.9.3, have only "medium" confidence, but this overall point is given "high" confidence. Recommend downgrading C.9 to "medium" confidence to align with the underlying scientific evidence in C.9.1 and C.9.3.	Government of United States of America, U.S. Department of State
15138	25	30	26	13	Add discussion of the role of indigenous and local communities, strategies such as community forest management, and integration of indigenous and local knowledge in achieving mitigation potential from AFOLU strategies and in optimizing co-benefits.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6584	25	30	27	6	<p>_FOOD: Within the two subsections C9 and C10 about AFOLU and demand-side measures, we miss a thorough discussion and provision of all information in one place about the demand-side options with the highest potential (see SPM Figure.7). It seems as if the information of chapter 5 and 7 and others on the same topic are not put together in the SPM, but are handled separately. Therefore, we urge the authors to dedicate one sub bullet on the topic of diet shifts and reduction of food waste and overconsumption and include information on chapter 5,7, 12 and 17 on the following issues (please feel free to add even more issues concerning demand-side options in the food sector):</p> <p>1) Provide available information on their potential and co-benefits such as health, freeing land, adaptation, water, etc..</p> <p>2) As clearly stated in the SPM, the reduction of methane and other non-CO2 GHG are very relevant regarding the overshoot and CDR need and it would be very helpful for policymakers to learn more about the mitigation measures that show the highest potential for methane and N2O reduction. Also, it would be very helpful to learn more about the assumptions concerning these measures for the C1-C3 scenarios as well as the IMPs LD and SP.</p> <p>3) Would it be possible to limit global warming while achieving the SDGs without demand-side measures in the food sector in a world with modest or high population growth (SSP2 and SSP3)? This is a very policy relevant information as shifting diets will be a rather long-term option.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15140	25	30	27	6	The points within this section could more clearly link demand-side solutions with reducing competition for land. Demand-side measures will be critical to achieving the climate, food security, biodiversity, and water resources benefits that AFOLU can deliver (and upon which some scenarios depend). That point could be brought out more clearly in this section.	Government of United States of America, U.S. Department of State
15142	25	31	25	31	Suggest adding "water security" after "food security" and before "wood supply."	Government of United States of America, U.S. Department of State
340	25	31	25	32	The following statement in C9 "Agricultural and forest products can also substitute for fossil fuels and GHG-intensive materials in all sectors." does not have a confidence level associated with it. Rewrite with a clear confidence level or delete.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
348	25	31	25	32	The use of the term "can" in C9 "Agricultural and forest products can also substitute for fossil fuels and GHG-intensive materials in all sectors." is not quantified. Rewrite in a quantifiable manner.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1186	25	31	25	32	Change to forestry. "Agricultural and forestry products"	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2372	25	31	25	32	Suggest clarifying the term 'forest products' for readers. Does the term 'forest products' include timber and non-timber forest products - NTFP (fruits, flowers, leaves, roots, yams, vines)? Can NTFP substitute GHG-intensive material? And at what scale?	Government of Australia, Department of Industry, Science, Energy and Resources
14010	25	31	25	32	In our view it may be confusing to mix agricultural and forestry products since the main objective of agriculture is to produce food, and therefore we suggest that the focus in this sentence are forest products, when it comes to substitution of fossil fuels.	Government of Norway, Norwegian Environment Agency
324	25	32	25	32	C.9: Rewrite the statement in accordance with the Paris Agreement, which focuses on emissions, not sources.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
15144	25	32	25	32	Need to recognize the increases in energy consumption, GHG emissions, water requirements, and unsustainable agrochemicals and trade-offs in food production with expanded agricultural production for energy and materials.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
716	25	32	25	34	As a headline sentence, the emphasis here is only on challenges of land use, living standards, and climate impacts in reducing emissions from agriculture and forestry, which fails to fully reflect the content in lines 2-3, page 26 that "Mitigation of CH4 and N2O emissions is constrained by costs and the complexity of agricultural systems", ignoring differences and difficulties of agricultural systems in different countries. It is suggested to add "costs and complexity of agricultural system" at the end of this headline sentence.	Government of China, China Meteorological Administration
2184	25	32	25	34	It would be important to also mention potential conflicts with biodiversity conservation.	Government of Finland, Finnish Meteorological Institute (FMI)
2962	25	32	25	34	This statement does not reflect in a balanced manner the content below, in particular C.9.2. For readers to fully grasp the implications of this statement, it would be relevant to rephrase it in order to first introduce these trade-offs and barriers and how they limit the potential of AFOLU, and then detail where they are coming from.	Government of France, Ministère de la Transition écologique et solidaire
6588	25	32	25	34	It would be important to stress that biodiversity protection can also be a barrier to implementation, as some approaches in the AFOLU-sector that provide (short-term) GHG emissions reductions or removals are not beneficial for biodiversity (e.g. monocultures, non-native species; see chapter 7, p.49, line 25ff). The current wording of C.9 ("competing demands on land") can appear anthropocentric and readers might not attribute biodiversity to one of the "competing demands". Therefore, it would be helpful to explicitly include biodiversity in C.9. You may include in this list 'insufficient integration of ecological and biodiversity aspects'.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14012	25	32	25	34	Please consider adding "and natural resources" after "land", if applicable.	Government of Norway, Norwegian Environment Agency
2964	25	32	35	34	We suggest to add "socio and cultural and political barriers" as well as mentioned in C9.2 line 4-6	Government of France, Ministère de la Transition écologique et solidaire
13022	25	33	25	33	The main concerns/issues, and not really barriers, would include adverse and irreversible impacts to the environment and biodiversity/species loss. Because currently, there is a tree planting "pandemic" raging around the globe, with most of the pressure coming from developed countries funding unresearched tree planting initiatives in developing countries.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
15146	25	34	25	34	Also note the possible leakages from displacing deforestation or forest degradation to other locations as well as the risks of nonpermanence due to climate change (droughts, floods, heat waves), fires, pests and diseases, illegal logging, and encroachment.	Government of United States of America, U.S. Department of State
10324	25	35	25	35	Please elaborate on which "commercially available and scalable options" we are referring to.	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
1322	25	35	25	36	Does this mitigation potential include all the aspects mentioned in C.9, i.e. removals and substitution? How is the mitigation potential and cost divided between these two aspects? Please clarify, if feasible.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
5724	25	35	25	36	It is not clear what the options are for "in the AFOLU sectors" -are they the same as the options with substantial co-benefits identified in lines 37-38? Could the authors please clarify?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9530	25	35	25	36	In C.9.1, we suggest inserting the word "in AFOLU" after "between 2020-2050" in order to make it clear which sector's mitigation potential is talking, just for the case C.9.1 will be independently referred.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12572	25	35	25	36	Reframe "C.9.1 Commercially available and scalable options offer a mitigation potential of 8-14 GtCO2 between 2020-2050 at costs below USD100 tCO2-eq-1, with the largest share coming from forests and other natural ecosystems." as "C.9.1 Based on sectoral assessments and Integrated Assessment Models, commercially available and scalable options offer a mitigation potential of 8-14 GtCO2 between 2020-2050 at costs below USD100 tCO2-eq-1." Reason: It is necessary to mention the source of mitigation potential figures. Also, the second part of the current sentence "with the largest share coming from forests and other natural ecosystems" is a repetition of the rest of paragraph C.9.1. It also puts undue focus on forestry sector, whereas the role of agriculture sector and other demand side measures is equally important. Reference: 7.4.1	Government of India, Ministry of Environment, Forests and Climate Change

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15148	25	35	25	36	Costs below \$100/tCO <sub>2</sub> e for AFOLU are not necessarily cost-effective. Many AFOLU interventions exceed \$50-100/tCO <sub>2</sub> e while clean energy can cost \$20-25/tCO <sub>2</sub> e. Carbon prices and social cost of carbon estimates are generally far below \$100/tCO <sub>2</sub> e. The current U.S. Government social cost of carbon estimate is \$51/tCO <sub>2</sub> e. If the costs exceed the benefits (social cost of carbon), an intervention is not cost-effective.	Government of United States of America, U.S. Department of State
718	25	35	25	37	Th emission reduction options with costs below USD100 tCO <sub>2</sub> -eq-1 are difficult to be adopted in developing countries. It is suggested to provide more detailed information, such as emission reduction potential of costs below USD20, USD50 and USD100 tCO <sub>2</sub> -eq-1, or delete "and scalable options".	Government of China, China Meteorological Administration
6590	25	35	25	37	Do these commercially available and scalable options include demand-side measures? Please clarify. Also, the last part of the section sounds quite odd. Shouldn't the mitigation potential be rather related to measures in a certain area than the area itself?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15150	25	35	25	37	It would be very helpful to clearly distinguish mitigation and removals in the quantitative estimates here (GtCO <sub>2</sub> e and cost), and to clarify the baseline against which this potential is being measured given that carbon stock storage in biomass depends on things like wildfire risk, drying, and other climate-driven issues.	Government of United States of America, U.S. Department of State
1100	25	35	25	38	The caveats noted in the SR Climate Land should also be reflected in this section especially WRT the scale of deployment and potential impact on biodiversity and ecosystem services .	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
840	25	35	25	40	Protection of forests against forest fires is an important way for reduction of anthropogenic GHG emissions. This should be clearly mentioned in C9.1 to demonstrate it to policymakers.	Government of Russian Federation, Institute of Global Climate and Ecology
3420	25	35	25	40	This paragraph would benefit from some clarifications on several levels, in order for the readers to grasp the risks, feasibility and sustainability constraints related to these various options - First, it is not very clear what is meant by "sustainable intensification" here : AFOLU-related measures and their side effects need to be detailed, as they could pose a number of challenges, constraints, negative impacts and even incompatibilities (e.g. related to biofuels vs. carbon sequestration), as detailed in the chapters. A similar question can be asked for "biological land-based CDR options" - Second, carbon sequestration is also not detailed, although depending on the scale it can result in a positive or negative result. The same is true for afforestation. - Third, it would seem fitting in such a paragraph to make a reference to nature-based solutions, as they are part of this picture in terms of ecosystem preservation. - This relates to a larger comment on the imbalance throughout the SPM between the treatment of technological CDR options, on which a strong and optimistic emphasis is made, and the treatment of "natural" options related to protection, sustainable management and restoration of natural sinks, as well as societal and demand related options, the stakes of which are barely covered. This is the case in particular for solutions related to the AFOLU sector, which lack detail throughout the SPM (not all AFOLU options are equivalent, and neither are all land-based CDR options – the report emphasizes mostly on BECCS and barely details existing soil carbon sequestration options) as well as nature based solutions and ecosystem based approaches. The underlying chapters indicate clearly that without a protection of natural sinks efforts will have to be compensated by additional mitigation action. This seems self-explanatory but it is not covered in the SPM and there is a risk of misunderstanding, in particular from the biodiversity community, if this is not addressed	Government of France, Ministère de la Transition écologique et solidaire
5726	25	35	25	40	Should rewetting peatlands also be mentioned as a sequestration option, considering how efficient it is at pulling in carbon?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6592	25	35	25	40	In C.9.1, the AFOLU potential for mitigation is presented without addressing sufficiently the specific potential trade-offs associated with the large-scale implementation of the mitigation approaches (possible negative effects on biodiversity, ecosystem functioning, air quality, water availability and quality, soil productivity, rights infringements, food security, and human wellbeing; see chapters 7.1, 7.4., 7.6). Addressing these trade-offs is highly relevant for AFOLU policies to prevent negative side-effects; addressing them in the SPM would Therefore, be helpful for readers not familiar with the AFOLU sector, as the high values of the mitigation potential of the sector might raise the interest in AFOLU approaches. Furthermore, it would be helpful to point to the role of safeguards that need to accompany implementation to manage the mentioned trade-offs, as they are of high relevance for policies in this sector to achieve sustainable land-based mitigation (see chapter 7, section 7.4, and on Nature-based solutions (NbS) with safeguards, p.121).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6594	25	35	25	40	In C.9.1, the potential of agricultural soils should be put in context as sequestration potential is limited (saturation) as well as related to the soil type and permanence depends on long-term sustainable land use practices (to keep the para in line with SPM C.11.3 of the SPM; see chapter 7, p.61, line 40ff ).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6596	25	35	25	40	It would be valuable for the reader to get a clearer picture on the role of ecosystems other than the mentioned forests. For instance, peatlands could be mentioned as an example for the other natural ecosystems in C.9.1, as they offer a great potential for contributing to reducing GHG emissions while providing further benefits (see chapter 7, p.5, line10ff; chapter 7, p.56, line 13ff; or other examples in chapter 7.4).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6598	25	35	25	40	Please add here from TS p. TS-87, l. 28-30: "[...] demand side measures. Measures which provide additional benefits to biodiversity and human well-being are sometimes described as 'Nature-based Solutions.'" From our perspective it is important that the term NbS appears in the SPM and that the IPCC makes clear what is its understanding of the concept (while we appreciate that the term is also mentioned in the glossary).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6852	25	35	25	40	"Bioenergy with CCS (BECCS) should be listed along with the options listed here, as recognized in the SRCCL.	Government of Brazil, Ministry of Foreign Affairs
12574	25	35	25	40	After line 40 in C.9.1, Add "This mitigation potential does not account for feasibility barriers and enabling conditions that vary by region and country. The feasibility of implementing AFOLU mitigation measures, including those with multiple co-benefits, depends on varying economic, technological, institutional, socio-cultural, environmental and geophysical barriers (high confidence)." Reason: Implementation of mitigation in AFOLU sector is highly dependent on the unique condition of each country, especially their development level. Chapter 7 has made an important note of these conditions which is not reflected in the SPM, where it is most important. Reference: 7.4.1, 7.6, TS 5.6, TS 6	Government of India, Ministry of Environment, Forests and Climate Change
14018	25	35	25	40	Chapter 7 describe that avoided deforestation is the cheapest land-based mitigation option (table 7.3, section 7.5.3, and 7.5.4). Please consider to include this important finding in C.9.1.	Government of Norway, Norwegian Environment Agency
15152	25	35	25	40	To match the underlying chapter text and highlight opportunities in the dietary change space, for the last sentence, suggest: "Sustainable intensification of agriculture and forestry, reduced food waste, and dietary change could enable land use for biological land-based CDR options among opportunities at the climate, health, and food nexus."	Government of United States of America, U.S. Department of State
14014	25	35	26	13	Please consider to include the role of indigenous people and their rights in forest protection in the SPM. There is no reference to indigenous peoples rights in the draft, but there is increasing evidence that shows that territories where indigenous peoples have received land rights protects more forests than protected areas (managed by the stated) on all three continents with tropical forests. This was also well documented in the IPCC special report on land. If appropriate, see for example: Sze, J.S., Carrasco, L.R., Childs, D. et al. Reduced deforestation and degradation in Indigenous Lands pan-tropically. Nature Sustainability (25 Nov 2021).	Government of Norway, Norwegian Environment Agency
14016	25	35	26	13	In the description of mitigation options related to forest and other natural ecosystems (e.g. C.9.1), we propose to highlight differences between conserving natural carbon sinks (protection and restoration of natural ecosystems), and activities such as reforestation. The land report describes reducing deforestation and forest degradation as important options, it would be useful to also in this SPM distinguish between reducing deforestation and other conversions of natural ecosystems.	Government of Norway, Norwegian Environment Agency
812	25	36	25	36	Is it UDS 2020 = in USD prices of 2020 or is it current (nominal value) for 2020-2050	Government of Russian Federation, Institute of Global Climate and Ecology
4106	25	37	25	37	There should be mention of the need to specifically maintain ecosystem health (e.g. by reducing habitat fragmentation, supporting measures that favour high biodiversity) since this will ensure ecosystems do not release their carbon, while maintaining their ability to sequester it.	Government of Canada, Environment and Climate Change Canada



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5728	25	37	25	37	Suggest expanding sentence on "options with substantial co-benefits include..." to imply this is not exhaustive, for example "include but are not limited to..."	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9532	25	37	25	37	"improved management (of natural ecosystems)" should be added as an example of options with substantial co-benefits, to be in line with relevant texts in the Technical Summary (TS) and Chapter 7, where improved management of different is clearly mentioned in the same context (e.g. "protection, improved management, and restoration of forests, peatlands..."). Thus the revised text should read "Options with... include the protection, improved management and restoration of natural ecosystems, ...."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
15154	25	37	25	37	What is meant by a "natural ecosystem"?	Government of United States of America, U.S. Department of State
15156	25	37	25	37	The co-benefits are overstated because no negative effects are presented in this statement.	Government of United States of America, U.S. Department of State
720	25	37	25	38	Carbon sinks include not only agricultural soils. It is suggested to replace "agricultural soils" with "vegetations and soils".	Government of China, China Meteorological Administration
6600	25	37	25	38	As discussed in the SRCCL, there are only two main demand-side measures. Diet shifts and reduction of food waste and overconsumption. Demand-side measures sounds like a lot of different measures, and it is not defined somewhere in the text. Hence, it would be helpful for policy makers, if the two demand-side options are spelled out, as it is also the case for the supply-side measures.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6602	25	37	25	38	Please include here the mitigation options improving fertilization practices as well as manure storage. Improving fertilization techniques, better planning etc. reduces nitrogen output. Important measure are for example storage of manure in solid tanks instead of lagoons and reducing nitrogen from agricultural management does not only contribute to mitigation but has many synergies for pollution reduction, biodiversity etc.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14020	25	37	25	38	Please consider adding text about peatlands from chapter 7.4.2.6, or use peatlands as an example of natural ecosystems that should be protected and restored. Peatlands are not mentioned directly in the SPM, even though they are important sinks, and if the existing carbon stocks are lost, they cannot be easily reversed.	Government of Norway, Norwegian Environment Agency
15158	25	37	25	40	Should "cover crops" and/or voluntary carbon markets be mentioned here?	Government of United States of America, U.S. Department of State
546	25	38	25	38	Suggest to expand the elaboration of "demand side measures" with some examples mentioned in Section 7.4.5.	Government of Singapore, Ministry of Environment and Natural Resources
2966	25	38	25	38	We suggest to add after reforestation "and halt deforestation"	Government of France, Ministère de la Transition écologique et solidaire
2968	25	38	25	38	We suggest to reformulate "in agricultural and in forest soils"	Government of France, Ministère de la Transition écologique et solidaire
1102	25	38	25	40	It would be better to provide a separate statement on demand-side measures as these have an indirect impact on agriculture and land use management. Much of the analysis which identifies the potential impact on emissions and removals assumes ideal and optimised response from the sector to the changes in demand (which in reality would involve changes in traditional livelihoods, lifestyle, social structures, investment, training and perhaps ownership).	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6604	25	39	25	39	The term "sustainable intensification" is a contradiction in itself and can very easily be misinterpreted. If what is meant with "sustainable intensification" is in fact "sustainable land management" or "sustainable and well-managed agriculture.....", we suggest to develop different wording which is not open for interpretation.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
10326	25	39	25	39	Please add "food loss" to "food waste"	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
11530	25	39	25	39	Explain sustainable intensification (or provide an example)	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12426	25	39	25	39	"Dietary Change" need more explanation on why and how"	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15160	25	39	25	39	Sustainable production and biodiversity gains are not the usual result of agricultural intensification efforts. Intensification may increase the demand for forest land conversion and high GHG-intensive inputs and consumption products. See <a href="https://www.sciencedirect.com/science/article/pii/S1877343514000359">https://www.sciencedirect.com/science/article/pii/S1877343514000359</a> and <a href="https://doi.org/10.1016/j.gloenvcha.2018.09.011">https://doi.org/10.1016/j.gloenvcha.2018.09.011</a>	Government of United States of America, U.S. Department of State
15162	25	39	25	39	Food waste is important, but it is a different issue with respect to AFOLU.	Government of United States of America, U.S. Department of State
838	25	39	25	40	As for sustainable intensification of forestry. This is perceived as supporting the concept of intensive forestry, which can't currently be presented to policymakers as justified. Instead, the concepts of retention forestry, climate smart forestry (demonstrated in Chapter 7, subsection 7.4.2.3). This is important, because in some cases the concept of intensive forestry is perceived as endorsement of forest use intensification only.	Government of Russian Federation, Institute of Global Climate and Ecology
2970	25	39	25	40	It would be relevant to also mention Nature-based solutions here, as they are presented in the underlying chapters and fall in these categories.	Government of France, Ministère de la Transition écologique et solidaire
4108	25	39	25	40	Recommend more specificity be added here about the type of dietary changes that would free up more land for biological land-based CDR. Presumably this would be a shift toward more plant-based consumption and reduced consumption of animal-based foods, given the land demands of the latter.	Government of Canada, Environment and Climate Change Canada
5730	25	39	25	40	Please replace "enable land use" with "free up land" if that is what is meant.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6606	25	39	25	40	As we learned from the SRCCL, all three measures "will" free land and not only "could" free land. Please revise the use of "could" as well as the medium confidence level. Also, please add some quantification on the potential range for freed land as provided in the SRCCL.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9534	25	39	25	40	"intensification" seems to be used primarily in conjunction with agriculture, not with forestry in relevant chapters (e.g. Chapter 7) and TS. As such "forestry" should be deleted from the intensification target at the beginning, and instead forestry activities should be added as CDR options at the end of the sentence. Thus the revised text should read "Sustainable intensification of agriculture, reduced food waste and dietary change could enable land use for biological land-based CDR options such as reforestation and restoration of natural ecosystems."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12594	25	39	25	40	The following statement is highly problematic and should be deleted as it completely disregards the context of regional differentiation and is policy prescriptive. Developing nations and LDCs will be requiring land-use change, resource extraction and infrastructure development to achieve their developmental goals. The section mentions reduced food wastage and changes in dietary preferences, with no reference whatsoever to differentiation, and the urgent need to improve nutritional outcomes in the developing countries.	Government of India, Ministry of Environment, Forests and Climate Change
14022	25	39	25	40	Is it possible to quantify the potential amount of land that can be used for CDR as a result of the measures mentioned? And at what scale the measures must be to achieve it? If so, please consider to add this kind of information here.	Government of Norway, Norwegian Environment Agency
356	26	0	27	0	The Following statement from Ch4 P59 L10-12 "A third set of obstacles are about technology availability and adoption. Lack of access even to existing cost-effective mitigation technologies remains an important issue, particularly for many developing countries, and even in the short-term." must be added to the SPM as it gives an understanding of the challenges faced by developing countries and lack of required technologies.	Government of Saudi Arabia, Sustainability Advisor to the Minister of Petroleum and Mineral Resources
15164	26	1	26	1	AFOLU is a sector. It is not an activity. Thus AFOLU does not yield emission removals.	Government of United States of America, U.S. Department of State
13692	26	1	26	13	Suggest noting here that there are large current opportunities to improve agricultural productivity (i.e. by breeding lower GHG emitting livestock) and reduce inputs (i.e. from fertilizers) which could reduce GHG emissions in both livestock and plant food systems. Also suggest noting how some of the new technologies (methane inhibitors etc.) being developed could be transformative in the medium term if they attract sufficient investment in the short term.	Government of New Zealand, Ministry for the Environment
2974	26	1	26	2	C.9.2 "1 Many AFOLU mitigation options are scalable, commercially available, 1 and can deliver emission 2 reductions within a decade" it could be interesting to develop these mitigation options	Government of France, Ministère de la Transition écologique et solidaire
2976	26	1	26	2	We suggest to add "(soil carbon management in croplands and grasslands and agroforestry 7.4.1.3)" after the first sentence	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12596	26	1	26	2	Delete first sentence of C.9.2 Reason: Complete absence of differentiation, equity issues and consideration of vulnerable population who are most closely associated with AFOLU sector.	Government of India, Ministry of Environment, Forests and Climate Change
15166	26	1	26	2	Also note the possible leakages from displacing deforestation or forest degradation to other locations as well as the risks of nonpermanence due to climate change (droughts, floods, heat waves), fires, pests and diseases, illegal logging, and encroachment.	Government of United States of America, U.S. Department of State
1108	26	1	26	3	Very unclear, the first sentence appears to be a more generic restatement of the first sentence of C.9.1 it seems to read, "Although there are many AFOLU mitigation options...mitigation of CH4 and N2O options are not among them". This is not the case.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
12448	26	1	26	6	There is lack of explanation for public transportation role in mitigating CO2. Therefore, one of the focus should entail on public transportation to support transportation at large	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
722	26	1	26	7	The confidence level is not consistent with the underlying report (lines 36-38, page 6, Chapter 7, and Sections 7.4 and 7.6). It is suggested to keep consistent with the underlying report.	Government of China, China Meteorological Administration
2376	26	1	26	7	Suggest including how REDD+ fits in this.	Government of Australia, Department of Industry, Science, Energy and Resources
2982	26	1	26	7	A clearer distinction could be made between supply-side and demand-side measures. In addition, it could be useful to mention some of the demand-side measures that were taken into account as presented in the Technical Review" (C.9.2.5).	Government of France, Ministère de la Transition écologique et solidaire
4110	26	1	26	7	This seems inconsistent with the issues raised in the WG2 SPM. Some consideration of power structures related to land use for mitigation and adaptation should be considered.	Government of Canada, Environment and Climate Change Canada
13344	26	1	26	7	To make it more accessible for policymaker, specific examples for such institutional and policy constraints and trade-offs should be mentioned.	Government of Switzerland, Federal Office for the Environment FOEN
15168	26	1	26	7	C.9.2 asserts that AFOLU mitigation options are scalable and affordable, and new technologies are emerging to address trade-offs; at the same time, this paragraph describes the context-specific challenges of trade-offs, the billions of consumers, and de-centralized decisionmaking. Again, given the challenges of scale, a policymaker reading this section would likely benefit from concrete examples of scalable mitigation options.	Government of United States of America, U.S. Department of State
15170	26	1	26	7	The C.9.2 statement "Many AFOLU mitigation options are scalable, commercially available, and can deliver emission reductions within a decade" is not reflected in the Chapter 7 Executive Summary or underlying text. It appears to be an oversimplification/misrepresentation. Most statements made in Chapter 7 discuss potential AFOLU mitigation between 2020-2050, not within a decade only. There are some statements about potential mitigation from AFOLU but they are caveated and not restricted to only one decade. The SPM should reflect the caveats associated with the AFOLU mitigation potential discussion as well remove the assertion that it can be done in one decade. Examples of what Chapter 7 does say on this matter include: "The AFOLU sector offers significant near-term mitigation potential at relatively low cost but cannot compensate for delayed emission reductions in other sectors" and "If implemented at appropriate scales and in a sustainable manner, land-based mitigation practices have the capacity to reduce emissions and sequester billions of tonnes of carbon from the atmosphere over coming decades, while also preserving or enhancing biodiversity, water quality and supply, air quality, soil fertility, food and wood security, livelihoods, resilience to droughts, floods and other natural disasters, and positively contributing to ecosystem health and human wellbeing (high confidence) (Toensmeier 2016; Karlsson et al. 2020)." In short, the timing of potential mitigation cannot be traced back to Chapter 7.	Government of United States of America, U.S. Department of State
2978	26	2	26	3	"Agricultural systems complexity" could also be considered as "agricultural systems diversity". Agricultural systems diversity might represent an opportunity to test, develop and upscale diverse options for mitigation of GHG emissions in the short to mid-terms	Government of France, Ministère de la Transition écologique et solidaire
6608	26	2	26	3	Reducing N2O-emissions must not be costly and also not complicated (which is somehow implied by the sentence), but depends on the implementation of good agricultural practices which can even include economic benefits for the farmers (e.g. when less mineral fertilizer is needed when manure is used more efficiently). The huge differences in surpluses in different regions and countries with similar yields show that huge reductions are possible. We suggest wording along the lines: 'Mitigation of CH 4 and N 2 O emissions can be constrained by costs and the complexity of agricultural systems, but with sufficient support und knowledge many effective measures can be implemented at low costs and with limited effort.' Please provide a more balanced assessment.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14024	26	2	26	3	In our understanding mitigation of methane from agricultural systems are first of all constrained by consumers demand for red meat. When this it not mentioned in the sentence, the reader could be left thinking that new technologies are more important. Please consider how information about demand could be included in the sentence.	Government of Norway, Norwegian Environment Agency
15172	26	2	26	3	Consider rephrasing as "New technologies are emerging to address costs and barriers to mitigation of CH4 and N2O emissions from agricultural systems." This would be more parallel to the treatment of CCS technologies and associated costs and barriers.	Government of United States of America, U.S. Department of State
9536	26	3	26	4	"Realizing the AFOLU economic potential relies on overcoming institutional, technical and socio-economic constraints and managing trade-offs"  It would be better to replace "policy" with "technical and socio-economic". As illustrated in Chapter 7.6, different AFOLU actions face specific constraints, including institutional ones such as capacity and infrastructure, technical ones such as access to technologies and trade-offs, and socio-economic ones such as costs and awareness/perception.  cf Barrier for AFOLU actions: Reduce deforestation and degradation (Chapter 7-48, line 14-18); Afforestation, reforestation and forest ecosystem restoration (Chapter 7-49, line 28-34); Improved forest management (Chapter 7-51, line 12-15); Fire management (Chapter 7-53, line 34-36); Reduce degradation and conversion of grasslands and savannas (Chapter 7-55, line 17-19); Peatland restoration (Chapter 7-57, line 45-46); Reduce conversion of coastal wetlands (Chapter 7-59, line 7-10); Coastal wetland restoration (Chapter 7-60, line 30-34); Soil carbon management in croplands and grasslands (Chapter 7-62, line 16-20); Biochar (Chapter 7-63, line 38-41); Agroforestry (Chapter 7-65, line 1-3); Enteric fermentation (Chapter 7-67, line 18-20); Improve rice management (Chapter 7-68, line 43-45); Crop nutrient management (Chapter 7-70, line 24-30); Manure management (Chapter 7-72, line 28-30); Bioenergy and BECCS (Chapter 7-78, line 5-7); Shift to sustainable healthy diets (Chapter 7-81, line 38-39); Reduce food loss and waste (Chapter 7-83, line 28-33); and Improved and enhanced use of wood products (Chapter 7-84, line 43-45).	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
354	26	3	26	5	C.9.2: Required action: include the RD&D option to address the emission problems as a mitigation option to realize the economic potential benefits of AFOLU as discussed and presented in TS. 6.5 "Innovation, technology development and transfer".	Government of Saudi Arabia, Sustainability Advisor to the Minister of Ministry of Petroleum and Mineral Resources
9538	26	3	26	7	The paragraph is redundant in mentioning the role of policies in realizing potential/co-benefits and managing trade-offs. The following two sentences could be merged: "Realizing the AFOLU economic potential relies on overcoming institutional and policy constraints and managing potential trade-offs." and "Context specific policies can manage trade-offs and realise co-benefits."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
15174	26	3	26	7	Regarding the text "Realizing the AFOLU economic potential relies on overcoming institutional and policy constraints and managing potential trade-offs", it is recommended that caveats associated with AFOLU mitigation or "constraints" be included. It is not just about "overcoming institutional and policy constraints", but also lack of incentives, etc.	Government of United States of America, U.S. Department of State
2980	26	4	26	4	It would be nice to have one or two example of potential trade-off with other ecosystem services.	Government of France, Ministère de la Transition écologique et solidaire
12266	26	6	26	26	Like the previous section, it is better to mention the nations with highest per capita GHG emissions.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
2374	26	6	26	7	This section includes a line of sight to a section that references the Australian Government's Emissions Reduction Fund (ERF). The Australian Government made comments during the first government review regarding incorrect and out of date information related to the ERF which do not appear to be actioned. Suggest that authors update the figures for the number of projects registered under the ERF and abatement achieved to be consistent with the information sources provided in our earlier comments.	Government of Australia, Department of Industry, Science, Energy and Resources
12614	26	6	26	7	Delete last sentence C.9.2 and replace by: " Context specific policies are required that take note of equity, regional, national and sub-national circumstances, a people oriented participatory approach and evaluation of short and long term risks before co-benefits can be realized in practice."	Government of India, Ministry of Environment, Forests and Climate Change

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
724	26	8	26	10	The confidence level is not consistent with the underlying report (lines 43-46, page 6, Chapter 7). It is suggested to keep consistent with the underlying report.	Government of China, China Meteorological Administration
15176	26	8	26	10	The cost estimate of ~USD400 billion/yr in 2050 cited here hinges on one study, Austin et al. (2020). While this study appears to be of high quality, additional studies would need to corroborate its findings in order for this conclusion to merit a "high confidence" rating. The discussion of this literature in Chapter 7 (Section 7.6, specifically Box 7-12) does not present any such corroborating citations.	Government of United States of America, U.S. Department of State
15178	26	8	26	10	Suggest downgrading first finding under C.9.3 to "medium confidence" in light of the lack of corroborating literature in Chapter 7 and lack of discussion of uncertainty.	Government of United States of America, U.S. Department of State
726	26	8	26	13	The confidence level is not consistent with the underlying report (lines 31-32, page 108, Chapter 7), in which no confidence level is given. The authors are requested to check and keep consistent with the underlying report.	Government of China, China Meteorological Administration
11532	26	8	26	13	It would be important to not only say that the costs for mitigation in the AFOLU sector would be smaller than current subsidies, but also that the current subsidies largely contribute to enhancing emissions, either directly or indirectly, by providing perverse incentives to agricultural production.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12616	26	8	26	13	Delete C.9.3. References to subsidies and policies both in the bullet and in parts of the chapter are very policy prescriptive.	Government of India, Ministry of Environment, Forests and Climate Change
14026	26	8	26	13	Section C.9.3. states that current subsidies for agriculture and forestry is higher than costs of delivering AFOLU mitigation for a 2 degree pathway, implying clear economic barriers to mitigation. It would be useful to summaries possible enabling responses to overcome these barriers. E.g. drawing from the special report on climate and land SPM section C.	Government of Norway, Norwegian Environment Agency
15180	26	8	26	13	Does AFOLU include urban land use?	Government of United States of America, U.S. Department of State
2984	26	8	26	8	One of the major problems is the cost/benefit balance: access to land, viable financial balance (investment/benefits/market), currently poorly managed by subsidies when they exist. <u>This point is underlined in other places "potential cost, potential for co-benefits" and should be underlined here too.</u>	Government of France, Ministère de la Transition écologique et solidaire
1324	26	8	26	9	Information on benefits (monetary and non-monetary) of AFOLU mitigation would be useful and also complement the information on costs. Could this be addressed as well?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
5732	26	8	26	9	The costs here don't account for the benefits I think in ecosystem services etc, which should be stated for balance	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6610	26	8	26	9	It is not clear what "pathways that likely limit warming to 2 °C and below" means. Are the estimated costs also valid for 1.5 °C pathways? Please clarify.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9540	26	8	26	9	The text should be revised to read, either: - "Delivering forest mitigation [...] is estimated to cost up to ~USD400 billion-1 by 2050" or - "Delivering AFOLU mitigation [...] is estimated to cost more than ~USD400 billion-1 by 2050." According to the underlying chapter text, it is not clear whether USD400 billion is referred in relation to AFOLU sector or forestry sector only, as both expressions can be found as below.  Cf. Relevant chapter descriptions: "As Box 7.12 discusses, forestry actions could achieve up to 5.8 GtCO <sub>2</sub> yr <sup>-1</sup> with costs rising from USD178 billion yr <sup>-1</sup> to USD400 billion yr <sup>-1</sup> by 2050." (Ch.7, page7-108, line31-32) "Section 7.6.1 illustrates that to date only USD0.7 billion yr <sup>-1</sup> has been spent on AFOLU mitigation, well short of the more than USD400 billion yr <sup>-1</sup> that would be needed to achieve the economic potential described in Section 7.4. " (Ch.7, page 7-112, line15-17) "Austin et al. (2020) estimate that in forestry, USD178 billion yr <sup>-1</sup> is needed over the 3 next decade to achieve 5 GtCO <sub>2</sub> yr <sup>-1</sup> , and investments need to ramp up to USD400 billion yr <sup>-1</sup> by 2050 to expand effort to 6 GtCO <sub>2</sub> yr <sup>-1</sup> ." (Chapter7 – Box 7.12, page7-113, line 2-5.)	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
14028	26	8	26	9	Please add a footnote explaining how this number is estimated, if possible.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
1110	26	9	26	10	This appears to be implying that current subsidies serve no purpose and/or are unnecessary, or are causing emissions with no societal benefits. The statement may be seen as prescriptive. A more useful statement might be to highlight the need for supports for agriculture and forestry to be consistent with climate and environmental goals.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
814	26	9	26	9	Is it in USD2020 or current (nominal value)? Please clarify.	Government of Russian Federation, Institute of Global Climate and Ecology
15182	26	9	26	9	There is no discussion of the level of uncertainty associated with this estimate of ~USD400 billion/yr in 2050. Presumably there is uncertainty in this cost estimate. If that is not true and there is evidence that this estimate is precise, that evidence would need to be cited in Chapter 7.	Government of United States of America, U.S. Department of State
15184	26	10	26	10	What do authors mean by "cheap measurement"?	Government of United States of America, U.S. Department of State
548	26	10	26	13	Suggest to include "real time and cheap measurement and monitoring", rather than just "real time and cheap measurement" in Line 10.	Government of Singapore, Ministry of Environment and Natural Resources
2480	26	10	26	13	The AFOLU sector is extremely important in the mitigation of GHGs, however, we draw attention to the fact that the broad involvement of the actors is effective only with a strong policy guidance, as the individual actors often have different information and interests.	Government of Hungary, Ministry of Innovation and Technology - Climate Policy Department
4112	26	10	26	13	This is awkwardly worded - "real time and cheap measurement, reporting and verification...". Suggest instead something like "Measurement, reporting and verification of land-based mitigation in real-time and at low cost...."	Government of Canada, Environment and Climate Change Canada
9816	26	10	26	13	third sentence of 3.9 is unclear; too complicated	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
13688	26	10	26	13	We suggest additional narrative is added to the sentence "Real time and cheap measurement, reporting and verification...could enable engagement by a wider array of actors" to highlight the critical importance of having a good reporting system for accurately evaluating the effect of AFOLU mitigation. Would it be possible to emphasise this in a separate paragraph?	Government of New Zealand, Ministry of Environment
15186	26	10	26	13	The monitoring costs of carbon-offset markets is not "cheap". Do authors mean relative to other mitigation or sequestration policies? If so, that should be stated explicitly.	Government of United States of America, U.S. Department of State
15188	26	10	26	13	"Real time and cheap measurement" was only parenthetically noted in Chapter 7 but figures prominently in the SPM. This is an important point but, without context and/or a description to what "cheap measurement" is referring, it is not helpful. What is inexpensive in one geography/economy may be cost-prohibitive in another. Expanding on this idea in Chapter 7 (page 7-7, lines 31-34) would be useful and support inclusion of this statement in the SPM. Furthermore, it is worth noting that, in many cases, authors are referring to estimates or predictions obtained from models which are developed using measurements in MRV systems. This may be a nuance but it is important to acknowledge, particularly when using "real time and cheap" together. Simply having measurements without the resources/capacity to convert those data to information/knowledge renders them useless.	Government of United States of America, U.S. Department of State
1188	26	13	26	13	Consider defining 'NGO' "private businesses and NGOs"	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
12600	26	15	26	16	The statement should be deleted or reframed significantly. Reason: With respect to the role of behavioural change, the following statement should be qualified by providing a quantified confidence level which provides a disaggregation of the confidence level achieved through models, simulations and illustrative pathways, as well as the that achieved from experimental/implementation studies. If this statement cannot provide a quantified estimate of associated confidence levels as described above, it should be deleted.	Government of India, Ministry of Environment, Forests and Climate Change
2986	26	15	26	19	On the demand side, reference could be made to the importance of information and communication technologies in all optimisation mechanisms. Moreover, at no point does the document mention the reflections on sobriety, which are nevertheless rising in the public debate and are the subject of a growing flow of research work.	Government of France, Ministère de la Transition écologique et solidaire
11534	26	15	26	19	This section should more clearly emphasize that individual demand-side opportunities and solutions are highly constrained and dependent on e.g. choice architectures, structural changes, spatial structure, availability of new modes of service provision, regulation, policy interventions...	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14030	26	15	26	37	We would appreciate if demand-side mitigation in the global food system could be better included and quantified in the text in C10. Figure 7 shows the importance of food (diet) connected to reducing emissions. The figure caption to (figure SPM 7) refers to how much further dietary changes can have positive effects on land use - up to 3 times higher (p. 28, under the figure SPM7, line 16 -19 (7Gt or over 3 times as high as 1.9 Gt)). Is there anything in the subchapters about food systems that could further illustrate this point and is worth highlighting here? If so, please consider to include this information into the text.	Government of Norway, Norwegian Environment Agency
15192	26	15	27	10	This section would be a good candidate for cutting to shorten the SPM. It substantially overlaps with previous sections, with many options identified as demand-side while other findings identify the same technologies or options as (presumably) supply-side. Alternatively, authors could retain just the last two paragraphs but explain "choice architecture" (aka marketing). The last paragraph is interesting but would fit better with the energy section in C.4, to combine with the options to reduce energy demand, since that is the only demand it addresses.	Government of United States of America, U.S. Department of State
15190	26	15	27	6	Of the underlying statements in C.10.1-4, two are given "high confidence" while four are given "medium" confidence. This would suggest that C.10 overall would have "medium confidence" on weight of evidence, but it is currently given "high confidence". Recommend reducing to medium confidence to reflect the average level of confidence in the underlying rationale.	Government of United States of America, U.S. Department of State
14032	26	15	27	8	We appreciate the inclusion of demand side mitigation information in C.10. In C.10.3, please consider mentioning additional behavioral mitigation options mentioned in chapter 5.4, such as green defaults and labelling. Please also consider mentioning some of the barriers to demand-side mitigation (e.g. business practices and corporate efforts, advertisement) either in this section or in part E with a link to figure SPM.10.	Government of Norway, Norwegian Environment Agency
11536	26	15	29	8	General comment on C.10 & Figure SPM.7 It is vital that this report addresses demand-side mitigation. However, this is very sensitive territory and greater care needs to be given to how such messages might be received around the world. On the one hand, the SPM should not imply that climate goals can be met entirely through supply-side action such as technology deployment (even if accompanied by greater financial flows and technology transfer). On the other hand, demand-based messages can easily be misinterpreted and resented. Section B3 already mentions inequality in emissions (subliminal message - the problem is caused by the people who are richer than you). SPM.7 could be seen as pouring fuel on this fire by identifying 'cultural dietary shifts' among the global average consumer as the primary mitigation tool. Therefore, this whole section should be re-considered with readers' perceptions in mind. Suggestions include: * distinguish between the mitigation potential of systemic changes (e.g. infrastructure, policies) and changes in individual behaviour – as well as what the two can achieve when combined. Ideally this would be quantified. * distinguish between changes that would merely decarbonise existing services (e.g. fuel and modal shift in transport, reduction of food waste, efficiency improvements...) and those where consumers would actually be confronted with the need to change their behaviour and consumption patterns. The Avoid-Shift-Improve framework in Section 5.3 seems to be the underlying report's main approach for doing this. It should be mentioned in this part of the SPM. * disaggregate Figure SPM.7 by income level somehow, without resorting to simplistic bifurcation between high-income countries and the rest. See also our comment on B3.1 - while differences in emissions mirror income inequalities, the middle 70% of countries by income are also apparently responsible for 70% of emissions - so the situation has to be more nuanced than a simple global average, but also not focussed exclusively on contrasting the extremes of high and low income.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12428	26	16	26	16	"Behavioural changes" is subjective and therefore need to be explained more clearly	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
1112	26	16	26	17	There is little evidence that many of these changes can be achieved in the near term (depends what is meant by near term, may need a definition of relative time scales ).	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
12602	26	16	26	18	The statement should be restructured significantly. Reason: The term "new ways of end-use service provision" should be quantified further. In its current form, the statement does not recognise the regional inequities and resource constraints that developing nations and LDCs face. Statement should be reframed to include differentiation across regions.	Government of India, Ministry of Environment, Forests and Climate Change
13284	26	20	26	20	What is meant by "shape patterns of demand"? Please explain.	Government of Switzerland, Federal Office for the Environment FOEN

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13286	26	20	26	20	What is meant by "alternative service provision"? Please digest this conglomerate of words and put it into simple words explaining what you mean.	Government of Switzerland, Federal Office for the Environment FOEN
13288	26	20	26	24	The sentence "By 2050, comprehensive ... to reducing GHG emissions" is a perfect example of how the findings could be digested and presented in an SPM. Please add this idea into the lead paragraph as it entails policy relevant information.	Government of Switzerland, Federal Office for the Environment FOEN
13290	26	20	26	24	What do you mean by "modest" contributions to reducing GHG emissions? Can you quantify? We are surprised that the collective potential of all people in the world do not have a major impact on reducing GHG emissions. When just thinking of consumption patterns that are changed towards being more sustainab, the effect should be significant? Please explain and justify.	Government of Switzerland, Federal Office for the Environment FOEN
1326	26	20	26	25	Are policies included in the "demand-side strategies"? This could be made more explicit. Also, the combination of comprehensive strategies and individual choices could be more clearly highlighted, if appropriate. Or, are such strategies alone sufficient?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
11538	26	20	26	25	The roles of institutions, governance, and subnational actors are not adequately reflected in the summary. Please add those in the summary.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
1114	26	22	26	22	Not clear what is meant by demand side strategies and how it interacts with deployment and implementation and ultimately emissions reduction.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1328	26	22	26	23	Which is the base year for the 40-70%? How scenario-dependent is this outcome?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6612	26	22	26	25	What are demand-side strategies and how do they relate do individual behavioural choices? We guess that the potential of 40-70% of GHG reduction include diet shifts, so they are part of demand-side strategies. In C.9.2 we learned that demand-side measures in the food system (so probably diet shifts and reduction of food waste and overconsumption?) depend on billions of consumers, hence it is rather an "individual behavioural choice", which only feature modest emission reductions. Please align the wording in C9 and C10 as it becomes clear what are demand-side strategies and what are individual behavioural choices and how a transformation of the food system can become strategic. Also, please use no vague language such as "modest contribution" and try to quantify better the differences of certain mitigation potentials.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15194	26	22	26	25	Clarify the second half of the sentence: "whereas individual behavioural choices alone make modest contributions to reducing GHG emissions." Is this saying that changes in social norms and transformation of societies is needed? If so, add the detail to this sentence so it is clear that individual behavioural choices are the first step to societal transformation needed to achieve large-scale demand-side strategies. The current framing of behavioural choices does not represent the content of Chapter 5 accurately, which clearly shows many roles each individual can take and has a FAQ on What Can Every Person Do To Limit Warming to 1.5°C. It also feels contradictory with the rest of C.10 which is on individual choices and behavior. Perhaps it would be even clearer to just delete this part of the sentence to reduce confusion.	Government of United States of America, U.S. Department of State
6614	26	23	26	23	Please clarify whether "reduce GHG emissions by 40-70%" refers to total global GHG emissions or to those of end-use sectors.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9542	26	23	26	23	It is necessary to show what a 40-70% reduction is compared to. Is this compared to the current level of emissions or to a future baseline scenario?	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
2988	26	24	26	24	We strongly recommand for further explanation of this very simplistic message that is open to misinterpretation as well as provide a figure for "modest contribution" for instance in %, if available information	Government of France, Ministère de la Transition écologique et solidaire
4114	26	24	26	24	Please specify whether these behavioural choices are without supportive policies. The word "alone" is very unclear.	Government of Canada, Environment and Climate Change Canada
5734	26	24	26	25	does 'individual behavioural choices alone make modest contributions to reducing GHG emissions' imply that there has to be a role for government or other-organisational coordination? That's my reading of it. If so, this is also a useful message to make explicit for policy makers.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14034	26	26	26	32	Please keep the following sentences in C.10.2: "Changes in built environment, new and repurposed infrastructures and service provision through compact cities, co-location of jobs and housing, more efficient use of floor space and energy in buildings, and reallocation of street space for active mobility could avoid 5 -20% of GHG emissions of end use sectors. The types of technologies in use and infrastructure access shape choices about : heating and cooling point adjustments in buildings ; reduced appliance use ; shifts to walking, cycling, shared pooled mobility and public transit ; sustainable consumption with reduced material input ; and reuse, repair, and improved recycling (medium confidence)."	Government of Norway, Norwegian Environment Agency
1116	26	26	26	33	The statement is quite urban centric. Need some consideration of rural development.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
12016	26	26	26	33	C.10.2: Please indicate whether these changes are feasible globally, or which are particularly feasible for which regions (or for developing / developed countries).	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
2990	26	27	26	28	There are many levers in this sentence. They deserve to be prioritised. Indeed, some are dependent. It is thanks to compact cities that we can mix jobs and housing, that short journeys on foot or by bicycle are possible, etc.	Government of France, Ministère de la Transition écologique et solidaire
358	26	28	26	28	The following statement in C10.2 "Changes in built environment, new and repurposed infrastructures and service provision through compact cities, co-location of jobs and housing, more efficient use of floor space and energy in buildings, and reallocation of street space for active mobility could avoid 5-20% of GHG emissions of end use sectors." does not have a confidence level associated with it. Rewrite with a clear confidence level or delete.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
360	26	28	26	28	The use of the term "could" in C10.2 Changes in built environment, new and repurposed infrastructures and service provision through compact cities, co-location of jobs and housing, more efficient use of floor space and energy in buildings, and reallocation of street space for active mobility could avoid 5-20% of GHG emissions of end use sectors." Rewrite in a quantifiable manner.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
9544	26	28	26	28	It is necessary to show what a 5-20% reduction is compared to. Is this compared to the current level of emissions or to a future baseline scenario? At what point in time?	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
2992	26	29	26	30	We suggest to add "better isolation, after "in buildings"	Government of France, Ministère de la Transition écologique et solidaire
2994	26	30	26	30	We suggest to explain the appliance of what	Government of France, Ministère de la Transition écologique et solidaire
6616	26	31	26	31	What exactly is "sustainable consumption"? Does it also encompass food consumption? What are potential regulations to achieve sustainable consumption (e.g. warranty/durability of products, repair)? Please add some clarification.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
5736	26	34	26	34	Choice architecture' is a bit unnecessarily abstract/technical. It would also be helpful to, very briefly, unpack how the way choices are presented can help end-users adopt low GHG intensive options - e.g. by helping prioritise options or to ensure coherence across policies and measures? Or both, maybe?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11540	26	34	26	34	choice architectures' needs more explanation. Is there an estimate of the impact of choice architectures alone?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13292	26	34	26	34	Omit the buzzwords such as "choice architectures" which the authors then explain in brackets anyway. Explain in simple words instead.	Government of Switzerland, Federal Office for the Environment FOEN
11542	26	34	26	35	"low GHG intensive options" Does not read smoothly	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
1118	26	34	26	37	The language in this section is obtuse. The observations are either profound or profoundly inane, I can't decide which.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
2202	26	34	26	37	We would like to suggest that formulations from previous version would be returned in relation to "luxury" emission trends (meat eating, flying etc). It would be important to add also for example sentence from the previous version: "Plant-based diets can reduce GHG emissions by up to 50% compared to the average emission intensive Western diet."	Government of Finland, Finnish Meteorological Institute (FMI)
3000	26	34	26	37	Bioclimatic architecture can also be promoted as less energy consumption architecture	Government of France, Ministère de la Transition écologique et solidaire
6152	26	34	26	37	As shown in the SRCCL and in chapter 5 of this report, emissions and emission reduction potentials within 'food systems' are important and these are not limited to food waste reduction and plant-based diets. Could you provide more information in the SPM, in particular with regard to a more systemic approach (considering the entire food system)? Relevant sentences from the underlying report include the following: "Realising the full mitigation potential from the food system requires change at all stages from producer to consumer and waste management, which can be facilitated through integrated policy packages (robust evidence, high agreement). (...) Both supply and demand side measures are important to reduce the GHG intensity of food systems. Integrated food policy packages based on a combination of market-based, administrative, informative, and behavioural policies can reduce cost compared to uncoordinated interventions, address multiple sustainability goals, and increase acceptance across stakeholders and civil society (limited evidence, medium agreement)". (chapter 12, p.4, I.31-40).	Government of Belgium, Belgian Science Policy Office - Belspo
6618	26	34	26	37	Are "choice architectures" the only/best incentive for behaviour changes? What about education, carbon prices, subsidies? In some cases, a major problem is that there are no low GHG choices (e.g. no public transit options; no plant-based options in canteen; no geothermal available). Would it not also be very important to assure that demands are met? Please add more incentives and change the bullet accordingly.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
7044	26	34	26	37	Please, substitute "plant-based diets" for "sustainable diets". Regarding GHG Emissions and the impact on climate change, the emphasis should be on production systems, rather than on the final product, as it has more influence in the final GHG balance. There are ways to produce both plants and animals that can be either high in emissions or can control and neutralize the emissions.	Government of Brazil, Ministry of Foreign Affairs
9668	26	34	26	37	"Choice architecture (the way choices are presented) can help end-users adopt low GHG intensive options such as plant-based diets, food waste reduction, [...]."  Description here would have to be consistent with the terms used in the annotation in Figure SPM7. It would be better to replace "planet-based diets" with "shift in dietary choice".	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9818	26	34	26	37	C.10.3 is too abstract to be understood: what is a choice architecture and how does choice architecture affect end user choices?	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11544	26	34	26	37	district heating/cooling doesn't seem to be a matter of end-user choice/subject to choice architectures. Also public transport (esp. rail) and other shared mobility options should be mentioned next to EVs	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12598	26	34	26	37	Add "as relevant to countries with differing stages of development" at the end of the sentence. Reason: The source chapters mention differences in socio-cultural factors based on the developmental stages of different countries. Example: "Literature results indicate that in developed economies consumers are the largest source of food waste, and that behavioural changes such as meal planning, use of leftovers, and avoidance of over-preparation can be important service-oriented solutions (Gunders et al. 2017; Schanes et al. 2018), while improvements to expiration labels by regulators would reduce unnecessary disposal of unexpired items (Wilson et al. 2017) and improved preservation in supply chains would reduce spoilage (Duncan and Gulbahar 2019)." (5.3, page 38 line 13 to page 39 line 5).	Government of India, Ministry of Environment, Forests and Climate Change

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12604	26	34	26	37	The statement should be deleted. Reason: The following statement does not provide a disaggregation of the proportion of models, simulations and illustrative pathways, as well as experimental/implemented studies that have been utilised to arrive at a 'high confidence' level. If this statement cannot provide a quantified estimate of associated confidence levels as described above, it should be deleted. The statement also fails to provide a qualifier of the critiques associated with over-emphasizing the role that choice architectures can play, an example of which is the statement below which is mentioned in Chapter 5 (Page 71): "Choice architecture has been depicted as an anti -democratic attempt at manipulating the behaviour of actors without their awareness or approval (Gumbert, 2019)."	Government of India, Ministry of Environment, Forests and Climate Change
13346	26	34	26	37	Examples for successful choice architecture should be mentioned to make this less abstract and more useful for policymakers.	Government of Switzerland, Federal Office for the Environment FOEN
14036	26	34	26	37	In our view, the summary would benefit from referencing the challenges different regions face in adhering to a plant-based diet. Plant-based diets have been suggested to reduce GHG emissions for some years now. E.g include what the main challenges and barriers are, faced by developed and developing countries, or different regions. Please consider to include this kind of information into the SPM.	Government of Norway, Norwegian Environment Agency
14038	26	34	26	37	The term "Choice Architectures" is not very well explained and is not very easy to intuitively understand. Please consider to explain this in glossary, and/or emitting/revising it. For many readers the explanations in the parentheses could be understood as the selection provided in the stores and the choices that are marked by the producers.	Government of Norway, Norwegian Environment Agency
15196	26	34	26	37	Delete "plant-based diets". Plant-based diets are discussed along side reductions of animal-based foods, particular from ruminant animals; however, there are other animal proteins and systems of livestock production that may also reduce pressure on forests and land. Moreover "sustainable healthy diets" is not an appropriate alternative as the term is vague and open to interpretation.	Government of United States of America, U.S. Department of State
15198	26	34	26	37	These examples seem out of place and random. Revise the list and/or add more detail in the preceding paragraphs regarding diets, food waste reduction, etc.	Government of United States of America, U.S. Department of State
2996	26	35	26	35	We suggest to add "'renewable energy" after "geothermal"	Government of France, Ministère de la Transition écologique et solidaire
5738	26	35	26	35	The geothermal example is somewhat arbitrary, location-specific and out-of-place compared to the other options.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
7006	26	35	26	35	We request replacing the expression "plant-based diets" for "low carbon options", as it includes other alternatives besides the aforementioned.	Government of Argentina, Ministry of Environment and Sustainable Development of Argentina
10328	26	35	26	35	Please add "food loss" to "food waste"	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
15200	26	35	26	35	Food waste reduction is important, but the achievable scale is often overstated.	Government of United States of America, U.S. Department of State
15202	26	35	26	36	Shallow geothermal for district heating/cooling can be useful, but has limited geographic applicability.	Government of United States of America, U.S. Department of State
2998	26	36	26	36	We suggest to complete the sentence with "... renewable energy and low carbon electricity for buildings..."	Government of France, Ministère de la Transition écologique et solidaire
15204	26	36	26	37	Suggest replacing "electric two, three or four wheelers" with "electric vehicles or transport".	Government of United States of America, U.S. Department of State
15206	26	36	26	37	Recommend replacing "two, three or four wheelers" with "light-duty vehicles".	Government of United States of America, U.S. Department of State
3002	26	37	26	37	We suggest to add {4.2.5}	Government of France, Ministère de la Transition écologique et solidaire
15208	26	37	26	37	Incorrect line-of-sight reference. Should be 5.4, not 5.3 (see page 5-71, line 19).	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
4116	27	1	27	1	Human needs vary as would be services needed to satisfy them. Therefore, as written, this sentence is less defensible than if phrased to refer to BASIC human needs, which is tied to core needs of food, water, clothing, shelter, etc. Recommend rewriting this statement as follows: "The services required to satisfy basic human needs.....".	Government of Canada, Environment and Climate Change Canada
12330	27	1	27	2	There is a lot of uncertainty about the possibility of reducing energy consumption by 60% and there are no valid studies or accurate calculations in this area. Therefore, we must be careful in raising this issue in the SPM.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
13294	27	1	27	2	The sentence "The basic services ... energy demand" is a perfect example of how the findings could be digested and presented in an SPM. Please add this idea into the lead paragraph as it entails policy relevant information.	Government of Switzerland, Federal Office for the Environment FOEN
15210	27	1	27	2	The "40-60% of current global final energy demand" statistic in this sentence is poorly connected to the underlying technical justification in Chapter 5. None of the Executive Summary statements cite this statistic. By digging deeply into Chapter 5, the basis for the 40% statistic might be on pages 5-48 and 5-49, but a stretch. The basis for the 60% end of the range cannot be found anywhere in Chapter 5, and is not addressed in Figure TS.22. Either clearly source to the underlying assessment or delete the finding.	Government of United States of America, U.S. Department of State
366	27	1	27	5	C.10.4: The finding "Addressing status consumption and inequality supports climate change mitigation efforts" has no confidence level. Provide the confidence level.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
362	27	1	27	6	C.10.4: This statement does not account for means to enable achieving SDG 7 (Ensure access to affordable, reliable, sustainable, and modern energy for all). The use of statements associated with medium confidence levels in this context is problematic as they detract from enablers of SDG7. Required action: delete the medium confidence statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1120	27	1	27	6	The added value of this is not clear, and it may be unhelpful or seen as prescriptive. There is an interesting point regard the efficiency of global energy systems, and poor use or waste of energy which may be useful. Statements that imply that "status consumption" is intrinsically environmentally and socially harmful or addressing inequality is intrinsically environmentally beneficial need to be substantiated.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1330	27	1	27	6	The C.10.4 could be useful to start with the currently concluding sentence ("Addressing..."), as it would seem to be the key in this paragraph and thus be useful to have in the mind of the readers before the details.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
14040	27	1	27	6	This section about the energy demand to satisfy human needs and enable human wellbeing is very important and should be kept or enhanced, preferably with a figure if possible.	Government of Norway, Norwegian Environment Agency
15212	27	1	27	6	Does this suggest reducing economic prosperity in the most developed countries? Or is the purpose of the statement to address the underserved and emerging economies? Is there a definition of human well-being that is accepted among the IPCC community and/or governments?	Government of United States of America, U.S. Department of State
12606	27	1	27	7	Should be deleted. This section is ideological and policy prescriptive which does not recognise the resource constraint, developmental priorities of developing nations and LDCs. There is no distinction made between modelling dependent and model independent results. The emphasis on energy demand and not emissions is misplaced as energy demand can very well rise with low emissions or renewable energy technology.	Government of India, Ministry of Environment, Forests and Climate Change
15214	27	2	27	2	The 40-60% statistic is not easily traceable to Chapter 5 or Figure TS.22. It might be sourced by combining the percentages of minimum energy requirements in each table of Figure 5.4 (i.e., where the arrow lands for each individual factor), but that seems pretty subjective. Source the percentages or delete them.	Government of United States of America, U.S. Department of State
364	27	2	27	3	In the following statement in C10.4 "Many services can be improved while reducing energy demand." there is no specification of the services that will be improved nor a confidence level to back this statement. Rewrite with a clear confidence level or delete.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
14042	27	2	27	3	We propose that the sentence "Many services can be improved while reducing energy demand." should be expanded with examples, to make the message clear for policy-makers.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5742	27	3	27	3	Suggest deletion of "for providing the infrastructures". The phrase is confusing when the paragraph seems to be about basic services.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5740	27	3	27	6	Total energy for providing infrastructure and global energy demand are very different things. One is additional energy, to be added, the other is current demand. What's the purpose of the comparison? If misread, it could look like all additional wellbeing gaps can be delivered without any increase in global energy demand - suggest rewording or even removing the false comparison, so as to avoid confusion.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14044	27	3	27	6	This is an important finding but in order to distribute the energy to all consumers it seems to be a need to build out the distribution of energy to the consumers in some area. Both because renewable energy requires a different type of distribution (e.g. electricity grid) than fossil fuels which can be transported by ships and lorries and because most renewable energy is variable by nature. Please consider to include this perspective in the SPM.	Government of Norway, Norwegian Environment Agency
6154	27	4	27	4	Could you shortly precise the notion of «basic wellbeing»? We suggest to refer to the notion of "Decent Living Standard" which is defined in the glossary and related to "basic wellbeing" in chapter 5, p.10, I.8-15 : "A key concern about climate change mitigation policies is that they may reduce quality of life. Based on growing literature, in this chapter we adopt the concept of Decent Living Standards (DLS, explained further in relation to other individual and collective well-being measures and concepts in the Social Sciences Primer) as a universal set of service requirements essential for achieving basic human wellbeing. DLS includes the dimensions of nutrition, shelter, living condition, clothing, health care, education, and mobility (...)"	Government of Belgium, Belgian Science Policy Office - Belspo
3004	27	5	27	5	the meaning of the expressions "status consumption and inequality" should be explained	Government of France, Ministère de la Transition écologique et solidaire
4118	27	5	27	5	This interaction of meeting human needs and wellbeing is intrinsically linked to addressing inequality. These structural issues really matter for the SDGs that could be referenced here. This also needs a confidence statement.	Government of Canada, Environment and Climate Change Canada
5744	27	5	27	5	Please add "status consumption" to the Glossary.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11546	27	5	27	5	what confidence?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11548	27	5	27	5	Why only status consumption and not overconsumption in general?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13668	27	5	27	5	A definition of "status consumption" could be helpful. It is currently not included in the glossary.	Government of New Zealand, Ministry of the Environment
15216	27	5	27	6	Delete "Addressing status consumption and inequality supports climate change mitigation efforts." Policymakers have little feasible leverage over status consumption, which has no agreed definition. Assertion that addressing inequality will reduce rather than increase GHG emissions is a political view rather than an evidence-based statement. Increasing incomes are expected to increase per capita meat consumption and fossil fuel use in vehicles.	Government of United States of America, U.S. Department of State
15666	27	5	27	5	It is also important to cite the number of population without access to modern energy.	Government of Algeria, Ministère de l'Enseignement supérieur et de la Recherche Scientifique
368	28	0	28	0	Figure SPM.7: Required action: clarify whether the technology options presented here depend on existing technologies only or include yet-to-be-developed.	Government of Saudi Arabia, Sustainability Advisor to the Ministry of Petroleum and Mineral Resources
3318	28	0	28	0	Please use consistently through the figure "LUC" or "Land-use change" OR use both "LUC (land-use change)"	Government of France, Ministère de la Transition écologique et solidaire
3320	28	0	28	0	Y-axis figure legend is « Gt CO <sub>2</sub> e » instead of « Gt CO <sub>2</sub> e Yr-1 »	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2378	28	0	28	1	Figure SPM.7: Suggest clarifying why technology adoption is not 'currently applicable' for food. In addition, it is not clear why deforestation is included only in 'food', as deforestation occurs for reasons other than food production.	Government of Australia, Department of Industry, Science, Energy and Resources
6624	28	1	18	1	Whereas a figure for demand-side mitigation is highly appreciated, we have several concerns which lead to the recommendation to revise the figure in concept and cartographic realisation: Please add "for the year 2050" to the figure title. The upper part of the figure consists of 5 bar charts. The first diagram for food differs in the unit of the emissions shown from the subsequent ones, since CO2 equivalents are shown there, e.g. for the conversion of methane in the food industry. But which units are to be used for the last bar chart for electricity, in which, among other things, land management is also shown? While the first four diagrams correspond with the table below, this is not the case for the last diagram. What do the percentages for "Additional electrification" and "Demand side measures" refer to? The last bar chart should be set off more clearly from the others, e.g. by a line. Finally, the columns shown in the last diagram are also displayed with a different colour code than in the first four diagrams. The colours for "Industry" and "Land transport" are also difficult to distinguish from those for "Emissions that cannot be avoided..." and "Socio-cultural factors". The grouping of "Land transport" and "Buildings" by the dashed line is not understandable. If "Land transport" belongs to it, why does "Industry" not belong to Human settlements? Please check if the dashed line can be omitted. Why don't demography or population dynamics play a role under "Socio-cultural factors"? Why does "technology adoption" not include e.g. smart logistics and/or smart buildings/cities? Please clarify. The mitigation options mentioned in the table leave the impression of having been arbitrarily selected. Please give more explanation for the used selection.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
816	28	1	28	1	In SPM 7, in the table under the picture (line Technology adoption and column Nutrition), the text should be corrected. It is very "hot" issue - influence on food consumption of people. It is rather 'Currently estimates are not available and subject of investigation' than 'Currently not applicable'.	Government of Russian Federation, Institute of Global Climate and Ecology
1122	28	1	28	1	Fig SPM.7 The labelling of "Food" sector is misleading It is explicitly AFOLU, not food as much of the reduction in emission arising from the assumption that reduced consumption and changes in diet will lead to land use change which achieve sequestration, so non-food activity (the light blue).	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1332	28	1	28	1	The "low-to-medium level" ranges now shown by the dots+dotted lines are very difficult to relate to the "high level agreement" bars. If one thought these as a kind of "error bars" or "uncertainty ranges", one would expect overlap. Also, it is not clear why the "low-to-medium" is narrower than the "high", such as in the case of "technology adoption" in the industry, to give an example. As such, showing the columns as "summing up" to total demand-side mitigation potentials is an informative way of presenting. But, it would seem to be difficult to show both the coloured columns and the ranges in the same graph as it is now. Perhaps the ranges could be discussed in the caption instead, which would clean up the figure rather nicely.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
1334	28	1	28	1	In the figure, only "avoid short life span products" are mentioned under socio-cultural factors/manufactured products. Given what is mentioned in C.10.2 (sharing economy, sustainable consumption (including buying less in total?, less waste of functioning products) as well as aspects such as conscious materials choices, the present entry would seem to risk underestimation of the mitigation potential. A note on this would be useful, if this applies.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
5746	28	1	28	1	The nutrition and technology adoption box of the 'demand for service' table states "currently not applicable". There could be scope for inclusion of innovations in food production such as meat substitutes (whether plant-based or cultured/bio-engineered substitutes), especially in the coming decade. It may be that this technology it not yet widespread or disseminated enough to justify inclusion here.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6156	28	1	28	1	Figure SPM.7 - The readability of this figure is poor because the hatching is not sufficiently visible on screen and it may be invisible on inkjet printouts. Please improve the graphical design. "LUC" could be spelled out for clarity. The rightmost graph could be separated with a vertical line as there is no continuity with the others, and in this graph, there could be a legend instead of the names placed under the bars, like it is done for the others. Please consider some editing to make all this clear (reduce the width of the left graphs ' legend ?).	Government of Belgium, Belgian Science Policy Office - Belspo
6620	28	1	28	1	Figure SPM.7: Please clarify how you have distinguished between socio-cultural factors and infrastructure use in cases where those strongly overlap: for example, would enhanced use of existing public transport count as socio-cultural (i.e. behavioural change) or as infrastructural? Vice-versa, enhanced instalment of infrastructure for walking and cycling would impact the socio-cultural shift to those transport modes - how are the resulting mitigation potentials allocated?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6622	28	1	28	1	SPM Figure.7, Food column: Concerning the infrastructure use for food, what about the role of subsidies, CO2 price and education? Please add information if reasonable.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11550	28	1	28	1	Figure SPM.7. Descriptions (e.g. shift in dietary choice...) seem very vague	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11552	28	1	28	1	Consider adding waterborne transport.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14046	28	1	28	1	For clarity, consider to split the figure into panel A, B and C, for food systems, electricity and other end use sectors respectively. This could make it easier to separate which colours/labels/information belongs to each panel. It could also allow for an explanation on why no yellow bar for "technology adoption" exists for food systems.	Government of Norway, Norwegian Environment Agency
14048	28	1	28	1	Figure 7 shows the importance of food (diet) connected to reducing emissions. The text also refers to how much further dietary changes can have positive effects on land use - up to 3 times higher (p. 28, under the figure SPM7, line 16 -19 (7Gt or over 3 times as high as 1.9 Gt)). Is there anything in the subchapters about food systems that could further illustrate this point and is worth highlighting here? If so, please consider to include this information into the text.	Government of Norway, Norwegian Environment Agency
14052	28	1	28	1	Please consider reorganizing the legend so that the structure/order corresponds to figure SPM. 7. Emissions (and deforestation and LUC), social cultural factors (economic potential without considering LUC), infrastructure use, technology adoption and unavoidable emissions.	Government of Norway, Norwegian Environment Agency
15218	28	1	28	1	Recommend removing "with reduced animal proteins" after "Shift in dietary choice". Plant-based diets are discussed in concert with reductions of animal-based foods, particular from ruminant animals; however, there are other animal proteins and systems of livestock production that may also reduce pressure on forests and land.	Government of United States of America, U.S. Department of State
15220	28	1	28	1	Strengthen the overarching title: What percent reductions are achieved through demand-side mitigation?	Government of United States of America, U.S. Department of State
15222	28	1	28	1	Consider positive language in the key. Change "Emissions that cannot be avoided or reduced through demand-side options" to "Supply-side emission reductions".	Government of United States of America, U.S. Department of State
15224	28	1	28	1	Figure SPM.7 conspicuously omits explicit reference to policies that have strong influence on demand-side mitigation. These can be corporate policies or government policies.	Government of United States of America, U.S. Department of State
2192	28	1	28	24	Figure contains term "Shelter" that is not used anywhere else in SPM. Please, consider a more common term.	Government of Finland, Finnish Meteorological Institute (FMI)
14050	28	1	28	24	We appreciate the focus on demand side mitigation, and a figure like this is should be included in the SPM. We suggest to alter the horizontal stripes legend to "Deforestation and land use change"-part of total emissions, as some readers might think that these emissions should be added to the total. Please also show the Electricity panel separately and not on the same x-axis as the other panels, and clarify that we look at the demand and mitigation option for electricity generated from fossil fuels. If the need for this additional electrification is not needed in 2050, almost all the electrification emissions can be reduced by demand side options as we read the figure. It should therefore carefully be explained where the 60% number for additional electrification from fossil fuels comes from.	Government of Norway, Norwegian Environment Agency
15234	28	1	28	24	Figure SPM.7 portrays a large uncertainty in Socio-Cultural Factors associated with demand-side behavior changes. The ability to quantify enteric methane emissions and/or manure methane emissions associated with individual "dietary choice with reduced animal protein" is extremely abstract. WGIII AR6 seems to venture into dietary choice advocacy. There is an enormous uncertainty associated with the statement that "dietary choice with reduced animal protein" will result in reduced emissions. This topic might be more appropriate for a Special Report and extensive research prior to inserting the language into an SPM. In the underlying report, "spill-over effects" of dietary changes are also recognized. Given the large quantification uncertainty of dietary choices and any associated direct or indirect impacts on GHG emissions, the IPCC should consider removing the Food segments of the graphic.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11554	28	1	28	3	Fig. SPM. 7. Figure use at the top chart "Buildings" and later below it refers to as "Shelter", the same for Food - Nutrition and etc. Keeping the same word (e.g. "building" in both places) may be clearer for the reader and will make less confusion. For example, the lower table mentioned reduced food waste, telecommuting and avoiding short life-span products. Where can we see the magnitude of each of these? The more general categories in the upper panel make little intuitive sense to a non-expert reader. Also the definition of building includes residential, office, warehouse and etc., and the "shelter" may have a slightly different meaning. Also while there is agreement that "Behavior" may change energy consumption, it is not clear how social practices may decrease energy consumption, therefore it is recommended to present more justification for the reader.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15226	28	1	28	3	Where are supply chain emissions for Food counted? Are these included in reductions associated with socio-cultural factors?	Government of United States of America, U.S. Department of State
15228	28	1	28	3	Under Manufactured Products, behavioral changes related to product labelling could be included (5.4).	Government of United States of America, U.S. Department of State
15230	28	1	28	3	Under Infrastructure Use in Building, include urban planning such as green/blue infrastructure as part of the built environment.	Government of United States of America, U.S. Department of State
15232	28	1	28	3	The source of the building estimates is not clear. They do not appear to come from Chapter 9, which has different scenarios.	Government of United States of America, U.S. Department of State
728	28	1	31	15	Fig. SPM.8 evaluates the cost and potential of technology-based emission reduction, which varies greatly depending on selected reference technologies. However, there is no relevant description of reference technologies in this figure. Therefore, it is recommended to add such description. In addition, both figures SPM.7 and SPM.8 about emission reduction potential are based on different methods which are not explained in the report. Including both in the SPM tends to confuse decision makers. The suggestion is to add explanation to clarify the methods.	Government of China, China Meteorological Administration
6158	28	3	28	3	We wonder about the limitations of the information provided in figure SPM.7: could these be shortly indicated in the caption? For example, could there be other important demand-side aspects of mitigation such as a move to agro-ecology, to limited consumption of goods, to reduced home-work distance? (see for example chapter 10, page 22).	Government of Belgium, Belgian Science Policy Office - Belspo
15236	28	3	28	3	In the Figure SPM.7 caption, indicate that these are 2050 estimates.	Government of United States of America, U.S. Department of State
12388	28	4	28	7	Would be good to mention that there are many publications on how religion and culture can be effective, e.g., how muslim communities/societies can approach the issue of climate change(Kula, 2001)(Hassan, et al., 2019)(Yaacob, et al., 2017)(Mangunjaya, et al., 2018)(Mangunjaya and Mckay, 2012)(Fikri and Colombijn, 2021)(Mangunjaya, 2010). Also, since there is no evidence of religious-based denial of climate change in muslim world, providing religious perspective on climate change can be a promising approach.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
14054	28	8	28	8	Please clarify if the "International Energy Agency's 2020 World Energy Outlook STEPS" is the baseline for all bars/figures in figure SPM.7. If bars/figures for the food system are based on other sources, this should be clarified.	Government of Norway, Norwegian Environment Agency
14056	28	14	28	14	Please explain why there is no dots connected by dotted lines for all mitigation potentials in the figure, e.g for infrastructure use in the Food sector.	Government of Norway, Norwegian Environment Agency
3322	28	15	28	15	Why "economic"? It is not clear, does it mean that it is economically feasible to reduce GHG emissions by 1.9 GtCO <sub>2</sub> -eq?	Government of France, Ministère de la Transition écologique et solidaire
12366	28	15	28	19	It is better to also name the regions/countries with already high-calorie food diets in this part or the main technical section of the report.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
15238	28	23	28	23	Consider clarifying that electrification increases overall demand and that demand-side mitigation strategies are able to reduce energy loads, so this statement can be better understood.	Government of United States of America, U.S. Department of State
15240	28	23	28	23	"though" should be "through".	Government of United States of America, U.S. Department of State
7026	28		28		Please, delete "with reduced animal protein" from figure SPM.7. In our view, shift in dietary choice shouldn't be restrict to only one aspect.	Government of Brazil, Ministry of Foreign Affairs
12618	28		28		Figure SPM 7 the chart associated with the food sector must be deleted and the alternative must be more nuanced, paying attention to inter-regional and inter-national equity and regional and national circumstances.	Government of India, Ministry of Environment, Forests and Climate Change
12268	29	6	29	6	The total is not equal to 100.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3324	29	8	29	8	A reference to Fig. TS.21 could be added (see page TS-101)	Government of France, Ministère de la Transition écologique et solidaire
3326	29	8	29	8	the horizontal scale could seem not clear.  We suggest to reproduce the wording "Potential contribution to mitigation (2030) Gt CO <sub>2</sub> -eq" at the bottom and the scale at the top	Government of France, Ministère de la Transition écologique et solidaire
3328	29	8	29	8	We suggest to replace "mitigation" by 'emission reduction' in the title "potential contribution to mitigation (2030) which might be clearer	Government of France, Ministère de la Transition écologique et solidaire
15252	29	11	26	16	The critical role of CDR to achieve net zero should appear much earlier in the SPM, as the finding has very strong policy implications.	Government of United States of America, U.S. Department of State
9914	29	11	28	11	(C11): Spell out "Carbon Dioxide Removal (CDR)" the first time it appears.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
1124	29	11	29	11	Unclear as to why global and national scales are being considered in the same context. Achieving net zero GHG emissions at national scale is not an objective of the Paris Agreement, but is a decision for a country to consider.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
3008	29	11	29	11	We suggest to rephrase: "is deemed necessary in most integrated assessment scenarios". In the future more IAMs will include demand-side options and changes in life style. Promising forerunners show that such IMAs could reach the 2° target without CDR (see chapter 3)	Government of France, Ministère de la Transition écologique et solidaire
3010	29	11	29	11	CDR is necessary... the reader cannot remember all these acronyms which has been defined only once p 20. It is necessary to recall the acronyms, especially when they are used as fundamental points, which greatly facilitates reading and understanding: Carbon dioxide removal (CDR) is necessary... Acronym reminders, which are numerous, could be made at different points of the document without making it more difficult to read, but on the contrary would greatly facilitate its understanding.	Government of France, Ministère de la Transition écologique et solidaire
4120	29	11	29	11	As per the first sentence in para C.11.2, CDR is necessary to achieve BOTH net zero CO <sub>2</sub> AND net zero GHG emissions, to balance residual hard-to-mitigate emissions. Recommend adding "net zero CO <sub>2</sub> " to the first sentence of this header. Adding net zero CO <sub>2</sub> to the headline statement also serves to emphasize the need to develop CDR methods in the nearer term even if in many C1 and C3 pathways net zero GHG emissions are not reached until after 2100.	Government of Canada, Environment and Climate Change Canada
6626	29	11	29	11	Section C, page 29, line 11-11: Please use the wording for the first sentence as in Ch. 12.3, p. 12-35, l. 26-28: "CDR is a necessary element of mitigation portfolios to achieve net zero CO <sub>2</sub> and GHG emissions both globally and nationally." to stress that CDR is just one of many options to reduce GHG emissions.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6628	29	11	29	11	Suggestion to clarify in the first sentence in line with C.11.2 and chapter 12.3.3: "To a certain extent, CDR is necessary to achieve net zero GHG emissions globally and nationally because some residual emissions need to be counterbalanced."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11556	29	11	29	11	Please write out the full meaning of "CDR" first time it is mentioned. Should the reference be net zero "GHG emissions" or "CO <sub>2</sub> emissions" here? Earlier sections of the SPM state that net zero CO <sub>2</sub> is needed to stabilise global temperature - and this presumably also requires CDR. Other sections of the SPM (e.g. C.2.4) seem more ambivalent about linking net zero GHG emissions to the 1.5°C & 2°C thresholds.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11558	29	11	29	11	Add to the end of sentence ", counterbalancing residual emissions from hard-to-transition sectors." since this is an essential reason for the need of CDR.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11560	29	11	29	11	"CDR is necessary to achieve net zero GHG emissions globally and nationally.": This requires clarification: * It should refer to "net zero *anthropogenic* GHG emissions. This is because net zero GHG flux to the atmosphere depends also (and significantly) on natural fluxes and indirect effects, beyond human control. * Whilst the necessity is understandable at the global level, stating the same for the national level seems to be policy prescriptive and inconsistent with other parts of the SPM. For example, C.6.4 presents offsets as a way cities can achieve net-zero GHG targets, without any caveats. If that is conceivable for cities, it should also be considered at the national level. Or, conversely, if CDR is deemed "necessary" for net zero at the national level, then offsetting should not be presented as an option for cities either, to avoid sending mixed messages. (E.g., it would be odd to suggest that city states could use offsets to declare themselves "net zero" as cities, but not as "nations".) Note that C.6.4 does not stipulate that the offset should involve any removals.	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15242	29	11	29	11	This statement seems too definitive given all of the uncertainties in national and global emissions projections. Suggest changing it to: "Some form of CDR may be necessary to achieve net zero GHG emissions globally [by when? in support of 2°C? 1.5°C?] if [add statement about all other mitigation options being adopted, but there still being remaining emissions]."	Government of United States of America, U.S. Department of State
15244	29	11	29	11	Given all of the different national circumstances, "and nationally" should be struck.	Government of United States of America, U.S. Department of State
15246	29	11	29	11	This is a very controversial statement, and without context: "CDR is necessary to achieve net zero GHG emissions globally and nationally." Representation of CDR in C.11 headline does not adequately or clearly represent the supporting bullets and Chapter 7 CDR text (e.g., national vs. global adoption of CDR measures).	Government of United States of America, U.S. Department of State
15248	29	11	29	11	"CDR is necessary to achieve net zero GHG emissions globally and nationally": Technically this is not true -- rather, it is true in all models, or in models with current expectations around economic growth or with some other caveat.	Government of United States of America, U.S. Department of State
1126	29	11	29	12	"The scale and timing of deployment of CDR" also depends on the metric used to define net zero GHG emissions.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
15250	29	11	29	12	Change the first sentence to read: "The scenarios analyzed in this assessment all employ Carbon Dioxide Removal (CDR) technologies as substantial components to achieve net zero GHG emissions, offsetting positive emissions." "Necessitates" can almost always be eliminated by rewording and is desirable to avoid what sounds like a policy recommendation.	Government of United States of America, U.S. Department of State
3006	29	11	29	15	The current para current para. C.11 does not bring across sufficiently clearly the message from C.2, C.3 and the IMPs that the scale of CDR deployment needed depends on the amount of upfront emission reductions: i.e. that the deeper emission reductions upfront (2030 and 2040s), the lesser the need to depend on CDR, which can address the various feasibility and sustainability constraints large CDR deployment faces. Authors should modify para C.11 to better express this critical message, which could also create more coherence with C.2 and C.3. To do so, authors could for example:  (1) insert, in the 2nd sentence of C.11, after "scale and timing of deployment" the term "needed" – in order to clarify further that scale of CDR deployment is dependent on the amount of emissions reductions that need to be balanced out.  (2), insert after "in different sectors" a phrase such as ", with deeper emissions reducing the need for CDR to compensate for remaining emissions"	Government of France, Ministère de la Transition écologique et solidaire
9820	29	11	29	15	C.11: start with sentence from TS 5.7: . Add to first sentence "and to achieve negative emissions after net zero is reached". The second sentence of C.11 has little meaning. replace by sentence of C.11.2: "Net zero CO2 or GHG emissions globally or nationally can be achieved only if CDR is deployed to balance difficult-to-abate residual emissions (e.g., from aviation, agriculture, industrial processes) (high confidence). Additionally add a sentence on the vulnerability and sustainability of various CDR options (biological, geochemical and chemical). (C11): .	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
15644	29	11	29	15	This headline statement should expand more on the CDR constraints that are briefly mentioned. Also the following paragraphs do not present sufficient information on this matter. A separate paragraph on such constraints should be added to this section.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
6630	29	11	29	16	It is crucial to mention here that scale and timing of deployment of CDR technologies is not only determined by emission reduction trajectories, but by political and societal choices that take into account costs, feasibility and sustainability constraints among others. The wording used in the TS (p. TS-94, I. 35-39) also aligns with this argument. We would suggest to combine wordings from TS and SPM as follows: "CDR is necessary to achieve net zero GHG emissions globally and nationally. CDR methods vary in terms of their maturity, removal process, timescale of carbon storage, mitigation potential, cost, co-benefits, adverse side-effects, and governance requirements. The scale and timing of deployment will depend on the trajectories of gross emission reductions and managing multiple sustainability and feasibility constraints, including political preferences and social acceptability."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13394	29	11	29	16	Might be necessary to state this at the very first instance CDR is introduced - maybe a footnote would do as it has been mentioned a number of times and highlighted in previous document here. This is very important for clarity	Government of Kenya, Kenya Meteorological Service
15254	29	11	29	16	The first sentence is powerful. The rest of the bold-faced finding is meh. It would be much more useful to focus on where or how CDR is likely to be promising, or the extent of financial or policy support needed to enable it, assuming the underlying chapters (especially Chapter 5) include that information.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15256	29	11	29	16	First sentence implies for ALL nations. Restate unless it is 100% known (e.g., "necessary"). Could not one nation have more CDR given more sequestration potential to offset another nation's net emissions?	Government of United States of America, U.S. Department of State
2380	29	11	29	36	The key role of CCS in mitigation pathways is clear in the underlying assessment but is under represented in the SPM. Suggest that this section could be revised to communicate the need for both CCS and CDR in pathways that limit warming to 1.5 and 2 degrees.	Government of Australia, Department of Industry, Science, Energy and Resources
2382	29	11	29	36	Suggest emphasising that policy coherence across various levels of governance (national to local) is a key enabling factor to facilitate investments in and adoption of CDR technologies.	Government of Australia, Department of Industry, Science, Energy and Resources
3422	29	11	29	36	The first sentence is not clear and would be relevant to be reformulated in order to clarify that achieving net zero emissions does not depend solely on the use of CDR, and that the scale and timing not only depend on trajectories but have an impact on them : the more focus is put in early deployment of CDR, the more it is likely that a moral bias will prevent early emissions reductions ; the more emissions reductions are delayed, the less natural sinks will be able to contribute to CDR;. This section is not clear enough and does not reflect in a balanced manner the content below. the information about the existence of a "variation" is not useful to readers. What is policy relevant is to indicate how this affects the scale, timing and deployment of CDR. Another wording, more conclusive and reflective of the 3 paragraphs below would be useful." We suggest to rephrase: "is deemed necessary in most integrated assessment scenarios". In the future more IAMs will include demand-side options and changes in life style. Prominsing forerunners show that such IMAs could reach the 2° target without CDR (see chapter 3) In C.11, the current phrase "co-benefits, adverse side-effects" provides no information on what and whom these benefits or side effects of CDR occur on. For the sake of greater clarity and connection with the 3rd sentence in C.11 and section D, the phrase "co-benefits, adverse side-effects" should be replaced with "co-benefits and adverse side-effects, including to SDGs".	Government of France, Ministère de la Transition écologique et solidaire
3424	29	11	29	36	In C.11, the current phrase "co-benefits, adverse side-effects" provides no information on what and whom these benefits or side effects of CDR occur on. For the sake of greater clarity and connection with the 3rd sentence in C.11 and section D, the phrase "co-benefits, adverse side-effects" should be replaced with "co-benefits and adverse side-effects, including to SDGs".  Furthermore, the current para current para. C.11 does not bring across sufficiently clearly the message from C.2, C.3 and the IMPs that the scale of CDR deployment needed depends on the amount of upfront emission reductions: i.e. that the deeper emission reductions upfront (2030 and 2040s), the lesser the need to depend on CDR, which can address the various feasibility and sustainability constraints large CDR deployment faces.  This was detailed very clearly in the SR1.5 SPM : "Significant near-term emissions reductions and measures to lower energy and land demand can limit CDR deployment to a few hundred GtCO2 without reliance on bioenergy with carbon capture and storage (BECCS) (high confidence)."  This critical message could be more consistent with C2 and C3 : for example by : (1) inserting, in the 2nd sentence of C.11, after "scale and timing of deployment" the term "needed" – in order to clarify further that scale of CDR deployment is dependent on the amount of emissions reductions that need to be balanced out. (2), insert after "in different sectors" a phrase such as ", with deeper emissions reducing the need for CDR to compensate for remaining emission".	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3426	29	11	29	36	<p>Also, as detailed for C2 and C11, for the sake of consistency and clarity, authors should consider linking the language in para. C.11.2 with the messages in C.2 and C.11. For example, after "in different sectors" authors could insert a phrase in the order of ", with deeper emissions reductions by 2030 and 2040 reducing the need for net negative CO2 emissions in the long-term, thereby helping limit sustainability trade-offs of large-scale CDR deployment (C.2, 3.7, 7.4)"</p> <p>All these comment relate to a more general comment on the treatment of CDR throughout the report :</p> <p>There is an imbalance, between the treatment of the potential of CDR and that of its feasibility and sustainability constraints, which was clearly summarized in the SPM of SR1.5 and in the underlying chapters. This is all the more problematic since the contribution from WG1 to the AR6 report introduced in its SPM the notion of risks, impacts, and sustainability implications on biogeochemical cycles and biodiversity without exploring them with the understanding that volume 2 and 3 would address it : (WG1 SPM) Potential negative and positive effects of CDR for biodiversity, water and food production are methods-specific and are often highly dependent on local context, management, prior land use, and scale. IPCC Working Groups II and III assess the CDR potential and ecological and socio-economic effects of CDR methods in their AR6 contributions. Not providing more details would fail on delivering on this point and provide an incomplete picture of this critical subject throughout the AR6. The current SPM of volume 3 does not provide sufficient detail and in most instances restricts itself in listing the fact that CDR methods vary in terms of impacts, risks, constraints, without indicating the direction of these impacts and risks and proposing an actionable conclusion which can be understood by policymakers – this is the case for this paragraph and such a listing is not policy relevant. In other instances, the listing is also lacking references to crucial impacts, such as on biodiversity – for example the notion of pressure on land is mentioned several times when referring to impacts of some CDR options such as BECCS, but the pressure and impact on biodiversity is not mentioned (although it was in chapters) – a similar statement can be made on socio-economic impacts.</p>	Government of France, Ministère de la Transition écologique et solidaire
3428	29	11	29	36	<p>Also, there is an imbalance in the treatment of scenarios compatible with 1,5°C regarding the priority and benefits of a reduction in emissions compared to a massive use of CDR – this is the case for example in section C.3. The role of CDR in scenarios in particular in terms of timing of deployment relative to the timing of emission reductions is also not explored enough. This has critical implications with relation to overshoot and related impacts : in terms of adaptation, depending on the delay of emissions reductions and thus on the extent of the overshoot, the capacity of natural carbon sinks to adapt to climate change impacts may be constrained and this will have an impact in turn on their capacity to act as a carbon sink – this is in addition to the other constraints already explored in WG1 regarding their reduced marginal storage capacity in higher emissions scenarios.</p> <p>The role of CDR in scenarios, in addition to the above mentioned constraints, are also explored in chapters and previous reports in terms of moral bias, an overemphasis on early implementation of CDR being likely to delay emissions reduction which are critical to avoid being on a high-overshoot track (which would in term pose new constraints as detailed above). These policy-relevant details are essential to inform the upcoming global stocktake, in particular on the credibility of net zero strategies from a science perspective.</p>	Government of France, Ministère de la Transition écologique et solidaire
5748	29	11	29	36	<p>Many readers will be aware that the levels of BECCS assumed in the AR5 IAMs were criticised as unrealistic. It would be helpful to address their concern by adding a statement, or perhaps a footnote, explaining the different BECCS potentials reported in the AR5, SROCC and SR1.5, what the technical net CDR potential of BECCS by 2050 is now assessed to be (5.9 (0.5-11.3) GtCO2 yr-1 globally, from section 7.4.4, page 7-78?) and how this affects IAM modelling.</p>	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5750	29	11	29	36	<p>Section C11 rightly recognises that some CDR is necessary to limit warming to 1.5C or to well below 2C, however there needs to be more focus on achieving a balanced text that also sets clearly the risks and limitations of CDR to build on the information given in SR1.5 and SRCLL. In particular, we request that this section:</p> <ul style="list-style-type: none"> <li>- Address the question of the amount of CDR necessary in different pathways. This could also be achieved if Table SPM1 were amended to provide more granular detail on 1.5C and well below 2C consistent pathways as in SR1.5 Fig SPM3.</li> <li>- Highlight that almost none of the CDR measures listed here are close to implementation without further research (see Chapter 12, p36 lines 10-13).</li> <li>- Provide a more balanced approach to setting out the risks to ecosystems and biodiversity, especially from large-scale CDR, for example that set out in chapter 7 (p81)</li> <li>- Reflect on the sustainable potential of large-scale CDR given these constraints, and others (for example political considerations, social acceptability), , as well as recognition of the challenges of scaling up (e.g. Chapter 12 p.40 lines 8-9).</li> </ul>	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5752	29	11	29	36	This section does not mention that CDR is included in scenarios before net-zero CO2/GHG is reached. It is not just a requirement to reach net zero, but also plays a role in emissions reductions while they are still positive. Some quantification of the relative role of emissions reduction vs CDR would be useful – analogous to SR1.5 figure SPM.3B. Neither the scenarios table SPM.1, nor your emissions figure SPM.5 show the CDR aspect implicit in the scenarios. There is some information in figure SPM.6, but the timeseries nature is not present, so it cannot portray how early CDR is required in these pathways. It was a much mis-understood outcome from AR5 that (for example) RCP2.6 had substantial CDR throughout most of 21st century. SR1.5 did a great job to remedy this and make the positive/negative components of scenarios clearly explicit. AR6 WG3 SPM should not undo this.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6632	29	11	29	36	<b>_CDR INFORMATION:</b> The SPM is clear about the need for CDR in order to limit global warming to 1.5°C or 2°C. However, the SPM is lacking concrete information on this topic compared to previous reports (SR1.5, SRCCL). As it is critical for policymakers to understand the basics about CDR such as the potentials, risks and technology readiness, we kindly urge the authors to include quantified and specific information on the following topics here in this subsection on CDR: 1) What is the actual need for CDR in the various pathways? The estimates for the amount of net negative CO2 emissions needed in certain scenarios are provided (see SPM Table.1). However, it would be even more policy-relevant to understand the total demand of CDR in these scenarios, i.e. also the amount of (gross) negative emissions needed to compensate for remaining emissions. 2) Please add information on the actual (maybe technical and/or sustainable) potential of CDR options. It is neither clear if the 200 Gt CO2 (C1, Table SPM.1) of cumulative net-negative CO2 emissions are of a magnitude that would actually be realistic, nor under which requirements/socio-economic pathway such an amount of net negative CO2 emissions could be realized. 3) What are the risks of CDR options on a Gigaton scale? Figures SPM.9 and 10 seem to show information on different scales (mostly much smaller). For example, DACCS (with its inherently high energy demand) would feature technological barriers as it is not yet a commercially available, scaled up technology. Please use C.11 to help policymakers to understand the concrete risks of specific CDR options, including at different scales. 4) Please add information on research gaps and technology readiness of the main CDR technologies (BECCS, DACCS, ocean fertilisation, Biochar...).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6634	29	11	29	36	In this subsection on CDR, a very basic but crucial relationship is missing. The need for CDR is directly dependent on the overshoot. As we learned in C.2, deeper emissions reductions by the 2030s will lead to a lower overshoot and hence, to a lower need for net-negative emissions and CDR. We strongly request to include this crucial relationship (early emission reductions -> lower overshoot -> less CDR demand) here. If there is something we know, then it is this relationship, we Therefore, strongly suggest to include this relationship in the C.11 headline. Otherwise readers get the impression that nothing is clear or certain at all when it comes to CDR.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6636	29	11	29	36	This section mentions several times that CDR methods vary in terms of their maturity, mitigation potential, costs, readiness level etc. Can some information about the costs and potential be included here?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6974	29	11	29	36	Chapter 12.3 is mentioned in the line of sight and explains very well the feasibility and sustainability constraints that are only mentioned in the headline statement here and not further discussed in any of the following sub-bullets aside from mentioning potential adverse side-effects. Please add a dedicated sub-bullet to this section.	Government of Jamaica, Meteorological Service Division
9546	29	11	29	36	ICDR in section C.11 covers all carbon removals occurred globally (e.g. it is explained in line 24-25 of C.11.2 that net zero can be archived if CDR and residual emissions are balanced). Improved or sustainable forest management should be added as an example of biological removal process, as it has already been widely practiced and acknowledged as one of the largest carbon sinks The future direction of overall biological CDR is to maintain and enhance existing forest removals and then expanding potential of biological CDR through deployment of additional measures referred here. In this regards, we suggest including the information on improved or sustainable land use or management to maintain or enhance carbon removals on land as a part of biological CDR.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11562	29	11	29	36	Section C.11 would benefit from including numeric estimates of the magnitude of negative emissions that different CDR methods could possibly provide based on e.g information in Chapter 12.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11564	29	11	29	36	C.11. should treat CDR options in a much more differentiated manner.	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11566	29	11	29	36	The contents/scope of C.11 (CDR) should be harmonised with C.9 (AFOLU). There are significant overlaps in scope (e.g., some or all forestry measures), but insufficient, inconsistent and asymmetrical cross-references. It is therefore unclear whether the respective mitigation potentials also overlap (potentially double-counted) or how they are separated from each other (and from natural sinks).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12018	29	11	29	36	C.11: An additional bullet should be added to section C.11 on CDR that explains potential feasibility and sustainability concerns as well as negative effects, especially drawing from Chapter 12.3, e.g.: "... very few [countries] are pursuing the integration of a broad range of CDR methods into national mitigation portfolios so far .... There are concerns that the prospect of large-scale CDR could, depending on the design of mitigation strategies, obstruct near-term emission reduction efforts ..., mask insufficient policy interventions..., might lead to an overreliance on technologies that are still in their infancy ..., could overburden future generations ... might evoke new conflicts over equitable burden-sharing ... could impact food security, biodiversity or land rights ..., or might be perceived negatively by stakeholders and broader public audiences".	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13574	29	11	29	36	We are concerned with the way that CDR is currently presented in this SPM and particularly in C.11. The headline statement does mention "feasibility and sustainability constraints" while not explaining it further, and "adverse side effects" are also only briefly mentioned in C.11, C.11.1 and C.11.3. To ensure that policy makers are presented with all the information necessary regarding this mitigation option, an additional bullet point C.11.4 should be added that adequately reflects side-effects and constraints, for which substantial information is available in Chapter 12.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
14058	29	11	29	36	Please discuss the main options for CDR on a case by case basis. As described in the headline statement here, the options are very different and have very little in common. As it stands in our view, C11 ends up giving limited information about these options. As CDR will in many cases be a part of solutions in the other sectors (ie. CCS in the pulp and paper industry, coal fired power retrofitted with CCS and partial use of biomass, waste-to-energy plants with CCS, cement kilns with bioenergy retrofitted with CCS, production of biogas and liquid biofuels with CCS, etc). Perhaps the sectoral sections could describe these in more detail, if C11 is meant to be general in nature?	Government of Norway, Norwegian Environment Agency
14060	29	11	29	36	Please consider to indicate the feasibility of the deployment of BECCS in the scenarios by incusion of the area needed for biomass production, and link that to the statements in D.2.3 about potential reduction e.g. in biodiversity.	Government of Norway, Norwegian Environment Agency
15258	29	11	29	36	Add discussion of the role of indigenous and local communities, strategies such as community forest management, and integration of indigenous and local knowledge in achieving carbon dioxide removal (CDR), optimizing co-benefits, minimizing potential adverse side-effects, and ensuring reliable measurement, reporting and verification of carbon flows.	Government of United States of America, U.S. Department of State
11568	29	12	29	12	Consider replacing "will" with "would", to the extent it refers to the implementation of net-zero targets, as that cannot be taken for granted universally. Also, the deployment of CDR is likely to depend on a number of factors not mentioned (e.g., affordability, social readiness), thus the sentence describes an idealised situation where CDR can be deployed at will, as demanded by the desired trajectory.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15260	29	12	29	12	Change "will depend on the trajectories" to "depends on the modeled trajectories". This is not a prediction.	Government of United States of America, U.S. Department of State
3012	29	13	29	15	This section is not clear enough and does not reflect in a balanced manner the content below. the information about the existence of a "variation" is not useful to readers. What is policy relevant is to indicate how this affects the scale, timing and deployment of CDR. Another wording, more conclusive and reflective of the 3 paragraphs below would be useful.	Government of France, Ministère de la Transition écologique et solidaire
11570	29	13	29	16	Include as well please rebound and spill-over effects.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11572	29	14	29	14	Please be more precise and include socio-environmental risks and uncertainties not only adverse side-effects.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
3464	29	14	29	15	In C.11, the current phrase "co-benefits, adverse side-effects" provides no information on what and whom these benefits or side effects of CDR occur on.  For the sake of greater clarity and connection with the 3rd sentence in C.11 and section D, the phrase "co-benefits, adverse side-effects" should be replaced with "co-benefits and adverse side-effects, including to SDGs".	Government of France, Ministère de la Transition écologique et solidaire
3014	29	15	29	15	It would be useful to be clearer on this sentence timing, scales, technologies, acceptance, etc...	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5754	29	15	29	15	The statement about the important role of CDR in paragraph C.11.2, needs to be balanced by a statement that CDR is no substitute for mitigation - I can't currently find such a statement in the SPM. Please add "and cannot serve as a substitute for deep emissions reductions" to end of sentence. (this is copied from 12-38 rows 2-3)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
7028	29	15	29	15	Please, change the word "constraints" by "issues" in line 15, once the paragraph refers to positive and negative aspects related to the technology. The text should be read as following: "Deployment of CDR faces various feasibility and sustainability issues".	Government of Brazil, Ministry of Foreign Affairs
11574	29	15	29	15	Ethics needs to be included as well.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11576	29	15	29	15	Does the confidence statement apply to all parts of the HS?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11578	29	15	29	16	14.4' should be added in the reference bracket.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2064	29	17	29	18	(Basis) although afforestation and reforestation are widely used, forest management actually contributes more to the achievement of the national reduction target is forest management. It can be found in the National Greenhouse Gas Inventory Report of Annex I countries with the Common Reporting Format (KP-LULUCF) in the Kyoto regime. So please check the sentence again.	Government of Republic of Korea, Korea Meteorological Administration
6638	29	17	29	21	In C.11.1, afforestation is introduced as an example for biological removal processes. To provide a more balanced view, it would be appropriate to mention reforestation instead, as it also has high potential for GHG removal and comes with less potential trade-offs than afforestation (in line with C.11.3 of the SPM; see chapter 7, p.49 ).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
3430	29	17	29	23	Ocean fertilisation is not the only ocean-based removal process; in this paragraph, it should be completed by other ocean-based processes contributing to enhancing the carbon sink (or replaced by a more general term of the sort).	Government of France, Ministère de la Transition écologique et solidaire
3432	29	17	29	23	<p>It is also worthwhile to mention that both biochar and BECCS are not fully biological processes as they rely on technology in one or several steps of their process.</p> <p>Furthermore, on biochar as a "biological process", this raises the question of the description and representation of land-based CDR options in the AFOLU sector, these options are most of the time reduced to biochar (which is partly technology based). It would be more balanced and reflective of the diversity of options outlined in the chapters to refer to these options as soil carbon sequestration techniques – as these techniques refer not only to biochar, but also to soil carbon sequestration through agroecology, non-tillage, agroforestry, among others. Representing this diversity would be more representative of the potential behind biological removal processes.</p> <p>Furthermore the potential trade offs of biochars with some SDG as SDG2 when deployed at large scale, or when made from biomass contaminated with pollutants, and the energy consumed to produce it should be taken more into account – this is valid as well for paragraphs D1.6 and D2.2.</p> <p>The below suggestions can also be highlighted for consistency with the SPM of SRCCL :</p> <p>To be consistent with panel B of figure SPM 3 of the SRCCL, the potential impact on food security when deployed at large scale should be mentioned.</p> <p>To be consistent with B3.1 of SRCCL SPM the "increase demand for land conversion" when deployed at scale should also be mentioned.</p> <p>To be consistent with B5.2 SPM SRCCL ("The application of certain biochars can sequester carbon (high confidence),and improve soil conditions in some soil types/climates"), the addition of "certain" before biochar would be appropriate. Or the sentence "mitigation and agronomic co-benefits depend strongly on biochar properties and the soil to which biochar is applied" from 7.4.3.2. could be used.</p>	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3434	29	17	29	23	<p>Finally and most importantly, on the structure of the sentence, which summarises that there are variation between CDR options, without clearly indicating which CDR options are providing the longest storage, have the highest potential, cost, cobenefits, negative impacts, technology readiness, this relates to a more general comment throughout this SPM :</p> <p>There is an imbalance, between the treatment of the potential of CDR and that of its feasibility and sustainability constraints, which was clearly summarized in the SPM of SR1.5 and in the underlying chapters : (SR1.5) "CDR deployment of several hundreds of GtCO2 is subject to multiple feasibility and sustainability constraints (high confidence)." This is all the more problematic since the contribution from WG1 to the AR6 report introduced in its SPM the notion of risks, impacts, and sustainability implications without exploring them with the understanding that volume 2 and 3 would address it : (WG1 SPM) "Potential negative and positive effects of CDR for biodiversity, water and food production are methods-specific and are often highly dependent on local context, management, prior land use, and scale. IPCC Working Groups II and III assess the CDR potential and ecological and socio-economic effects of CDR methods in their AR6 contributions". Not providing more details would fail on delivering on this point and provide an incomplete picture of this critical subject throughout the AR6. The statement in this paragraph is however of the same order as the statement from volume 1.</p> <p>Furthermore, this paragraph does not provide sufficient detail and restricts itself in listing the fact that CDR methods vary in terms of impacts, risks, constraints, without indicating the direction of these impacts and risks and proposing an actionable conclusion which can be understood by policymakers –the policy relevance of such a listing is not obvious.</p>	Government of France, Ministère de la Transition écologique et solidaire
11580	29	17	29	23	C.11.1 This section should note (as per the TS) that the feasibility of ocean-based CDR methods is uncertain due to the limited understanding of their mechanism (fate of carbon, potential feed-backs) and possible side-effects on the marine environment.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13690	29	17	29	36	The end of section C11 on CDR mentions the need for "agreed methods for measurement, reporting and verification of carbon flows", we think this point needs to be more strongly emphasised. There is a risk the implementation of some of these technologies could be delayed because the method/mechanism for including them in inventories or carbon markets/emissions trading schemes is unclear or can't be recognised.	Government of New Zealand, Ministry%20for%20the%20Environment
6640	29	18	29	18	Biochar applications still need to be tested and evaluated for different vegetation zones. Please add this very important information.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14062	29	18	29	18	Consider replacing "biochar" with "soil carbon sequestration", as soil carbon sequestration is a more generic approach and "biochar" is probably not a removal process, rather a storage medium.	Government of Norway, Norwegian Environment Agency
3016	29	18	29	19	Soil carbon sequestration in land sector (Forest, croplands and grasslands, and other ecosystems) should be mentioned as well especially as it has no competing effect on land use, biodiversity and food security according to SRCCCL.	Government of France, Ministère de la Transition écologique et solidaire
4122	29	18	29	19	Suggest simply including the expanded forms for BECCS and DACCS in the text rather than a footnote.	Government of Canada, Environment and Climate Change Canada
15262	29	18	29	19	BECCS requires chemical processes, and ocean fertilization is arguably geochemical in some forms. Suggest being really careful with how these are defined.	Government of United States of America, U.S. Department of State
6642	29	18	29	21	Several examples for "biological" removal processes presented here are rather hybrid approaches, which go beyond biological processes (e.g. BECCS, biochar, ocean fertilisation). It would Therefore, be helpful to distinguish between purely biological processes and hybrid approaches to prevent misunderstandings, if this structure is to be kept. The current structure does not reflect the structure of the presentation of different approaches in the AFOLU sector in chapter 7.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2120	29	19	29	19	It is good to add "ocean alkalinity enhancement" in the geochemical. So, it would be enhanced weathering and ocean alkalinity enhancement.	Government of Republic of Korea, Korea Meteorological Administration
6160	29	19	29	19	"DACCS" is presented as a "chemical process", but we think that it is not necessarily chemical: it can be physical (e.g. gas-solid adsorption), biological, etc. If relevant, could you clarify this in footnote 20? This remark also applies to the glossary definitions for "DAC" and "DACCS".	Government of Belgium, Belgian Science Policy Office - Belspo
14064	29	19	29	19	Please note the typo in footnote 20. Not DACCS, but DACCS.	Government of Norway, Norwegian Environment Agency



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
10330	29	19	29	32	Line 19 refers to "ocean fertilisation" while line 32 refers to "ocean alkalisation". It would be useful to clarify if both terms are equivalent	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
11582	29	19	29	33	Could it be explained what ocean alkalisation is, perhaps in a footnote?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11584	29	20	29	20	"range from decades": Why from decades? Are there any options that cannot store carbon beyond a few decades? Can it be relied on to achieve multi-decadal targets? If it is an allusion to the risk of reversal of certain methods, then it should be spelled out and the lower end of the timescale should consider the risk of instantaneous reversal, as the reversals mentioned in C.11.3 can happen almost immediately, or perhaps never. It is unclear why "decades" would be a lower limit for any interpretation.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5756	29	21	29	21	What is meant by "Within the same category"? It isn't clear what categories are referred to. Perhaps the phrase isn't needed?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15264	29	21	29	21	Delete "Within the same category,".	Government of United States of America, U.S. Department of State
2122	29	21	29	23	The lists of the different aspect, it is better to follow the order of lines 13 to 14. So, technology readiness level would be first. And "governance requirement is added at the end as in line 14.	Government of Republic of Korea, Korea Meteorological Administration
3018	29	22	29	22	We suggest to add : "especially towards biodiversity (afforestation, BECCS, etc.)" after "adverse side effects"	Government of France, Ministère de la Transition écologique et solidaire
11586	29	22	29	22	Please be more precise and include socio-environmental risks and uncertainties, not only adverse side-effects.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
9788	29	24	29	24	add to C11.2 from TS 5.7: CDR is a key element in scenarios that likely limit warming to 2°C or 1.5°C by 2100 (high confidence). This provides a clearer context and adds an important message.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
9548	29	24	29	25	Net Zero... can be achieved "only if" CDR is deployed to balance difficult-to-abate residual emissions: This is important message, thus should be mentioned in the headline (C.11) and stressed ONLY IF as a necessary precondition for Net-Zero.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
15266	29	24	29	25	Define the time frame and emissions assumptions for saying net zero can only be achieved if CDR is deployed. This is especially important since this statement is made with high confidence.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3436	29	24	29	28	<p>This paragraph is formulated in a way which is very difficult to understand.</p> <p>It would be useful to specify the logical journey that brings us to residual and hard to abate emissions.</p> <p>On the first sentence, it would be relevant to precise, after "Net zero CO2 or GHG emissions globally or nationally can be achieved only", a detail of the following order "after deep emissions reductions in all sectors, and". This would help to understand the core of the net zero CO2 or GHG emissions strategies, and ensure a balance with CDR – otherwise, this paragraph makes it look like the only and core focus of net zero CO2 strategies is to apply CDR measures.</p> <p>Furthermore, the paragraph would benefit from further details on the implications of CDR for net zero emissions scenarios. This relates to a more general comment on the treatment of CDR in this report : there is an imbalance in the treatment of scenarios compatible with 1,5°C regarding the priority and benefits of a reduction in emissions compared to a massive use of CDR – this is the case for example in section C.3. The role of CDR in scenarios in particular in terms of timing of deployment relative to the timing of emission reductions is also not explored enough. This has critical implications with relation to overshoot and related impacts : in terms of adaptation, depending on the delay of emissions reductions and thus on the extent of the overshoot, the capacity of natural carbon sinks to adapt to climate change impacts may be constrained and this will have an impact in turn on their capacity to act as a carbon sink – this is in addition to the other constraints already explored in WG1 regarding their reduced marginal storage capacity in higher emissions scenarios.</p> <p>The role of CDR in scenarios, in addition to the above mentioned constraints, are also explored in chapters and previous reports in terms of moral bias, an overemphasis on early implementation of CDR being likely to delay emissions reduction which are critical to avoid being on a high-overshoot track (which would in term pose new constraints as detailed above). These policy-relevant details are essential to inform the upcoming global stocktake, in particular on the credibility of net zero strategies from a science perspective.</p> <p>In a similar way as our suggestion above, this could thus be completed among others with details considering a linkage of the language in para. C.11.2 with the messages in C.2 and C.11. For example, after "in different sectors" authors could insert a phrase like ", with deeper emissions reductions by 2030 and 2040 reducing the need for net negative CO2 emissions in the long-term, thereby helping limit sustainability trade-offs of large-scale CDR deployment {C.2, 3.7, 7.4}"</p>	Government of France, Ministère de la Transition écologique et solidaire
3438	29	24	29	28	<p>Finally, it would be preferable to specify CCS here in addition to CDR. Indeed, the technical summary recalls (p94 line 40 to p95 line 3) that "Carbon Capture and Storage (CCS) and Carbon Capture and Utilisation (CCU) applied to fossil CO2 do not count as removal technologies. CCS and CCU can only be part of CDR methods if the CO2 is biogenic or directly captured from ambient air, and stored durably in geological reservoirs or products". However, there are occurrences in the SPM, including this paragraph, where the words are used interchangeably when CCS actually refers and applies to specific situations. This is the case for example regarding application of CCS to industrial processes and energy production in mitigation strategies. In such instances, it would be relevant to specify the term CCS in complement to CDR (and maybe refer in a footnote to the distinction between the two, referring to the glossary &amp; TS) – there are sufficient references in the chapters to base it from, for example Chapter 12, page 8, lines 8 to 10 regarding application to industry sectors and energy production, or throughout chapter 3, 4 and the technical summary.</p>	Government of France, Ministère de la Transition écologique et solidaire
6644	29	24	29	28	<p>It might be worth adding here that a "reversal of global warming" might not undo damage from irreversible changes (or potential tipping points without any option to return to the former state) that has occurred before.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11588	29	24	29	28	<p>C.11.2 Agree that CDR can only contribute to the global climate goals if all but the most difficult to abate emissions are eliminated at source. However, in the real world, many activities will claim to be 'hard to abate'. It would help if this paragraph could indicate what is the plausible range of CDR contributions to 1.5°C and 2°C scenarios as a % of overall global mitigation or % of emissions that are captured.</p>	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12608	29	24	29	28	<p>Implications of CDR where with co-benefits, there may also be adverse effects that are yet to be fully understood gives it a sense of uncertainty. Therefore, to say that upscaling CDR might enable reversal of global warming is not with high confidence, and subsequently risky, and may affect the current push for other mitigation action. Suggest removal of the last sentence. (Reference 12.7 knowledge gaps, WGIII).</p>	Government of India, Ministry of Environment, Forests and Climate Change
15268	29	24	29	28	<p>Cite 10.5 since the statement mentions aviation.</p>	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2142	29	25	29	25	The representative areas that are difficult to reduce GHG emissions are the aviation and shipping sectors, and in the case of industrial processes, it is necessary to adjust the example parts because the GHG reduction effect is expected through the development of high-efficiency innovative technology and process conversion.	Government of Republic of Korea, Korea Meteorological Administration
5758	29	25	29	25	Please replace "difficult-to-abate" with something else, as the word "abate" is not used anywhere else in the SPM. On page 20 line 5 we find the phrase "CDR measures to counterbalance remaining emissions". I notice chapter 12 uses "hard-to-transition"(12.4 8-9). Please decide on one term and use it consistently throughout the AR6.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14066	29	25	29	25	Please consider to restock the list in the parentheses, so that "agriculture" comes before "aviation", since emissions from agricultural are even harder to reduce to zero.	Government of Norway, Norwegian Environment Agency
11590	29	26	29	27	The whole section jumps between net negative CO2 and net negative GHG emissions - it could be harmonised.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14068	29	26	29	28	Please consider to mention that a full reversal of global warming is no longer possible, even if the Paris Agreement is fully implemented (Example sea level rise).	Government of Norway, Norwegian Environment Agency
4124	29	27	29	27	Add "gradual" before "reversal of global warming". This would also make the text here more consistent with text in section C.2 that refers to gradual declines in global temperature with sustained net zero GHG emissions.	Government of Canada, Environment and Climate Change Canada
5760	29	27	29	27	CDR could only partially reverse global warming. The impacts on oceans are much more difficult to reverse than land temperatures, for example, and will have little effect if irreversible climate impacts are seen or tipping points passed. This is a key consideration for policymakers. Suggest making this point explicitly.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
1336	29	29	29	29	Blue forestry and preservation/restoration of coastal ecosystems and habitats could also be relevant and important to mention here.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
9550	29	29	29	29	We suggest changing the first sentence of C11.3 as follows: "Currently, improved or sustainable forest management, afforestation and reforestation, and soil carbon sequestration are widely deployed."  It is not appropriate to state that "only afforestation and reforestation are widely deployed" as CDR options, as relevant chapters suggest that improved forest management and soil carbon sequestration are also widely deployed.  cf Some of these methods (including afforestation and improved forest management, wetland restoration and SCS) have been practiced for decades to millennia, although not necessarily with the intention of removing carbon from the atmosphere. (Chapter 12-36, line 8-10) When considering implementation barriers, soil carbon management in croplands and grasslands is a low-cost option at a high level of technology readiness (it is already widely deployed globally) with low socio-cultural and institutional barriers, but with difficulty in monitoring and verification proving a barrier to implementation (Smith et al. 2020a). (Chapter 7-62, line 17-20)	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11592	29	29	29	29	"Currently, only afforestation and reforestation are widely deployed": It is unclear what the authors consider "deployment" in this context. Whilst it is true that afforestation/reforestation have been widely practiced in many regions, often for centuries, very little of that has ever been done with the purpose of mitigation. Even recent afforestation programmes and projects are typically motivated by other considerations. Perhaps more importantly, afforestation is just a fraction of the carbon dioxide removals accounted by countries as "mitigation" (e.g., under the Kyoto Protocol), or foreseen in their strategies. Accounted sinks are dominated by forest management. It is therefore unclear why "afforestation and reforestation" are named here, and why not forest management which is bigger both in terms of area and amount of carbon removed. If forest management is not considered part of CDR because it is part of AFOLU, then it would be important to explain the boundary, as "reforestation" is mentioned both under AFOLU and CDR. Or perhaps it is not considered to be "deployed" as it is seen more as a business-as-usual activity, but from a practitioner's perspective so would be afforestation and reforestation.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15270	29	29	29	29	After "deployed" add "for CDR".	Government of United States of America, U.S. Department of State
15272	29	29	29	29	"Widely deployed" though not explicitly as CDR. Need to be really careful about the difference between tree planting to prevent further carbon losses from forests vs. that which is explicitly removal.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
806	29	29	29	30	Carbon capture and storage with afforestation/reforestation is opposed to soil carbon sequestration in this sentence. It is perceived that only agricultural soils are capable for carbon sequestration, whereas afforestation/reforestation leads only to carbon sequestration in trees biomass. However, it is widely known that some forest soils, e.g., in boreal forests, are very efficient in carbon storage. The statement should be corrected.	Government of Russian Federation, Institute of Global Climate and Ecology
6646	29	29	29	33	Both risks of reversal and biodiversity impacts of all listed measures here (afforestation/reforestation and BECCS/DACCS/ocean alkalinisation) need to be mentioned here for a more balanced description of CDR options. We suggest to rephrase as follows: "Currently, only afforestation and reforestation are widely deployed. Carbon stored by these methods, or by soil carbon sequestration, can be reversed by human or natural disturbances, but can enhance biodiversity if deployed in the right manner." It would also be interesting for policy makers to be informed about the impacts of climate change on forests in this context.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
730	29	29	29	36	The confidence level is not consistent with the underlying report. No "high confidence" is found in Section 3.4 of Chapter 3, Section 7.4 of Chapter 7 or Section 12.3 of Chapter 12 of the underlying report, while "medium evidence, high agreement" is given to lines 40-43, page 55 of Chapter 12. The authors are requested to check and ensure the confidence level is consistent with that in the underlying report.	Government of China, China Meteorological Administration
2384	29	29	29	36	The representation of vulnerability/ permanence of land-based mitigation (mentioned in C.11.3 only, which notes these can be reversed) in the SPM appears inconsistent with the underlying assessment. C.9 also says climate change can be a barrier to implementation – which seems like an oblique way to reference the risks to permanence of increased fires drought etc. The underlying Chapter 7 of WGIII makes more of this – 23 mentions of "permanence", 30 mentions of climate change. Suggest that the SPM better reflect the weight given this issue in the underlying report.	Government of Australia, Department of Industry, Science, Energy and Resources
3440	29	29	29	36	The sentence is ambiguous. It assumes that knowledge is sufficient to state that some CDR are effective, and that adverse side-effect are just « potential », while these side-effects are already well documented, including in the chapters and in special reports. In addition, some CDR methods are well understood but badly assessed at this stage. Possible alternative is to mention the upscaling the deployment of CDR methods "that are proven to be effective and to have limited side-effects", while addressing the benefits and side-effects "of unconstrained methods", requires (...). An order of magnitude of the scale, the development delays and the uncertainty should be given to inform policy makers on the actual roles of these techniques in scenarios. In this paragraph it would be interesting to highlight the risks linked to the deployment of CDR technologies. In particular, relying too much on CDR can jeopardize the achievement of ambitious climate targets, if technologies are not ready in time or are not accepted due for example to their impacts on the environment. This relates to a more general comment throughout the SPM on an imbalance in the treatment of scenarios compatible with 1,5°C regarding the priority and benefits of a reduction in emissions compared to a massive use of CDR – this is the case for example in section C.3. The role of CDR in scenarios in particular in terms of timing of deployment relative to the timing of emission reductions is not explored enough. This has critical implications with relation to overshoot and related impacts : in terms of adaptation, depending on the delay of emissions reductions and thus on the extent of the overshoot, the capacity of natural carbon sinks to adapt to climate change impacts may be constrained and this will have an impact in turn on their capacity to act as a carbon sink – this is in addition to the other constraints already explored in WG1 regarding their reduced marginal storage capacity in higher emissions scenarios. The role of CDR in scenarios, in addition to the above mentioned constraints, are also explored in chapters and previous reports in terms of moral bias, an overemphasis on early implementation of CDR being likely to delay emissions reduction which are critical to avoid being on a high-overshoot track (which would in turn pose new constraints as detailed above). These policy-relevant details are essential to inform the upcoming global stocktake, in particular on the credibility of net zero strategies from a science perspective.	Government of France, Ministère de la Transition écologique et solidaire
4126	29	29	29	36	While using the term 'reversal of global warming' to refer to a decline in global temperature makes sense, but using 'reversal' to refer to the release of previously stored carbon is less intuitive. The storage of carbon could be reversed, but the carbon itself is released. Suggest avoiding using 'reversal' when discussing the durability of carbon stored in different reservoirs. Alternative phrasing should be easy to find. For example, on line 30, the text could say "...can be re-emitted by human intervention", and on lines 32-33 the text could say "... is more durable".	Government of Canada, Environment and Climate Change Canada
4128	29	29	29	36	Consider the societal acceptability of these solutions. This is presented as a technical problem where there are a wider range of societal concerns and implications for SDGs that should be addressed more clearly.	Government of Canada, Environment and Climate Change Canada

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5762	29	29	29	36	Agreed methods for measurement, reporting and verification of carbon flows' - do these agreed methods exist yet (e.g. in the IPCC accounting guidelines)? If not, suggest it's worth saying that this is still to be agreed - more accurately characterising the challenge ahead. Also, is it still the case that CDR is represented in IAMS as predominantly/all BECCS? If so, should this be stated and that if non-BECCS delivered the necessary CDR, the electricity generation gap created by removing BECCS would need to be filled by other forms of power generation capacity, some of which may not be low-carbon? There's also a time-lag between planting trees and actual net carbon sequestration, which isn't really picked up in the text at all.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13694	29	29	29	36	Suggest ways to prevent reversal of afforestation and reforestation are outlined here. For example, in New Zealand policies we have implemented include legislation protecting indigenous forests and requiring sustainable forest management, and including forests in our ETS [in our ETS participants are rewarded for forest carbon storage and those who deforest face a large unit surrender liability, participants are also rewarded if they quickly replant forests after unavaoidable natural events such as fire]	Government of New Zealand, Ministry%20for%20the%20Environment
	29	29	29	36	the words "natural loss" is misleading as human-induced climate change can also affect the efficacy of storage (eg soil carbon, tree mortality, fire, forest dieback etc).	WGI Bureau,
3020	29	30	29	30	Do you mean "or by other soil carbon sequestration methods"?	Government of France, Ministère de la Transition écologique et solidaire
3022	29	30	29	30	We suggest to add "and by the impact of climate change as well" such as (AR6 WGI)= impact of fire, carbon cycle feedbacks, etc...after "human intervention"	Government of France, Ministère de la Transition écologique et solidaire
6648	29	30	29	31	The authors could add a short, but important message: "The uptake is slow, but unwanted release could be fast." with the meaning of „Grows slowly, but burns quickly."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6650	29	30	29	31	The reversal of stored carbon can be reversed by human intervention not only at the project level, but also beyond that. Therefore, please modify the end of the sentence as follows: "[...] can be reversed by human intervention, and a fraction is vulnerable to natural loss."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12620	29	31	29		At the end of the sentence ending with "...natural loss" add the following: " However, afforestation and reforestation have serious implications for gender equity, and the vulnerability and adaptive capacity of most vulnerable sections and indigenous peoples. Further, mitigation focus can lead to large scale destruction of biodiversity and natural habitats as a result of carbon-market mechanisms, which will inevitably encompass such activities".	Government of India, Ministry of Environment, Forests and Climate Change
1338	29	31	29	31	Could the "fraction" be characterised in more substantial terms? How large is this fraction?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2386	29	31	29	31	Suggest including an indication of the estimate of what fraction of carbon stored by afforestation and soil carbon is vulnerable to natural loss.	Government of Australia, Department of Industry, Science, Energy and Resources
2100	29	31	29	33	(Basis) It is generally agreed that DACCS has little impact on ecosystems. Thus, it is inappropriate to state the adverse environmental impacts with the current subject of the sentence being "Removal of CO2 through ... DACCS ...". To avoid overgeneralization, it would be better to split the sentence into two, each showing positive and negative characteristics respectively with an appropriate subject. •(Present) "Removal of CO2 through BECCS, DACCS, ocean alkalisation and other methods that store carbon in geological and ocean reservoirs is less vulnerable to reversal, but impacts on ecosystems and biodiversity are not well understood." •(Change) "Removal of CO2 through BECCS, DACCS, ocean alkalisation and other methods that store carbon in geological and ocean reservoirs is less vulnerable to reversal. But impacts from some technological CDR methods on ecosystems and biodiversity are not well understood."	Government of Republic of Korea, Korea Meteorological Administration
2102	29	31	29	33	While DACCS has little impact on ecosystems, ocean fertilisation may negatively affect ocean diversity and BECCS may also have impacts on biodiversity. Thus, it would be better to mention ocean fertilisation and BECCS in explaining the environmental impacts •(Present) "... but impacts on ecosystems and biodiversity are not well understood." •(Change) A possible revision for the environmental impacts would be: "... but impacts on ecosystems and biodiversity are not well understood, especially from ocean fertilisation and BECCS."	Government of Republic of Korea, Korea Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2388	29	31	29	33	This statement suggests that only these CDR methods (BECCS, DACCS, alkalisation etc) can impact ecosystems and biodiversity. However, large-scale afforestation and other similar CDR approaches may also have impacts on ecosystems and biodiversity, and these impacts are still not completely understood. Section D.2 notes that "...land and aquatic ecosystems can be adversely effected by mitigation action". Suggest rewording the section to communicate that impacts are not completely understood for many methods of CDR, not only BECCS, DACCS and alkalisation.	Government of Australia, Department of Industry, Science, Energy and Resources
2456	29	31	29	33	It is unclear if risks are associated with direct or indirect impacts from the technologies or parts of them. BECCS, DACCS and ocean alkalisation are banded together although potential direct and indirect impacts on ecosystems and biodiversity are different. Also they may differ for the different steps in CCS technologies (capture-transport-storage). The last part of the statement does not capture this complexity.	Government of Denmark, Danish Meteorological Institute
3024	29	31	29	33	In C.11.3, after "impacts on ecosystems and biodiversity are not well understood" should be replaced by "impacts on ecosystems and biodiversity are not yet fully understood and/or well assessed." This replacement is extremely important, as the statement in C.11.3 that "impacts on ecosystems and biodiversity are not well understood" is incorrect, especially as it relates to the impact of BECCS, and does not reflect well the literature on the negative impacts of BECCS, that is documented across the AR6 WGIII, namely in Sections 3.7.6.2 (p. 3-108), Section 7.4.4 (p. 7-81), and 12.5.3 (p. 99-100).  The current statement "are not well understood" misleadingly minimizes to the reader the impacts of BECCS for example on biodiversity, when the various sections listed above all state that large-scale BECCS can have major deleterious impacts on biodiversity.	Government of France, Ministère de la Transition écologique et solidaire
3026	29	31	29	33	High confidence may not apply similarly on both geological and ocean reservoirs. Reversibility may be not so well assessed in the latter, as noted in the second part of the sentence, « impacts on ecosystems are not well understood». Could this statement be made more specific by either separating geological and ocean reservoirs or referring to WGI or WGII conclusions?	Government of France, Ministère de la Transition écologique et solidaire
5764	29	31	29	33	It doesn't make sense to say the impacts on ecosystems and biodiversity are not well understood for "BECCS, DACCS, ocean alkalisation and other methods that store carbon in geological and ocean reservoirs" These CDRs are so very different from each other that they need to be discussed separately. Suggest instead "CO2 removal and geological storage (by BECCS, DACCS) is less vulnerable to reversal, and more amenable to monitoring, reporting and verification, than other methods. CO2 capture and storage in soils or the oceans are not only more vulnerable to reversal and more difficult to measure, but their impacts on ecosystems and biodiversity are not well understood."	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
14070	29	31	29	33	The sentence starting with removal of CO2 lists very different methods. DACCS is listed up among other CDR techniques and it is stated that the effect on ecosystem and biodiversity is not well understood. Please provide examples of possible positive and negative impacts of the different methods. Further, we believe that the impacts of DACCS are fairly well understood. Please consider to rephrase the sentence in order to pay justice to the effects of DACCS.	Government of Norway, Norwegian Environment Agency
15274	29	31	29	33	This should be broken into two separate ideas. Recommended revision: "Removal of CO2 through BECCS, DACCS, ocean alkalisation and other methods that store carbon in geological and ocean reservoirs is less vulnerable to reversal (high confidence). The impacts on ecosystems and biodiversity will be highly variable depending on the approach and site specific considerations and, for some of these approaches, are not well understood."	Government of United States of America, U.S. Department of State
15276	29	31	29	33	Permanence is one point and the need to study the environmental risks is a separate point. Regarding the second point, the potential impacts and level of risk of these technologies is highly variable depending upon the approach and site-specific considerations and are also impacted by the level of regulatory oversight. There is a significant body of research on the risks and potential impacts of geologic storage, for example.	Government of United States of America, U.S. Department of State
1128	29	31	29	34	The word "cases" would be better than circumstance - the latter is potentially hypothetical only, the former implies existence of such cases.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6162	29	31	29	36	We suggest to add here (or as a footnote) that the captured CO2 by CDR methods such as CCUS/DACCS will have to be transported to an use or storage site. The CO2 transport infrastructures are also very important and must be considered.	Government of Belgium, Belgian Science Policy Office - Belspo

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11594	29	31	29	36	Removal of CO2 through ...ocean alkalisation and other methods that store carbon in geological and ocean reservoirs is less vulnerable to reversal (high confidence). Can this be stated with such confidence? There is scarce scientific evidence of AOA being less vulnerable to reversal, and no track record comparable to afforestation. Geological options also carry with them the leakage risk among other negative aspects.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
3028	29	33	29	33	We suggest to add "and have to be taken into account before acting" after "not well understood"	Government of France, Ministère de la Transition écologique et solidaire
3030	29	33	29	33	To be consistent with figure SPM9 page 33, the potential impacts on other aspects (as on SDG2 and food security of large scale BECCS) should be mentioned. SPM9 says CCS has trade offs with SDG6 so some impacts on ecosystem and biodiversity seem to be understood, this sentence could maybe better reflect it.	Government of France, Ministère de la Transition écologique et solidaire
11596	29	33	29	33	Add after "not well understood" "and can be harmful". There are many references to the negative impacts of AOA, including in IPCC reports, IPBES, GESAMP, WOA, etc. and many scientific papers!	Philippe Tulkens, European Union (EU) - DG Research & Innovation
6652	29	33	29	36	CDR is an element for "counterbalancing residual emissions" (see ch. 12.3, p. 35, l. 27) and "cannot serve as a substitute for deep emissions reductions" (see ch. 12.3, p. 38, ll. 2-3). Therefore, CDR must be given lower priority than mitigation and should also be framed in this way (among other things, because almost none of these mentioned CDR measures is ready to be implemented without further research, see ch. 12.3, p. 36, ll. 10-13). We suggest to rephrase as follows: "[...] understood. Due to uncertainties, research gaps and potential adverse side-effects of CDR methods, ambitious emission reduction in all sectors remains crucial to minimize the need for negative emissions. Further research, development and agreed methods and regulation are needed before the deployment of CDR can be upscaled."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6654	29	33	29	36	Mentioning the unclarity around the impacts on ecosystems and biodiversity for approaches like BECCS in C.11.3 is important. Chapter 7 states a "risk for negative outcomes for GHG emissions, biodiversity, food security and a range of other sustainability criteria", which could be referenced or reflected in the SPM as well (chapter 7, p. 81, line 1ff). Consequently, it would also be relevant to point out to the need for safeguards and reflect on limits of sustainable potentials in the last sentence, where upscaling requirements are presented without clear guidance on how to prevent negative side-effects (beyond the need for research, and MRV for carbon cycles) (see chapter 7, p.77f).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6656	29	33	29	36	Please consider mentioning "governance framework and regulations as well as stakeholders' participation" as assessed in chapter 12 to the requirements for upscaling, e.g. because the private sector involvement and the potentially large-scale needed.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15278	29	33	29	36	Suggest adding "and appropriate" to read: "Upscaling the deployment of CDR methods that are effective and appropriate ..."	Government of United States of America, U.S. Department of State
11598	29	34	29	34	Please remove 'potential'.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
6658	29	35	29	35	Here, accelerated research is mentioned. What type of research is meant here? Please consider some additions to further clarify, such as "accelerated evidence-based research with development of model regions and demonstrations are required preliminary."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12430	29	35	29	35	"accelerated research" not vry clear what is meant . Why not "requires more research"	Government of United Republic of Tanzania, Tanzania Meteorological Authority (TMA)
1340	29	35	29	36	Risk assessment would seem to be a relevant addition to make to the list of requirements here, if supported by the assessed literature. (Such as appropriate risk assessment practices/methods/...)	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
1130	29	40	29	43	if not appropriately managed. This needs to be balanced against estimates of the cost of excessive climate change.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
732	30	1	30	1	It is suggested to explain the meaning of cost price USD100 tCO2-eq-1.	Government of China, China Meteorological Administration
818	30	1	30	1	Clarify, please, of which year USD is. E.g. UDS 2019 = in USD prices of 2019	Government of Russian Federation, Institute of Global Climate and Ecology

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6660	30	1	30	1	Note that carbon sequestration in agriculture need more biomass production with possible adverse effects (i.e. nutrient leaching).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
1132	30	1	30	2	Since CO <sub>2</sub> eq using GWP100 is not a robust indicator of climate impact, it would be useful to discuss what this cost threshold means for the different gases (separately) and the contribution to warming (or avoided warming) it would represent. For example, a 1Gt CO <sub>2</sub> eq emission reduction in CO <sub>2</sub> does not have the same impact on climate as a 1Gt CO <sub>2</sub> eq reduction in methane emissions (using GWP100). Indeed, a reduction a CO <sub>2</sub> source which is also a source of aerosol emissions would indirectly lead to warming.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
15280	30	1	30	2	C.12 neither tracks directly to any sentence in 3.6, 3.8, or 12.2, nor appear in the Executive Summaries for either Chapters 3 or 12. Figure SPM.8 does not provide any kind of total estimate of mitigation potentials available for less than \$100. The reader must do a substantial amount of work to piece together the basis for this finding.	Government of United States of America, U.S. Department of State
398	30	1	30	28	The text in Chapter 3, L28-29, Pg. 12, states, "An emission pathway is a modelled trajectory of anthropogenic emissions (Rogelj et al. 2018a) and, therefore, a part of a scenario." This text should be reflected in the SPM, since it provides clarity that an emission pathway are part of a scenario. Include this statement in the SPM.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
6664	30	1	30	28	<u>MITIGATION COSTS</u> : Section C.12 and its subparagraphs do not adequately summarize the findings of the underlying report regarding the costs of mitigation options compared to the co-benefits of such action, in addition to the direct effects of avoided climate change damages. The current text seems unbalanced and lacks highly policy-relevant information from the underlying chapters, also partly summarized in TS-48-4 to TS-48-38: - Despite the lack of quantitative information on avoided climate change damages, please clarify if mitigation action limiting warming to 1.5°C or 2°C provides advantages in comparison to the potential damages that could result from increasing climate change (shown in WGII, in particular when considering non-material losses). - Please add information on mitigation (co-)benefits for 1.5°C versus 2°C pathways when writing about their mitigation costs in paragraph 12.2. - In addition to the direct cost perspective, please include more information regarding mitigation co-benefits in terms of both indirect cost reductions and immaterial advantages. This includes co-benefits of air quality control, diet shifts, and reduction of food overconsumption on human health leading to significant savings in the health systems, improving human well-being and reducing competition of land. - Please mention social effects, including on employment rates and energy access.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6976	30	1	30	28	This is a very interesting section that could potentially strongly impact policymakers' economic considerations with regards to mitigation and must therefore be carefully worded and framed. That said, the fact that only 2°C is mentioned is highly problematic and the same assessments must be added for 1.5°C. The same robust assessment may not be available for 1.5°C but this would then have to be clearly stated. Even assessments with limited evidence are better than none, as policymakers are expecting 1.5-related assessments from this SPM. We understand that assessments would be available for the whole of society in terms of GDP as well as for individual sectors or parts of the economy such as jobs. Any and all of this should be added from the underlying chapters to the SPM, with quantitative findings where available. This is particular relates to 12.3, which we would propose should be completely reworked in this regard.	Government of Jamaica, Meteorological Service Division



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9552	30	1	30	28	Argument that mitigation (under 2degree) benefit is higher than mitigation cost is somewhat misleading and need to explain with care. Mitigation cost is "real" and need prior to its influence on climate, which is hypothetical with various uncertainties. Mitigating emissions with massive cost may bring smaller impact on climate than expected, and it will become evident long (years and decades) after spending such money. Even though the potential (hypothetical) benefit of limiting temperature increase by 2 or 1.5 degrees is expected to be massive, it cannot have the same value to compare the "real and immediate" upfront cost of mitigation, which may reduce emissions but not certain to bring what impact on climate stabilization and when. In this context, "unless future costs are discounted at rates in the higher end of the range usually considered" (line23-24) is very misleading. The future climate impact of mitigation is one of the most uncertain scientific issue and the discount rate for the value calculation for this matter should be much higher than "the range usually considered". The last paragraph (line 27-28) "taking account of other sustainable development dimensions and non-market damages from climate changes enhances the imputed benefits of mitigation action" is a subjective description. If mentions other sustainable development dimensions and non-market damages from climate changes, "other sustainable development dimensions and non-market damages from mitigation actions" should also be considers and mentioned.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9916	30	1	30	28	(C12): Difficult to read and assess, unnecessary complex and sometimes confusing formulation of costs of mitigation, cost concepts and boundaries, etc. Suggest to revisit and thoroughly rewrite.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12020	30	1	30	28	C.12: Much more information is needed on benefits for reduced impacts and damages of limiting warming, as well as overall benefits of low-carbon transitions. These additions could then replace the more descriptive statements of section C.12, e.g. bullet C.12.3 in order not to make the section longer. Overall, section C.12 could be strengthened with findings from e.g. section 6.7.7: "The near-term, economic outcomes of low-carbon energy system transitions in some sectors and regions may be on par with or superior to those of an emissions-intensive future (high confidence)."; and "Phasing out fossil fuels in favour of low-carbon sources, is likely to have considerable SDG benefits, particularly if tradeoffs such as unemployment to fossil fuel workers are minimized (high confidence)". The SPM should make sure to provide some concrete numbers to illustrate the benefits for individual areas of the economy or different sectors, e.g. from Chapter 6.7.7, p.126, "fossil fuels are estimated to generate only 2.65 jobs per USD 1M as compared to projected 7.49 from renewables". Information must be added for different warming levels including for warming at 1.5°C (and not just 2°C as is currently the case in the headline statement). Even if quantification may be difficult, some estimates and values for comparison need to be added. The dedicated cross-WG box should be added to the line of sight. Unfortunately, the cross-WG box on Economic benefits of avoided impacts in Chapter 3 as well as Box TS.7 remain much too descriptive and general. They should contain much more quantitative information, despite the caveat of large uncertainties. The figure in the cross-WG box seems to be missing (p.93 in Chapter 3) but from the figure caption it sounds like it could provide the necessary numbers for GDP loss at different warming levels or different pathways. Please add these statements to the SPM, and also consider elevating this figure (or a simplified version of the WGII CWGB ECONOMIC figure in WGII Chapter 16 p.114) at least to the TS level.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13576	30	1	30	28	The (economic) (co-)benefits of limiting warming and pursuing mitigation action are covered insufficiently in this SPM and particularly in C.12 and C.12.3. First, this information must not only be presented only for 2°C but also for 1.5°C, even if there may be less robust evidence available (which should then also be stated transparently). Second, there is not enough quantitative information presented, which is however available in the chapters, e.g. in chapter 6 with regards to energy or chapter 3 with regards to health. Lastly, we very much welcome the Cross-WG box on the subject mentioned in the Introduction section but it unfortunately lacks the quantitative statements one would expect, even if those were associated with large uncertainties. Kindly revise C.12 and particularly C.12.3 to include quantitative statements, including on 1.5°C, and particularly with regards to health sector-related cost benefits.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
15282	30	1	30	28	This text does not speak to distributional equity at all in how the various scenarios will be experienced. It would benefit from something on distribution equity – perhaps both geographically and by income if that is available in the underlying text. That also may help with linking to the discussion in Section D.	Government of United States of America, U.S. Department of State
734	30	1	30	29	It is suggested to elaborate on economic costs of Path C1-C8 to give decision makers a clear concept for costs of different mitigation options.	Government of China, China Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
392	30	1	30	7	C.12: The headline statement discusses the impact of mitigation pathways on global GDP. It specifically states that it is expected to be " a few percentage points lower in 2050 than it otherwise would have been in pathways likely to limit warming to 2°C or to limit warming to 1.5°C with no or limited overshoot". This does not mean equal impact on the economies of countries or regions. This will affect in return the sustainable development goals of these countries and regions and would increase the gap between the world economies and development status. The impact on equity needs to be clarified in the headline statement.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1342	30	1	30	7	It would be useful and balancing to give a percentage indication also for how the global GDP would be in 2050 when limiting the warming to 2oC. The present wording on lines 6-7 indicates that the global GDP would be larger when the benefits are considered.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6164	30	1	30	7	Mitigation costs may depend on regions. Could you clarify that these are average mitigation costs and that actual costs depend on regions?	Government of Belgium, Belgian Science Policy Office - Belspo
6662	30	1	30	7	In C.12, it would be helpful for the reader to directly reference and hint to possible trade-offs with biodiversity protection and food production in the AFOLU sector, which is included here and in Fig. SPM 8 without further specifications (e.g. by establishing a link to chapter 9.1 of the SPM). It should be comprehensible for the reader, that looking merely at the costs is not sufficient to reflect the complexity of these options.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12622	30	1	30	7	Which of these statements in C 12 are model dependant and the assumptions involved should be clarified? It should also be clarified whether these least cost options show lower cost due to immediate and substantial mitigation by developing countries.	Government of India, Ministry of Environment, Forests and Climate Change
13670	30	1	30	7	The headline statement would be "punchier" if it started with the last sentence.	Government of New Zealand, Ministry%20for%20the%20Environment
738	30	1	31	15	Prices and values change over time, and calculation of the related economic loss has a large range of uncertainty. So, it is suggested to give the corresponding description.	Government of China, China Meteorological Administration
13358	30	1	31	15	SPM8. One or two reading examples (for example for wind energy as well as Bioelectricity, having both very different reduction potential and costs) would be helpful	Government of Switzerland, Federal Office for the Environment FOEN
3032	30	2	30	3	Please specify if this affirmation take into account climate change impacts or not.	Government of France, Ministère de la Transition écologique et solidaire
15284	30	2	30	3	Put this sentence into the conditional tense, not present tense. These are scenarios.	Government of United States of America, U.S. Department of State
1134	30	2	30	5	Very important potential confusion: suggest you move "in pathways...overshoot" to the beginning of the sentence.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6666	30	2	30	5	For clarity, please consider rephrasing/re-structuring this sentence in order to make the references within the sentence clearer / avoid misunderstanding: "In pathways likely to limit warming to 2°C or to limit warming to 1.5°C with no or limited overshoot, global GDP continues to grow but, without accounting for the economic benefits of mitigation action, is a few percentage points lower in 2050 than it would have been without that mitigation action."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9822	30	2	30	5	The second sentence of C.12 can better be reformulated: "In mitigation pathways likely to limit warming to 2 degrees or to 1,5 degrees with no or limited overshoot GDP continues to grow, but is a few percentage points lower in 2050 than it otherwise would have been, without accounting for the economic benefits of mitigation action."	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11600	30	2	30	5	unclear. The wording for the similar idea in C,12,2 is much better	Philippe Tulkens, European Union (EU) - DG Research & Innovation
384	30	2	30	7	In C.12, the text states, "Global GDP continues to grow but, without accounting for the economic benefits of mitigation action, is a few percentage points lower in 2050 than it otherwise would have been in pathways likely to limit warming to 2°C or to limit warming to 1.5°C with no or limited overshoot. The global economic benefits of likely limiting warming to 2°C exceed the mitigation costs under most assumptions (medium confidence). (Figure 7 SPM.8)" C.12 should not be included in the SPM, since it is recommending a specific policy and not within the objective mandate of the IPCC. Similarly, the "global economic benefit" is not in the mandate of WG3 and should be in WG2. C.12 and its supporting statements (C.12.1, C.12.2, C.12.3) do not align with the IPCC mandate and objectives.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5766	30	2	### ### #	6	We appreciate the authors' efforts to summarise a complex evidence base in the underlying chapters into a few paragraphs but feel that some of the critical nuance in the underlying analysis has been lost. As a result, the text as currently written is unbalanced and as a result is misleading, as it is from models with a "no climate impacts" baseline which suggests this is a possible choice - it's not. The text needs to be clearer on this. Secondly, these costs largely do not include current wind, solar and battery cost falls, or potential for these to be seen in other sectors either. The text is largely drawing on the economic literature to make this statement, but the reader doesn't get the message that (i) the economic literature can only quantify a limited range of impacts, (ii) as more impacts are added and modelling issues dealt with, costs have tended to go higher and (iii) a fuller reading of physical impacts makes scale of unquantified impacts and risks clear - all of this is critical to this point. Maybe the full version of this is for the synthesis report, but it needs addressing here too. The final sentence of the paragraph should be the focus, and the text should overall give a clear and balanced picture to policymakers.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9918	30	3	30	3	(C12): Unclear what "without accounting for benefits of mitigation" encompasses, language is different from the C12 detail statements.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
15286	30	3	30	3	How is "mitigation" defined? As any mitigation action, or as mitigation actions beyond what are already planned? The phrasing "without mitigation" needs to be defined as well (lines 16-17).	Government of United States of America, U.S. Department of State
378	30	3	30	4	C.12: Required action: rewrite "is a few percentage points lower in 2050 than it otherwise would have been in pathways" to clarify that is a prediction/projection.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
380	30	5	30	6	C.12: The statement "The global economic benefits of likely limiting warming to 2°C exceed the mitigation costs under most assumptions (medium confidence)" discusses climate impact/benefit. Required action: delete or rewrite without discussion of climate impact/benefit, which is within the mandate of WGII not WGIII.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
382	30	5	30	6	C.12: The statement "The global economic benefits of likely limiting warming to 2°C exceed the mitigation costs under most assumptions (medium confidence)" lacks accuracy and is based on assumptions: quantifying assumptions and assuming equal or variable weights does not provide accurate finding. Required action: remove; because of lack of accuracy caused by using 'most assumptions'.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
4130	30	5	30	7	We would like to see a similar statement (to that about limiting global warming to 2C) about the relative global economic benefits vs costs of limiting global warming to 1.5C, assuming there is literature on this topic assessed in the main report. Supporting evidence could then be brought into para C.12.3.	Government of Canada, Environment and Climate Change Canada
2390	30	8	30	10	Suggest prices should be in CO2-equivalent, not CO2, for consistency with the rest of the SPM	Government of Australia, Department of Industry, Science, Energy and Resources
11602	30	8	30	10	C.12.1 These lines repeat lines 1&2 of the C.12 headline statement. The SPM only needs to say it once.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
370	30	8	30	11	C.12.1 Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
736	30	8	30	13	It is inconsistent with the underlying report, the text from which (lines 36-41, page 24, Chapter 12) reads "The overview of the mitigation potential is based on a variety of approaches, relying on a large number of sources, and the number of sources varied strongly from sector to sector. The main conclusions from this section are: i) there is a variety of options per sector, ii) per sector the options combined show significant mitigation potential, iii) there are a few major options and a lot of smaller ones, and iv) more than half of the potential comes at costs below 20USD tCO2-eq-1 (between sectors: medium to robust evidence, high agreement)." The authors are requested to verify and reflect the essential findings in the underlying report.	Government of China, China Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12358	30	8	30	13	Most low-cost emission reduction solutions are for least developed or developing countries. Helping these countries implement low-cost mitigation options, is the cheapest and fastest way to reduce global greenhouse gas emissions.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
15290	30	8	30	13	Per Figure SPM.8, fuel switching appears to make up a larger share of emissions reduction potential than energy efficiency ("energy efficiency" is only listed as a strategy under the "Industry" heading; if the reference to energy efficiency in the last sentence of C.12.1 is meant to encompass other rows as well, that is not made clear to the reader). In fact, several strategies not called out in C.12.1 appear to have comparable or greater potential at less than \$100 than energy efficiency. Yet energy efficiency is called out in C.12.1 and these strategies are not. This shows a lack of balance and a potential bias towards energy efficiency as a mitigation strategy. Recommend either deleting energy efficiency from the last sentence of C.12.1 or expanding the list of strategies to also include all others with greater potential than energy efficiency.	Government of United States of America, U.S. Department of State
32	30	8	30	8	The "eq" is missing.	Government of Czech Republic, Czech Hydrometeorological Institute
820	30	8	30	8	Clarify, please, of which year USD is. E.g. UDS 2019 = in USD prices of 2019	Government of Russian Federation, Institute of Global Climate and Ecology
3034	30	8	30	8	Economic mitigation potential up to USD100 tCO <sub>2</sub> -eq-1 is estimated to be greatest in tropical countries because of the large potential from reducing deforestation and sequestering carbon in forests and agriculture (7.4.1.3, Figure 7.11)	Government of France, Ministère de la Transition écologique et solidaire
6166	30	8	30	8	The costs seem to be provided in USD/tCO <sub>2</sub> -eq (such as in Figure SPM.8) but in the text (e.g. line 8), it is only indicated "tCO <sub>2</sub> " without the "-equivalent". Here and in any place in the document, attention must be paid to the use of "CO <sub>2</sub> " and "CO <sub>2</sub> -eq".	Government of Belgium, Belgian Science Policy Office - Belspo
15288	30	8	30	8	The first sentence is entirely dependent on Figure SPM.8 for justification, as Section 12.2 of the report does not lay out anywhere the total amount of reduction available for less than \$100 relative to 2019 levels. Unfortunately, Figure SPM.8 also does not clearly provide this estimate. The reader is asked to visually total amounts from dozens of rows to reach the conclusion that the total quantity of Gt CO <sub>2</sub> -eq mitigation available for less than \$100 is equal to a number that is more than half of 2019 emission levels. This is asking too much of the reader in a document like the SPM, where conclusions need to be quickly verifiable. Recommend revising Figure SPM.8 to rectify this.	Government of United States of America, U.S. Department of State
386	30	9	30	10	In the following statement in C12.1 "Taking into account interactions between response options, these mitigation options would reduce GHG emissions by 2030 to about 50% of the 2019 level or lower. " Rewrite: it is based on a projection, the term "is projected to" must be added.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
9554	30	9	30	10	It seems that the GHG emission mitigation potentials by 2030 is calculated based on each sectoral assessment, as stated in Chapter 12 Executive Summary (page 12-4, lines 2-4) and 12.2.2 Costs and potentials of options for 2030 section. It would be better to clarify how to calculate these mitigation potentials by "taking into account interactions between response options".	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
822	30	10	30	10	Clarify, please, of which year USD is. E.g. UDS 2019 = in USD prices of 2019	Government of Russian Federation, Institute of Global Climate and Ecology
11604	30	11	30	11	"market benefits of some options exceed costs". You mean that in some cases zero carbon energy sources are the most competitive?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11606	30	11	30	11	"The market benefits of some options exceed their costs.": Is it a reference to "no-regret measures"? Or do "market benefits" include carbon markets?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
388	30	11	30	13	In the following statement in C12.1 "The market benefits of some options exceed their costs. Solar and wind energy, energy efficiency improvements, reduced deforestation, soil carbon sequestration and CH <sub>4</sub> emissions reductions make large contributions to this potential". As there is a range of confidence levels from medium to high, the statement must be rewritten as to indicate the confidence level of each.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
390	30	11	30	13	In the following statement in C.12.1 "The market benefits of some options exceed their costs. Solar and wind energy, energy efficiency improvements, reduced deforestation, soil carbon sequestration and CH4 emissions reductions make large contributions to this potential". The basis of the assessment of costs of different options should be clarified, e.g., life-cycle vs bottom-up leveled costs	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
9556	30	11	30	13	The word "this potential" at the end of C.12.1 is vague as no word of "potential" appears from the beginning of C.12 to the end of C.12.1. To ensure consistency with the expression in Figure SPM.8, we suggest using "mitigation potential" instead of it.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
6668	30	12	30	12	It seems that N2O should be inserted in "reduced deforestation, soil carbon sequestration and N2O and CH4 emissions reductions make large contributions to this potential".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11608	30	12	30	12	reduced deforestation, soil carbon sequestration' - Do these refer to natural climate solutions? If so, how about the marine and ocean based ones?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
3036	30	12	30	13	We suggest to be more precise regarding "CH4 emissions reductions" by which mitigation action and through which sector?	Government of France, Ministère de la Transition écologique et solidaire
3040	30	14	30	14	It should be better highlighted that not accounting for economic benefits of avoided climate change (i.e. not taking into account potential damages from high level of warming) is actually a major flaw in these estimates. (cf physical impacts projected in WGI and WGII such as tropical regions no longer habitable).	Government of France, Ministère de la Transition écologique et solidaire
6670	30	14	30	15	Please specify if "co-benefits or adverse side-effects" are related to mitigation (action) - and not to avoided climate change impacts - by correspondingly adding "co-benefits or adverse side-effects of mitigation / action". Furthermore, as not only economic benefits but also costs are associated with mitigation co-benefits and adverse side-effects, please clarify if (mitigation) "co-benefits or adverse side-effects" refer to both.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6672	30	14	30	16	The first sentence in C.12.2 gives very condensed information about global GDP in scenarios with or without mitigation. The last part of the sentence 'a reduction in annual growth of 0.04–0.09%' remains unclear. Maybe it could be put in parenthesis like in the following sentence.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9920	30	14	30	16	(C.12.2): Confusing and even misleading sentence that suggests GDP is growing thanks to "limiting pathways", but is still lower than without mitigation action. In fact the underlying economic projections assume GDP growth regardless of climate change, due to other factors such as effective labour force and productivity growth. Suggest to replace this part of the sentence as follows: "...global GDP in pathways likely to limit warming to 2°C is reduced relative to a situation without mitigation by 1.3–2.7% in 2050, a reduction in annual growth of 0.04–0.09%."	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12692	30	14	30	16	Without accounting for economic benefits of avoided climate impacts....." sounds like an unreasonable scenario. If changes to the GDP are being reported, it should be inclusive of all things impacting the GDP.	Government of India, Ministry of Environment, Forests and Climate Change
6168	30	14	30	18	The total abatement costs have decreased dramatically since SR15. This is worth mentioning and it would be interesting to explain why.	Government of Belgium, Belgian Science Policy Office - Belspo
9558	30	14	30	18	The statement here can be assumed to be the results in the case of global cost minimization (equal marginal abatement costs) scenario in principle. It would be better to mention that.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
15292	30	14	30	18	The first two sentences of C.12.2 appear to correspond to scenario results presented in Figure 3.34. However, the language used to describe these findings on page 3-87 is very different than what is used here in C.12.2. It is rather difficult to track the statements in C.12.2 to the corresponding language on 3-87. Consider revising the SPM to use similar language as is used in Chapter 3.	Government of United States of America, U.S. Department of State
374	30	14	30	20	C.12.2: Required action: rewrite to indicate, explicitly, that the bases of the projections are model outcomes.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
394	30	14	30	20	C.12.2: The reduction of global GDP should be always discussed in connection with equity, the sustainable development goals of countries and regions, and the gap between the world economies and development status.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3038	30	14	30	20	It does not really make sense to compare GDP in 1.5°C or 2°C scenarios with GDP in scenarios in which there are no mitigation efforts and no impacts of climate change, as the latter are impossible	Government of France, Ministère de la Transition écologique et solidaire
9560	30	14	30	20	C.12.2 states that Without accounting for the economic benefits of avoided climate change impacts, co-benefits or adverse side-effects, global GDP grows in pathways likely to limit warming to 2 degrees, but is reduced relative to a situation without mitigation by 1.3–2.7% in 2050. The marginal abatement cost of carbon neutrality for 2030-2050. For example, Figure 3-30 and Figure 3-31 in Chapter 3 of the SOD should be shown in the SPM, and the carbon price levels for pursuing the 1.5 degrees and 2 degrees targets should be clearly stated in the text.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9562	30	14	30	20	The economic negative impact assessment of mitigation to limit temperature increase within 2 degrees excluding benefit of climate stabilization (1.3-2.7% GDP) tend to include positive bias such as technological progress and behavior change of people, while the climate change impact analysis of no mitigation (2.6-4.2%GDP loss) tend to bear negative bias to consider worst case scenarios. This imbedded tendency of model analysis must be noted here.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9868	30	14	30	20	C.12.2 unclear text. Impact of different pathways on GDP are not easily distracted from the text.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11610	30	14	30	20	It seems to state that all projections show net economic losses (excluding benefits of avoided climate change). Should it also state it excludes benefits such as reduced air and other local pollution? Does the literature include a discussion on the policy tools used as well as the potential of double dividends through carbon pricing? Such scenarios that capture double dividends or co benefits do sometimes show positive results.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12356	30	14	30	20	It should be noted that the adverse impact of the global implementation of emission reduction methods on the GDP of all countries is not the same. In some countries or regions, especially in oil or other fossil fuel-producing countries, the rate of GDP will be declined many times from the global average. Helping these countries to cope with the sharp decline in economic growth is a global necessity.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
13480	30	14	30	20	The section C12.2 is very difficult to understand. Please rewrite.	Government of Estonia, Estonian Meteorological & Hydrological Institute
14072	30	14	30	20	The GDP numbers are calculated "Without accounting for the economic benefits of avoided climate change impacts, co-benefits or adverse side-effects, global GDP...". If possible, could you please add GDP accounting with the economic benefits including economic benefits of avoided climate change impacts, co-benefits or adverse side-effects even if the uncertainty might be large, as these factors have to be accounted for in real life.	Government of Norway, Norwegian Environment Agency
15294	30	14	30	28	Recommend reversing the order of C.12.2 and C.12.3. It feels counter-intuitive to refer to the benefits without having discussed them and, if the benefits outweigh the costs, it makes sense to start with that.	Government of United States of America, U.S. Department of State
3044	30	16	30	16	Rounding error (inconsistency between the situation in 2050 and annual reduction): it should be 1.2%-2.8%	Government of France, Ministère de la Transition écologique et solidaire
400	30	16	30	18	C.12.2: The use of 'pathways that limit warming to 1.5' is not accurate and is inconsistent with other working groups reports and with the rest of this report. Replace pathway with 'scenario'.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
3042	30	16	30	18	To avoid ambiguity and misinterpretation, it would be preferable for this sentence to retain exactly the same structure as the previous sentence on the +2°C scenarios	Government of France, Ministère de la Transition écologique et solidaire
3046	30	17	30	17	Rounding error (inconsistency between the situation in 2050 and annual reduction): it should be 2.8%-4.3%	Government of France, Ministère de la Transition écologique et solidaire
9564	30	18	30	20	Figure 3.35 in Chapter 3 gives us more detail information about "large variations". It would be desirable to rephrase the sentence with the information, such as "Relative GDP reductions also occur in most country-level mitigation scenarios, and the loss is relatively high in developing countries".	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
1344	30	21	30	21	Would some quantification of the global economic and other benefits be possible to quote (akin the cost quantifications in C.12.2)?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6674	30	21	30	21	Do the "global economic benefits" also account for the reduction of adaptation costs? Please briefly clarify.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3048	30	21	30	23	it would be insightful to describe that climate damages are much more complicated to estimate than mitigation costs and that they are probably very much underestimated.	Government of France, Ministère de la Transition écologique et solidaire
372	30	21	30	24	C.12.3: Attach confidence levels to the statements.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
3050	30	21	30	24	This sentence is really complicated in ordre to make an opinion	Government of France, Ministère de la Transition écologique et solidaire
4132	30	21	30	24	This sentence requires its own confidence statement. Also consider separating the assumptions into its own sentence and clearly explaining the alternative baseline off of which the benefits are calculated.	Government of Canada, Environment and Climate Change Canada
9566	30	21	30	24	" C.12.3 The global economic benefits associated with reduced warming and lower climate impacts outweigh mitigation costs over the 21st century for emission pathways likely to limit warming to 2 degrees if climate damages are at the middle to high end of the assessed range, and unless future costs are discounted at rates in the higher end of the range usually considered." means the total cost less than zero (in blue) is larger than total cost (in red) in Figure SPM 8, but such a definition of "global economic benefit" is questionable.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
376	30	21	30	28	C.12.3 states, "C.12.3 The global economic benefits associated with reduced warming and lower climate impacts outweigh mitigation costs over the 21st century for emission pathways likely to limit warming to 2°C if climate damages are at the middle to high end of the assessed range, and unless future costs are discounted at rates in the higher end of the range usually considered. Such pathways require more rapid near-term transformations and have higher up-front costs than those which exceed 2°C, but have lower aggregate costs in the long term and bring forward the benefits of avoided impacts (high confidence). Taking account of other sustainable development dimensions and non-market damages from climate change enhances the imputed benefits of mitigation action (medium confidence)." This text should be removed from the SPM, as it goes against the IPCC mandate and objectives. Remove the entirety of C.12.3 to ensure IPCC mandate and principles are respected.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
396	30	21	30	28	C.12.3: The statement provides discussion on the global economic benefits of reduced warming in comparison to mitigation costs. The word benefit is not really scientifically measured. Also benefits and costs are incomparable in this context. There are huge uncertainty about costs and the benefits has very wide range. Remove this paragraph.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
402	30	21	30	28	C.12.3: "Transformations" require stringent and rapid actions and human and financial resources in very short time which might not be available at this time for every country. The principle of Common But Differentiated Responsibilities and Respective Capabilities (CBDR-RC) outlined in the United Nations Framework Convention on Climate Change (UNFCCC), recognizes that countries have different duties and abilities to address the negative impacts of climate change. System transitions is more suitable implying the varying levels of resources of different countries. "System transformations" should be replaced with "system transitions".	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
5768	30	21	30	28	Co-benefits for health and the environment in particular are not included in the cost-benefit analyses, so the paragraph should be clear that the economic benefits are more likely to be higher than what has been computed.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5770	30	21	30	28	There is considerable uncertainty over the costs of climate impacts, as they are very sensitive to the choice of methodology (Underlying Chapter 3 page 92 Cross-WG Box 1: Economic benefits). Econometric studies of actual impacts appear to be much larger than those assumed in models such as DICE in the past. Hence the cost of impacts could be much greater than assumed in the cost-benefit analysis, and the benefits of short-term mitigation much larger. The uncertainty in the cost of impacts, and the resulting uncertainty in the cost-benefit analysis, should be made clear to policymakers.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6676	30	21	30	28	Would it be possible to underpin this paragraph with numbers regarding the economic benefits/avoided costs? The statement otherwise could lose impact in comparison to C.12.2.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12022	30	21	30	28	C.12.3.: This section is problematic in its sole focus on likely limiting warming to 2°C while lacking critical statements on 1.5°C. This might misleadingly imply that 2°C is cost-efficient. Separate information on 1.5°C should be added, wherever possible with quantitative statements, even in case of large uncertainties. Information provided in Chapter 3 makes clear that also 1.5°C-specific information is available, even if more ambiguous than information on 2°C, which can easily be made transparent in the SPM. Specifically, statements on health co-benefits that are available in Chapter 3 should be elevated to the SPM: "Regarding health effects from air quality improvement and from diet change, co-benefits are shown to be of the same order of magnitude as mitigation costs"; "The financial value of health benefits from improved air quality alone is projected to exceed the costs of meeting the goals of the Paris Agreement (Markandya et al. 2018)."; "The avoided health impacts associated with climate change mitigation can substantially offset mitigation costs at the societal level (Chang et al. 2017; Ščasný et al. 2015; Schucht et al. 2015; Markandya et al. 2018)."; "The net health benefits of controlling air pollution as part of climate mitigation efforts could reach trillions of dollars annually, depending on the air quality policies adopted globally (Markandya et al. 2018,..."; "Air pollution reductions resulting from meeting the Paris Agreement targets were estimated to provide health co-benefits-to-mitigation ratios of between 1.4 and 2.5 (Markandya et al. 2018)". It is critical that policymakers are clearly presented with such findings.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
15296	30	21	30	28	C.12.3 is problematic. The current estimates of the marginal global damages from carbon emissions have significant limitations that result in major uncertainties of the true costs of carbon emissions, thus the benefits of mitigation action. Many vitally important risks and costs (such as cascading impacts, non-marginal changes, collapse of ecosystems) associated with climate change are not captured, and global estimates of climate change damages tend to undervalue impacts in the developing countries, and inequality. To rest the discussion of climate mitigation action based on costs and benefits while giving equal consideration of the low and high estimates of climate damages without full acknowledgement of the uncertainties and value judgement embedded in the estimates of climate damages, as done in this paragraph, can misguide policy decisions.	Government of United States of America, U.S. Department of State
15646	30	21	30	28	This paragraph is lacking separate conclusions with regards to the assessment of economic benefits associated with limiting warming to 1.5°C. This then affects the headline statement, which does also not include findings on 1.5°C. Such an assessment should be added, together with quantitative statements, which are currently lacking from the paragraph. What would be especially interesting are findings with regards to benefits in the health sector, which alone have been shown to potentially outweigh mitigation costs.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
3052	30	22	30	23	Many publications have stressed that current estimates of potential climate change damages are probably highly underestimated. In addition, most readers are unaware that most studies on economic costs of mitigation actually don't take into account CC impacts (cf Box 3.5). This issue has to be more clearly acknowledged.	Government of France, Ministère de la Transition écologique et solidaire
9568	30	22	30	24	The first sentence of C12.3, "if climate damages are at the middle to high end of the assessed range and unless future costs are discounted at rates in the higher end of the range usually considered," is an important precondition for the proposition that the benefits of global warming countermeasures pursuing 2 degrees exceed the costs, and should be clearly stated. In other paragraphs, there is a description of the case to limit warming to 1.5 degrees with no or limited overshoot, so the 1.5 degrees case should also be specified in C.12.3. The distributional implications of mitigation measures at a pace and depth below 2 degrees should also be described.  Chapter 3, page 9, lines 46-48 Mitigations at the pace and depth required to limit global temperature increase to below 2 degrees imply deep economic and structural changes, raising Multiple types of distributional concerns across regions, income classes and sectors.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
3054	30	23	30	24	This formulation "and unless...usually considered" is hard to interpret. It makes it unclear how to understand the assertion which is: the overall economic benefit is greater than the mitigation cost. Would it be good to formulate it differently?	Government of France, Ministère de la Transition écologique et solidaire
9570	30	23	30	24	The discount rate (number or range) used for the calculation must be specifically written in here, before imputing the sentence after "unless future costs.." are inserted.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11612	30	23	30	24	this is the only mentioning of discount rates in the SPM, and their impact on outcomes. It would be important to elaborate on this further and in other contexts. What would be "the range usually considered"? What would be the range of discount rate for which the statement would be valid? Are there other findings in the SPM that depend strongly on the discount rates applied?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
1346	30	24	30	24	An indication of which time frames / applications the "usually considered" refers to, would be useful. Are these time frames and applications relevant for climate change over the 21st Century?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
9572	30	24	30	24	It is stated that "at rates in the higher end of the range usually considered". However, "the range usually considered" should be indicated with specific figures.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
5774	30	24	30	26	This sentence is a key policy-relevant message as it gives a broader view of mitigation costs, and should be elevated to the headline statement.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11614	30	26	30	28	The information on accounting for other SD dimensions and non-market damages should be made more visible (chapeau text), and examples should be provided	Philippe Tulkens, European Union (EU) - DG Research & Innovation
3056	30	27	30	27	The expression "non market damages" is not very clear	Government of France, Ministère de la Transition écologique et solidaire
6170	30	27	30	28	Could the consideration of indicators of welfare beyond GDP help in synthesising these other dimensions and non-market benefits?	Government of Belgium, Belgian Science Policy Office - Belspo
3330	31	0	31	0	The scope of presentation of transport decarbonisation options could be clarified, in particular the possible disregard of public aid, differentiated taxation or differences between countries. Such a presentation would risk underestimating the overall cost to society if applied to a country like France. Indeed, the figure shows negative abatement costs for almost all of these decarbonisation levers. However, for example, the modal shift to public transport is significantly subsidized in France and has a positive and high total abatement cost in a large number of situations. A possible negative abatement cost would then be a priori only seen from the user's perspective without taking into account public aid and / or any differentiated taxation. The formulation concerning regulations should be adjusted to reflect these elements.	Government of France, Ministère de la Transition écologique et solidaire
3334	31	0	31	0	We suggest to both have the scale and its meaning at the top and the bottom axes for a better lisibility	Government of France, Ministère de la Transition écologique et solidaire
3380	31	0	31	0	Fig SPM.8 the AFOLU option "Reduce conversion of natural ecosystems" and "Restoration (e.g. reforestation)" hide the fact that these options are also a combination of demand reduction and yield increases (total demand equal yield times land used). This missing information might lead to misinterpretations, in particular that reductions of conversion of natural ecosystems can happen independently from demand reduction and yield increase. This also should help clarify that the associated costs are not direct costs (natural vegetation regrows spontaneously), but opportunity costs of non use of land (cost of intensification). This issue is enhanced by the presence of "Reduce food loss and waste" and "Shift to sustainable healthy diets" that will certainly be misinterpreted, for instance as the full effect of demand change as it is not defined clearly (in chapter 7 definition is obscure: "emissions reductions accounting only for diverted agricultural production from diets and food waste to avoid double counting"). One way to improve the situation would be to put on the figure SPM.8 some information that "Reduce conversion of natural ecosystems" and "Restoration (e.g. reforestation)" depend on yields and demand, for instance replace "Reduce conversion of natural ecosystems" by "Conversion of ecosystems, demand and yields change" and "Restoration (e.g. reforestation)" by "Restoration (e.g. reforestation), demand and yields change".	Government of France, Ministère de la Transition écologique et solidaire
2392	31	0	31	1	Figure SPM.8: suggest having a sum total line for each cost bracket included on this graph, i.e., how much net emissions are possible in each cost bracket.	Government of Australia, Department of Industry, Science, Energy and Resources
824	31	1	31	1	In SPM 8: the under the picture (right side): suggestion 'No cost could be allocated' could be replaced with 'No cost could be allocated currently'	Government of Russian Federation, Institute of Global Climate and Ecology

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1136	31	1	31	1	FIG spm 8Perhaps explain why there is no costing for reduced food loss and food waste mitigation and similarly for the mitigation due to shift to "sustainable diets". The latter having been identified the one of the more significant options and enabling some of the land use opportunities.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1348	31	1	31	1	It would be interesting to have some information on how figures SPM.7 and SPM.8 overlap. How much of the potentials in fig SPM.8, for example, are or could be addressed on the demand side. Would a comment on this be possible to craft?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
4134	31	1	31	1	Figure SPM.8: Missing from the Figure message at the top of the Figure is that many options are available now AT LOW COST. This is indeed what is shown in the Figure and we think the phrase "at low cost" should be added to the end of the Figure message.	Government of Canada, Environment and Climate Change Canada
6172	31	1	31	1	Figure SPM.8: Please improve readability. In particular, non-expert readers may have difficulties understanding that a longer line means a larger potential, not a larger cost: insisting on this might be useful.	Government of Belgium, Belgian Science Policy Office - Belspo
6174	31	1	31	1	Figure SPM.8 : This is a "picture" taken at a precise moment: there should be an information about the value of USD used (reference year?) and the reference year of the prices/costs estimates, as these can change rapidly due to any market cause.	Government of Belgium, Belgian Science Policy Office - Belspo
6678	31	1	31	1	Please explain why the "Mitigation options" shown in this figure are not consistent with the "Sectoral and system mitigation options" in figure SPM.9. We would prefer to have the same categories and options in the same order for both figures which would ease the comparison line by line. We also kindly request more clarity regarding the scientific robustness of this figure when considering the information provided in paragraph C.5.1 and the coherence of evaluation criteria applied across sectors (e.g. the transport sector is assessed as the cheapest after energy, which is inconsistent with continuing challenges reported in Table.TS.1). Please clarify.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6854	31	1	31	1	Figure SPM.8 wildly misrepresents costs and mitigation potential for a large number of options. It misrepresents the costs of electric light duty vehicles (how can be less than zero if they are still (BEVs) substantially more expensive than combustion vehicles and require enormous investments in charging infrastructure and power grid upgrades?). It also exaggerates the cost of bio-based solutions, including biofuels and bioelectricity, already on the market and moderately cost competitive with fossil fuel equivalents. Some options that have a known high mitigation potential over the long term, such as bioenergy with CCS, are listed here with very small potential.  More broadly, there may be a misleading impact of projecting costs and mitigation potential just through 2030 in Figure SPM.8., as longer term cost and potential for those options would be substantially different. It is suggested to carefully review and make transparent the basis and assumptions behind all of the estimations of cost and mitigation potential in figure SPM.8, as well as to include longer term mitigation potential projections in the figure. Alternatively, the figure could be simply removed, as the usefulness for policy makers of providing a short term list that is based on a reference scenario for policies in place during 2015-2019 is quite dubious.	Government of Brazil, Ministry of Foreign Affairs
11616	31	1	31	1	This is a nice figure. The "improvement of existing building stock" relates to construction material for the renovation or energy savings? It is not fully clear at first sight. "avoid demand for energy services" is also not clear. Does it refer to behavioral change or improved energy equipment?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11618	31	1	31	1	Please clarify whether AFOLU (notably "Reduce conversion of natural ecosystems") includes marine ecosystems.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14074	31	1	31	1	Figure SPM.8. Carbon capture and storage on energy (bar no. 7 from top) seems too be to low compared to the resent IEA report. They estimate 1.63 GtCO2 reduction in 2030 [ref: IEA Net Zero Scenario 2050 - <a href="https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroBy2050-ARoadmapfortheGlobalEnergySector_CORR.pdf">https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroBy2050-ARoadmapfortheGlobalEnergySector_CORR.pdf</a> ]. It seems like this graph do not include retrofitting of existing power plants. Please consider to include data from the IEA-report, and clarify if retrofitting of existing power plants are included in the mitigation potential estimate.	Government of Norway, Norwegian Environment Agency
14076	31	1	31	1	Figure SPM.8. Carbon capture and storage on industry (bar no. 38 from top) seems to be too low. The figure shows a potential of about 200 Mt CO2/year. No reference is given. This is in contrast to IEA Net Zero stating a potential of 360 MtCO2/year. E.g. potential for reduction of CO2 emissions from cement industry. This industry release approx 5-7% of world CO2 emmission and CCS is now beeing seen as the main toolset to reduce emission in this industry sector and have started realizing CCS on their assets. Please consider to add data from the IEA net zero report ( <a href="https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroBy2050-ARoadmapfortheGlobalEnergySector_CORR.pdf">https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroBy2050-ARoadmapfortheGlobalEnergySector_CORR.pdf</a> ).	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14080	31	1	31	1	Figure SPM. 8 is a great figure, with a good headline! Please keep. However, one suggestion for improvement is to rank the mitigation options under each sector (Energy, AFOLU, Buildings ect.) from largest to smallest potential contribution, if possible.	Government of Norway, Norwegian Environment Agency
14084	31	1	31	1	Please consider the categories used in the AFOLU section of the figure. For example it is not intuitive that agroforestry belongs under "carbon sequestration in agriculture", or that afforestation belongs under "restoration" (table 7.3). It is also unclear why figure 8 and 9 and also 10 use different categorisations of mitigation options. Please try to align mitigation options in figures 8-10.	Government of Norway, Norwegian Environment Agency
14086	31	1	31	1	Figure SPM 8. is very informative and important so please keep it. However we think that it should be explained whether the mitigation option "carbon sequestration in agriculture" includes biochar. It is also unclear in which of the mitigation options methane reductions from reduced meat consumption are counted. Please clarify if they are counted in "reduce CH4 and N2O emissions in agriculture" or "shift to sustainable healthy diets".	Government of Norway, Norwegian Environment Agency
15298	31	1	31	1	Figure SPM.8 needs to provide additional stacked bars that show the total mitigation potential at different costs. It is too much to ask the reader to total up mitigation potentials of different colored bars across dozens of rows to reach the conclusion stated in the first sentences of C.12 and C.12.1.	Government of United States of America, U.S. Department of State
15300	31	1	31	1	Figure SPM.8 appears in the Technical Summary as TS.23, but does not appear in the underlying report. The data points could not be verified for buildings in Chapters 6, 9, or 12, or the supplementary materials for these chapters.	Government of United States of America, U.S. Department of State
15302	31	1	31	1	Under "Transport" in Figure SPM.8, recommend changing "electric heavy duty vehicles" to "hydrogen or electric heavy duty vehicles".	Government of United States of America, U.S. Department of State
9574	31	1	31	10	In the power sector, wind power is compared to the cost of thermal power. Does electric vehicle in the transportation sector also imply that the cost is lower compared to internal combustion engine, which consume fossil fuel? Isn't there a difference in the evaluation method between sectors? If there is a difference, its should be clearly stated.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11620	31	1	31	15	Fig. SPM.8. Very surprising that all transportation technologies except biofuels would have negative costs in 2030. It was not possible to trace back vague references to a number of sections. By which findings is this substantiated?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14082	31	1	31	15	It is not specified whether the costs include environmental externalities, i.e. if it is private or social costs that are in the figure and in the figure text. Please consider if it is possible to make this explicit - for example in the text title (line 3) and in line 8-9 ("Only monetary costs and revenues are considered")?	Government of Norway, Norwegian Environment Agency
14088	31	1	31	15	We would appreciate a better description for the connection between mitigation options both in relation to figure SPM 8.	Government of Norway, Norwegian Environment Agency
14090	31	1	31	15	Please clarify if the potential contribution to mitigation in 2030 is by 2030 (i.e. aggregated over the periode 2019 to 2030) as it is stated in the heading or for 2030 as it is stated in the caption.	Government of Norway, Norwegian Environment Agency
15312	31	1	31	15	"Restoration (e.g., reforestation)" is included as an option within the AFOLU mitigation options in Figure SPM.8. Restoration is a broad term that should be defined relative to other terms that are used in the SPM, particularly afforestation and reforestation. In Chapter 7, "forest restoration strategies" are mentioned and restoration is treated separately from reforestation and in other cases afforestation, reforestation, and restoration are broadly classified together (Table 7.3). Consistency in the treatment of these terms is critical in Chapter 7 and perhaps even definitions in the glossary would be helpful.	Government of United States of America, U.S. Department of State
15314	31	1	31	15	The updated estimates of the absolute cost-constrained potential contribution across each sector to climate mitigation targets are extremely valuable. It would be very helpful to clarify how this translates to proportional contributions to targets. This could be done, for example, by adding a (sub)figure representing the proportional cost-constrained contribution by each of the six sectors to limiting warming below 1.5 and 2°C, based on the results presented in Figure SPM.8. These proportional values could either be presented as an inset to Figure SPM.8, or as a small donut diagram or a small table. This would allow better understanding of the contribution of each sector in achieving targets in the Paris Agreement, and could be referenced in other sections to understand how potential contributions match (or do not match) with the scale of financing (and innovation, etc.) for each sector.	Government of United States of America, U.S. Department of State
15304	31	1	31	2	For the Figure SPM.8 legend, add something about the Low-Mid-High cost ranges (with the corresponding color shadings).	Government of United States of America, U.S. Department of State
9824	31	1	31	3	Question: why is the potential of CCS so low and the costs in the 100-200 range only? seems a change from AR5 assessment.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14078	31	1	31	3	The figure SPM8. gives a snapshot of the 2030 volumes for different solutions. While we appreciate the focus on near term solutions, this figure could benefit from extending the perspective to 2050 in the accompanying text. Given the long project development timeline this would give a more reflected information of the different climate solution the industry has started on. It would also raise awareness about near term action such as innovation and deployment policies that are needed to drive the solutions that are needed in much larger quantities post 2030. Please consider to provide a 2050 perspective in the text and explain why the figure could not be extended to 2050.	Government of Norway, Norwegian Environment Agency
14242	31	1	31	3	In the figure SPM.8, the contribution of nuclear to reducing net emissions by 2030 is depicted as having a rather increased cost per tCO2 equivalent avoided. We question whether the assessment took into consideration life time extension projects which have the lowest levelized cost of electricity, in accordance with International Energy Agency (IEA) on the Projected Costs of Generating Electricity 2020 (source: <a href="https://www.iea.org/reports/projected-costs-of-generating-electricity-2020">https://www.iea.org/reports/projected-costs-of-generating-electricity-2020</a> ). Also, it is not clear if this assessment illustrated in the figure SPM.8 takes into account the subsidies.	Government of Romania, National Meteorological Administration
15306	31	1	31	3	It is interesting that, with the exception of biofuels, the transport sector options for substantially reducing new emissions by 2030 are relatively inexpensive. However, there appears to be one conspicuous, inexpensive, and highly effective omission -- especially given that "shift to public transportation" and "shift to bikes and e-bikes" are (rightfully) listed as options -- and that is "shift to walking".	Government of United States of America, U.S. Department of State
15308	31	1	31	3	Hydrogen is missing from the "Transport" section of the Figure SPM.8. Hydrogen is increasingly prevalent in transit bus fleets and may expand further for other medium and heavy duty vehicle applications.	Government of United States of America, U.S. Department of State
15310	31	1	31	3	Add the units to the x-axis labeling in Figure SPM.8.	Government of United States of America, U.S. Department of State
6176	31	1	31	7	Figure SPM.8: the calculation method would benefit from a clarification: does the figure report emission reductions in 2030 from additional measures that might be taken now? For example, does the potential for nuclear include the time needed to build nuclear power plants, which would limit the potential at such a short-term scale as compared to a somewhat more distant future? How is the potential for cycling estimated (it also seems low)?	Government of Belgium, Belgian Science Policy Office - Belspo
404	31	3	31	3	Figure SPM.8: Required action: rewrite the title with explicit statement that values are projections.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
15316	31	4	31	10	The baseline for the cost estimates needs to be made clearer in the figure title as well as the supporting text. The text should state that "These estimates are based on global estimates; actual costs would vary by place and context."	Government of United States of America, U.S. Department of State
9576	31	4	31	13	For instance, in wind power or solar power generation, it is presumed that the grid integration costs such as balancing costs will increase as the scale increases. However, Figure SPM.8 does not consider those costs. It would be better to put a note on that.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
14092	31	4	31	4	Footnote 22: We would appreciate if the definition of "mitigation potential" could make it clear if it means technically or economically achievable. When reading the figure 8 caption, its gives an impression that only monetary costs and revenues are considered.	Government of Norway, Norwegian Environment Agency
6178	31	5	31	7	We wonder to what extent demande-side options are fully covered here, as indicated. For example, all transport-related measures relate to supply. Does it mean that the demand cannot be reduced, at least as compared to a baseline?	Government of Belgium, Belgian Science Policy Office - Belspo
15318	31	8	31	10	Regarding the statement "If costs are less than zero, lifetime monetary revenues are higher than lifetime monetary costs", was the same assessment criteria applied to nature-based solutions? What's the lifetime assumed for forest and soil, and the bacteria underneath? If not, this cost picture is biased toward technology rather than nature-based solutions.	Government of United States of America, U.S. Department of State
9578	31	8	31	9	It is a common understanding that the reason why a mitigation option does not diffuse in the market despite of its negative cost is the existence of hidden costs, such as investment costs, other profit opportunities, and so on. The comment of "Only monetary costs and revenues are considered." does not seem to explain enough. It is suggested to clearly state that hidden costs such as various introduction barriers are not accounted. The hidden costs in energy end-use sectors are usually higher than in energy supply sectors. Therefore, it would be better to add the note "the cost comparisons across sectors are not recommended," for example.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
14094	31	9	31	10	It seems that there is no discounting, is that correct? Would it be appropriate to give an explanation for this choice in the text (alternatively state that it is discounted, if it is)? Please consider to add language that makes this clear.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15320	31	9	31	10	The text in the SPM and referenced chapters do not delineate the baseline for mitigation costs per mitigation option, and it does not appear that a consistent baseline is being used. For example, in the Figure SPM.8 legend, "for wind energy, for example, negative cost indicates ..." suggests the costs are net costs and seems inconsistent with the definition that "only monetary costs and revenues are considered". Suggest clarifying as this is a really significant difference in the calculation (i.e., can the wind farm be profitable (negative cost) vs. is the wind farm cheaper than baseline alternatives).	Government of United States of America, U.S. Department of State
6180	31	9	31	9	"Lifetime monetary revenues are higher than lifetime monetary costs": For clarity, please indicate if these are discounted.	Government of Belgium, Belgian Science Policy Office - Belspo
1350	31	11	31	11	Would "uncertainty ranges" be a better term here than "error bars"? To keep to the overall terminology in the SPM.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
3332	31	14	31	15	A reference to Fig. TS.23 could be added (see page TS-108)	Government of France, Ministère de la Transition écologique et solidaire
12292	31	28	31	45	The emerging demand for cryptocurrency mining facilities (crypto farms), which has become a fairly significant demand in the last two years should have been mentioned in Digitalisation energy demand section	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
1352	31	28	31	28	In addition to "displace", would it be correct to also mention "enlarge", as increasing (in addition to relocating) exploited land would have similar impacts.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
4136	31		31		This very interesting figure provides some material that could be used for cross-section inferences. For example, earlier text stressed the potential of CDR and of BECCS as mitigation actions. Yet we see in this figure the high cost and low potential of BECCS or of CCS by itself. This information could be brought forward in the relevant earlier parts of this SPM. In addition, the inclusion of biomass only as "Bioelectricity with CCS", "Biofuels" and generically in "Fuel switching" was surprising to see. The first two are the least energy-wise efficient use of biomass. Simple heat production or co-generation with heat production are, by contrast, very efficient uses of biomass energy and are being deployed across the developed world at scales from small to moderate one building at a time. It was a surprised not to find "Bioenergy for heat" in the figure, although maybe it is just too small a contributor.	Government of Canada, Environment and Climate Change Canada
12256	31		31		C12: Figure SPM.8:in section Transport. shift to buy local goods can be added. It reduces the carbon footprint by reducing the cost and pollution from the farm to your food table. Further, consumers can make a conscious effort to support products made as a result of "sustainable" farm practices.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
6978	31		38		Figure SPM.8 (and Figure SPM.9, Figure SPM.10): It is our understanding that the synthetic figures are topically linked and invite comparability due to their similarities in design and display of mitigation options. The sectors and the individual mitigation options should therefore be directly comparable, which is currently not the case, as some options are the same across figures while some are not. While we understand that authors are constrained by the available literature, please still revise as much as possible to allow the reader to directly compare figures that are consistent.	Government of Jamaica, Meteorological Service Division
416	32	0	32	0	The high confidence statement from Chapter 3 and included in the Technical Summary Page 135 Lines 9-11 should be added to the paragraph to address trade-offs between mitigation and SDGs. "Many of the potential trade-offs between mitigation and other sustainable development outcomes depend on policy design and can be compensated or avoided with additional policies and investments, or through policies that integrate mitigation with other SDGs (high confidence)." It is essential to consider innovations and technologies as well as bottom-up approach rather than top-down approach to reflect the CBDR.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
410	32	0	34	0	The following statement from Ch4 P48 L4-5 "electrifying heavy-duty road transport and fuel switching in aviation and shipping are much more difficult and have not been addressed in most of the recent research." this should be clearly stated in the SPM as to ensure a balanced and inclusive report and to give a full understanding of the lack of research in electrification.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
3058	32	1	32	1	This chapter makes extensive use of the conditional or the expression "can" "may", and so on. This assumes the possibility of doing something, but does not give firm solutions; which had been developed in the various chapters. We should be more affirmative as to the possible solutions or alternatives.	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3060	32	1	32	1	<p>General comment on section D " Mitigation, adaptation and sustainable development":</p> <p>Authors should insert in section D language in existing paragraphs (especially D.1 and D.1.6) or create a new paragraph emphasizing the key importance of upfront climate action in the 2030 and 2040 decades for maximizing synergies and minimizing trade-offs between mitigation and sustainable development. This given upfront ambitious mitigation action will help avoid dependence on large-scale CDR, whereas latter action will require more CDR and net-negative emissions.</p> <p>Specifically, this can mean connecting together:</p> <p>(1) the key message in C.2 "Deeper emissions reductions by 2030 and 2040 reduce the risk of overshooting warming limits and the associated need for net negative CO2 emissions in the long-term" (drawn from sections 3.3, 3.5, Chapter Box 3.4, Cross-Chapter Box 3 in Chapter 3) with</p> <p>(2) the insight from Ch.3 Executive Summary that states "The timing of mitigation actions and their effectiveness will have significant consequences for broader sustainable development outcomes in the longer term" and namely "food, employment, water stress, and biodiversity, [will] come under pressure from large-scale CDR deployment" (p. 3-8) and</p> <p>(3) the insights section 3.7.6.2 (p. 3-99), Section 7.4.4 p. 7-81, and section 12.5.3 (p. 99-100), which highlight that larger scale and higher expansion rate of land-based CDR namely BECCS generally translating into higher sustainability risks.</p>	Government of France, Ministère de la Transition écologique et solidaire
3442	32	1	32	1	<p>Authors should insert in section D language in existing paragraphs (especially D.1 and D.1.6) or create a new paragraph emphasizing the key importance of upfront climate action in the 2030 and 2040 decades for maximizing synergies and minimizing trade-offs between mitigation and sustainable development. This given upfront ambitious mitigation action will help avoid dependence on large-scale CDR, whereas latter action will require more CDR and net-negative emissions. Specifically, this can mean connecting together:</p> <p>(1) the key message in C.2 "Deeper emissions reductions by 2030 and 2040 reduce the risk of overshooting warming limits and the associated need for net negative CO2 emissions in the long-term" (drawn from sections 3.3, 3.5, Chapter Box 3.4, Cross-Chapter Box 3 in Chapter 3) with</p> <p>(2) the insight from Ch.3 Executive Summary that states "The timing of mitigation actions and their effectiveness will have significant consequences for broader sustainable development outcomes in the longer term" and namely "food, employment, water stress, and biodiversity, [will] come under pressure from large-scale CDR deployment" (p. 3-8) and</p> <p>(3) the insights section 3.7.6.2 (p. 3-99), Section 7.4.4 p. 7-81, and section 12.5.3 (p. 99-100), which highlight that larger scale and higher expansion rate of land-based CDR namely BECCS generally translating into higher sustainability risks.</p>	Government of France, Ministère de la Transition écologique et solidaire
6856	32	1	32	1	<p>Figure SPM.9 Biofuels should have a synergy with SDG 1 due to its demonstrated impact on rural incomes and creating livelihoods, being more job-intensive than other forms of energy.</p> <p>All mitigation options tied to widespread and large-scale use of lithium-ion batteries (which have a relatively short useful life, depend on mining rare materials, and are currently not recyclable) should have tradeoffs listed under SDGs 14 and 15, due to negative environmental impacts of both the mining activity and the discarding of the batteries. Among such options in Fugure SPM.9 are Electrification of the Urban Energy System, Electric light duty vehicles, and Electric Heavy duty vehicles.</p>	Government of Brazil, Ministry of Foreign Affairs
15338	32	1	32	1	<p>Suggest changing the title of this section to: "Synergies and tradeoffs between mitigation, adaptation, and sustainable development". This will clarify the content of this section.</p>	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9582	32	1	34	29	In D1, synergies are emphasized but there is lack of focus on trade-offs, so trade-offs should be addressed equally to synergies. In Figure SPM9, synergies of Goal 13 is evaluated to all other 16 goals of SDGs, but trade-offs of Goal 13 is only evaluated to Goal 3, 4, 5, 7 and 17. The reason behind this uneven evaluation should be explained, and if there are not sufficient reasons trade-offs should be evaluated to the all other 16 goals.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
424	32	1	36	13	The text in Chapter 17, L15-18, Pg. 21, states, "There are, however, several challenges involved in balancing the dilemmas associated with meeting the SDGs, such as, for example, energy access, equity and sustainability. Fossil fuel-dependent developing countries cannot transit to low-carbon economics without considering the wider impacts on development by doing so." This may also include non-producers who rely on fossil fuel because of its low cost and availability compared to alternatives. This text should be included in the SPM, as it discusses dilemmas associated with meeting SDGs for fossil-dependent developing countries and the importance of considering wider impacts on development in order to do so.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
428	32	1	36	13	This text should reference underlying chapters that discuss the economic implications for lower income countries that are dependent on hydrocarbon resources, are endowed with significant untapped oil and gas reserves, and may not have the transitional tools to move towards low-carbon technologies or economies in order to achieve their SDGs. Required action: Include this important aspect of implications in the SPM.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1354	32	1	36	13	Health benefits of improved air quality are mentioned rather in passing in the present Section D (D.1.3, and also E2.2). Given the very considerable synergies between mitigation and global health (also food security), a paragraph in Section D could be considered.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6680	32	1	36	13	Section D of the SPM deals with the relationships between mitigation, adaptation, and sustainable development. In our view the statements are not balanced sufficiently: the perspective of climate impacts, particularly extreme events, and their consequences for the necessary transformation should be more highlighted; additionally, the integrated perspective is underrepresented. Therefore, we suggest to consider more specific aspects of the integration of mitigation, adaptation, and sustainable development - see the following statements from the Technical Summary to be considered in the SPM: "Urban green and blue infrastructure can mitigate climate change through carbon sinks, avoided emissions, and reduced energy use while offering multiple co-benefits (high confidence). Urban green and blue infrastructure, including urban forests and street trees, permeable surfaces, and green roofs offer potentials to mitigate climate change directly through storing carbon, and indirectly by inducing a cooling effect that reduces energy demand and reducing energy use for water treatment. Globally, urban trees store approximately 7.4 billion tonnes of carbon, and sequester approximately 217 million tonnes of carbon annually, although carbon storage is highly dependent on biome. Among the multiple co-benefits of green and blue infrastructure are reducing the urban heat island (UHI) effect and heat stress, reducing stormwater runoff, improving air quality, and improving the mental and physical health of urban dwellers. Many of these options also provide benefits to climate adaptation." (Source: TS P 6 L 3-12) "The beneficial and adverse impacts of deploying climate-change mitigation and adaptation responses are highly context-specific and scale-dependent. There are synergies and trade-offs between adaptation and mitigation as well as synergies and trade-offs with sustainable development (high confidence). Strong links also exists between sustainable development, vulnerability and climate risks, as limited economic, social and institutional resources often result in low adaptive capacities and high vulnerability, especially in developing countries. Resource limitations in these countries can similarly weaken the capacity for climate mitigation and adaptation. The move towards climate-resilient societies requires transformational or deep systemic change. This has important implications for countries' sustainable development pathways (medium evidence, high agreement)." (Source: TS P 133 L 23.32)	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12694	32	2	32		At the end of the sentence before the full stop enter the following: "but the extent of mitigation varies across regions, depending on their contribution to cumulative emissions, equity, and regional and national circumstances."	Government of India, Ministry of Environment, Forests and Climate Change
412	32	2	32	2	The following statement in D1 "Accelerating climate change mitigation is essential to achieve sustainable development. Mitigation actions contribute to the achievement of development priorities." The term "essential" must be removed as mitigation may have negative impacts on developing countries to allow room for national circumstances and/or adaptation in accordance with NDCs.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5778	32	2	32	3	Switching between 'development' and 'sustainable development' can be a bit disorienting in parts of this section - it isn't always clear what's referred to or how the two relate to each other, e.g. in D.1. the first two sentences seem to say the same thing, unless the 2nd sentence does not mean 'sustainable development'? A similar thing happens in D.3.1 where development appears to be 'conflated' with sustainable development. Please could you review usage of these terms and clarify accordingly.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6682	32	2	32	36	As we learned in the SRCCL and as found in the underlying report, shifting diets and reduction of food waste and overconsumption have high mitigation potentials of several Gts CO2 and feature many co-benefits with almost all SDGs. They also feature co-benefits with adaptation and of course food security and will help to avoid deforestation and free land. They will also lead to significant methane and N2O reduction, which is important for limiting the overshoot and the need for CDR. However, they are not mentioned in the subsection D1, although many measures are mentioned in detail - only in D.1.3 demand side mitigation is mentioned. This is not appropriate for a no-regret and win-win measure and we strongly request to mention the measure concretely as it is done for other measure.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12024	32	2	32	36	D.1: Could section D.1 be shortened and the number of bullets reduced? While it is understandable that the text tries to provide aggregated high-level statements, this also means that some of the statements are quite general, and could then also be further condensed. For example, maybe only one sector-specific bullet would suffice (summarizing the current bullets D.1.3-D.1.6 or picking out only some of the sectors as examples).	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
418	32	2	32	7	The implication of mitigation on SDG has to be understood and the co-benefits included. The statement from the Technical Summary Page 133 Lines 10-14 should be added to the paragraph. "The SDG framework can serve as a template to evaluate the long-term implications of mitigation on sustainable development and vice versa (high confidence). Understanding the co-benefits and trade-offs associated with mitigation is key to understanding how societies prioritize among the various sectoral policy options (medium confidence)."	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
5780	32	2	32	7	Accelerating climate change mitigation is described as essential to achieving sustainable development. D.1 implies that this is because mitigation offers numerous co-benefits, but another key driver not mentioned is that the impacts of climate change are likely to disproportionately affect people in less developed countries in more tropical areas. It would be useful to be explicit about both drivers.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5782	32	2	32	7	The headline statement D.1 is a bit confusing to read, and doesn't seem to capture the key messages in the underlying reports. Paragraph D1.2 is clearer, and covers similar ground, and parts could be as a substituted into D.1.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13396	32	2	32	7	We just wonder if there would also be use in pointing to the Paris Agreement and especially the NDC implementation mechanism as also a more structure way for evaluating and measuring this especially given the fact that the actions and priorities are nationally determined	Government of Kenya, Kenya Meteorological Service
15340	32	2	32	7	D.1 headline statement is not very clear and does not offer a strong message for policymakers. Develop a more useful statement about the state of the science, looking at links between mitigation and development. Importantly, not all climate change mitigation supports sustainable development -- for example, if it were to exacerbate energy poverty. Or, if it were to undermine economic growth, it could undermine sustainable development. A suggested revision could be: ""Sustainable development, meeting the needs of the current generation without compromising the capacity of future generations to meet their needs, relies on mitigating adverse climate change impacts through GHG emissions mitigation and adaptation without undermining other components of sustainable development, such as growing incomes, providing affordable access to energy, and efficient mobility. Well-designed policies to reduce the adverse impacts of climate change, and seeking opportunities associated with it, may in tandem promote other components of sustainable development, such as health and food security.""	Government of United States of America, U.S. Department of State
6684	32	3	32	3	What are "development priorities"? Please clarify or use a different term that is commonly known.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12696	32	3	32	3	Replace "Mitigation actions contribute to the achievement of development priorities." with the following: "Mitigation actions can contribute to the achievement of development priorities, while also adding to the cost of development for the economies of developing and least developed countries."  Reason: The statement should be modified to include the challenges and increased vulnerabilities of developing nations and LDCs.	Government of India, Ministry of Environment, Forests and Climate Change
15342	32	3	32	3	Revise to: "Mitigation actions may contribute ..."	Government of United States of America, U.S. Department of State
6686	32	3	32	4	Please add a sentence referring to TS.2 (line10-13) as T.2 also stresses the high importance of the way of designing climate policies in regard to the effect of sustainable development (see also T.1, line 25-27). Please note that T.2 refers to climate policies while SPM D.1 focuses more specifically on mitigation policies.  We suggest to write "While effective and equitable climate policies are largely compatible with the broader goal of sustainable development, mitigation policies can also result in trade-offs that need to be addressed when designing mitigation policies." instead of "These can also result in trade-offs that can be addressed when designing mitigation policies."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15344	32	3	32	4	It is not necessarily true that the trade-offs can be addressed. They can be evaluated, but this suggests any trade-offs can be dealt with in mitigation policy design, which is not always true.	Government of United States of America, U.S. Department of State
11622	32	4	32	4	Consider changing 'trade-offs that can be addressed' to 'trade-offs that should be addressed'.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12698	32	4	32	4	Replace "These can also result in trade-offs that can be addressed when designing mitigation policies" with the following: "These can also result in trade-offs that need to be addressed by international cooperation and the provision of finance, technology transfer and capacity building support to developing countries".	Government of India, Ministry of Environment, Forests and Climate Change
12980	32	4	32	4	D.1 This paragraph makes developmental approaches the 'converse'. SA's view and reading of the underlying chapters is that a developmental approach is the main way forward. Mitigation as a narrow, environmental concern has not reduced emissions. Therefore make sentences 3 and 4 the first ones.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
5784	32	5	32	5	"These can also result in trade-offs that can be addressed when designing mitigation policies." - This text could be improved: if trade-offs can be addressed, then what is the value in mentioning it? A message that well-designed mitigation policies will help to achieve the SDGs would be clearer.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5786	32	5	32	5	To clarify what is being mitigated and linking to the main reference figures of this section (SPM.9) in line 7, there is need to provide a clear link to the key message, so it is proposed to include, following 'mitigate', additional words of 'negative outcomes across different global-local contexts'. In this way it links to the figure's title, that states synergies and trade-offs vary widely and depend on context. It also strengthens the link to many similar points later in the section, such as in line 31 'context-dependent'.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6688	32	5	32	5	Please add "[...] of the UN 2030 Agenda for Sustainable Development [...]" after "The SDG framework [...]" in order to refer correctly to the agreed UN document (UN, General Assembly, A/RES/70/1, <a href="https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&amp;Lang=E">https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&amp;Lang=E</a> ) that includes the SDG framework mentioned here.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6690	32	5	32	5	Please consider re-phrasing into "...other development priorities CAN impact emissions and/OR the ability to mitigate."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12700	32	5	32	5	Delete the following statement "Conversely, actions to achieve other development priorities impact emissions and the ability to mitigate."	Government of India, Ministry of Environment, Forests and Climate Change
13296	32	5	32	5	Add "... impact emissions POSITIVELY AND NEGATIVELY and the ability ..."	Government of Switzerland, Federal Office for the Environment FOEN
13298	32	5	32	6	The 2030 Agenda serves as - as the title suggests - as an agenda for the progress towards sustainable development. In the 2030 Agenda there is also a chapter on "follow up and review". --> Change "SDG framework" to "2030 Agenda for SD". Also change "template for the evaluation" to "provide information on the progress towards sustainable development and can help to assess the long term implications ..."	Government of Switzerland, Federal Office for the Environment FOEN

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6184	32	5	32	7	It is not clear to us that this sentence is fully substantiated by scientific analysis, given how it is currently phrased. It might be read as suggesting that the report assessed the SDGs as a framework for the evaluation of sustainable development. This does not seem to be the purpose of the chapter. Sustainable development as a concept is not focused on 2030 and could be regarded as broader than the SDGs (and one could also question what is to be evaluated - sustainability, development, and their relations). We noticed that the wording is "can serve as", but there is no other proposed method so it looks like it "is" the framework. Instead of "can serve as a template", we suggest something like "is useful for" or "is a useful contribution to".	Government of Belgium, Belgian Science Policy Office - Belspo
11624	32	5	32	7	"The SDG framework can serve as a template for the evaluation of the long-term implications of mitigation actions for sustainable development (high confidence)". Indeed let us hope that this sentence is true and its high confidence level well-deserved. However, the verb "can" seems to be working very hard in this sentence. The SDG framework, and literature showing synergy-trade-off matrices, is now a few years old. Do we yet have literature with examples of the framework demonstrating the sustainable development implications of mitigation actions?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5788	32	6	32	6	To expand the current 'long-term implications' to 'short, medium and long-term implications'. This is needed because the framework is a basis for not just the long-term. For example the SDGs are specifically targets for 2030, which is defined as short term in this report. Also, the alignment with the framework is required in the immediate term to make longer term investment decisions. For reference, the short term (now to 2030), medium term (2030-2050) and long term (2050 onwards) are defined in Chap 4, page 3, line 5-6.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12702	32	6	32	7	Remove the following statement: "The SDG framework can serve as a template for the evaluation of the long-term implications of mitigation actions for sustainable development". Reason: The following statement conflates the SDGs with mitigation action and assumes that the two can be implemented interchangeably without any trade-offs. Also, the time scales of the SDGs and mitigation are very different.	Government of India, Ministry of Environment, Forests and Climate Change
5790	32	7	32	7	The reference to Figure TS.30 needs further explanation. The original figure, on page TS-136, line 1, shows 'Impacts on SDGs of mitigation likely limiting warming to 1.5°C with narrow mitigation policies vs broader sustainable development policies'. It is proposed that the reference in the SPM should more explicitly state that the figure relates to climate change mitigations for SDG13 against a holistic sustainable development agenda that includes the other 16 SDGs. This clarification is also needed in the description of Figure SPM.11, that is covered in relevant comments below.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2472	32	8	32	12	The first sentence is very clear and important. Please consider if it is possible to make connection between 2nd and 3rd sentence clearer	Government of Denmark, Danish Meteorological Institute
406	32	8	32	11	D.1.1: Required action: rephrase to indicate explicitly that the list of reasons provided on lines 8 and 9 is not an exhaustive one.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
5794	32	8	32	12	Paragraph D.1.1 is a rather confusing mix of messages which are covered better in subsequent paragraphs, and does not give clear indication of the policy actions required. It might be clearer if the text after the first sentence were replaced to bring out the message in the underlying chapter 17 (p3 line 11) around "Changing these practices and patterns requires a fundamental reframing of development. Sustainable development, by emphasising sectoral integration and social inclusion, offers just such a reframing."	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5796	32	8	32	12	D.1.1 lost an important point made by the SOD version, i.e. that 'in the absence of mitigation, development objectives are likely to be compromised.' The sentence 'Linking mitigation with sustainable development poses particular challenges for LDCs' sounds like these two activities can be achieved completely independently from each other and seems to contradict D.1, which notes that accelerating mitigation is essential for SD. Is this more about the ability to maximise synergies/avoid trade-offs? Possible wording: 'Maximising synergies and avoiding trade-offs poses particular challenges to least developed countries.' This paragraph, especially the first 2 sentences also feel abit disjointed - possible addition from the TS after sentence 1: Climate change is the result of decades of unsustainable energy 14 production, land -use, production and consumption patterns{...}. {...} shifting development pathways towards sustainability can help transform these patterns and practices {...} (medium evidence, high agreement) {come back to this...}. {maybe something else on the SDGs framework} ...Climate action is a key component in meeting SDGs. However, maximising synergies...(as above)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13302	32	8	32	12	This paragraph constitutes of a mixture of messages and findings. Please streamline as it is unclear what key finding is being highlighted here.	Government of Switzerland, Federal Office for the Environment FOEN
15348	32	8	32	12	This paragraph focuses only on challenges (line 10) but mitigation actions provide many opportunities for development. How the opportunities and barriers balance out depends largely on policy choices. The paragraph could be more balanced in this respect. In order to address this point, revise the last sentence to: "Nonetheless, well-designed climate action is a key component in meeting the SDGs (high confidence)."	Government of United States of America, U.S. Department of State
12360	32	8	32	17	Countries under international sanctions or sanctions imposed by another country(s) can also be added to this category. Economic sanctions cause major economic disruptions and reduce income, limit economic diversification, and increase the economy's dependence on natural resources (e.g., Fossil fuels). In response to sanctions and to evade its grip, the sanctioned country adopts a range of survivalist, aggressive, and unsustainable policies that reduce the economic pressure of sanctions at the expense of accelerated resource consumption, environmental degradation and excess emissions.  Under sanctions and embargos, even when there is the capacity for international cooperation and synergy between mitigation actions with other countries or SDGs, these synergies to fulfill mitigation plans will be severely limited.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
13304	32	8	32	36	We would like to see that the text is more closely linked to the figure SPM9. That means that the text does take up the sectorial and system mitigation options (energy systems up to industry) and portrays the most important observations with the matching with the SDGs. That will lead to a clearer structure and order in the text. At this moment in time, many sectoral and system mitigation options are not talked to at all.	Government of Switzerland, Federal Office for the Environment FOEN
13308	32	8	32	36	We would like to point the authors to an imbalance and request to adapt the text to overcome this imbalance. Whereas the text speaks of synergies and trade-offs in a ratio of roughly 50:50, the analysis in the figure portrays a clearer picture that is about 80:20 in favor of synergies versus trade-offs. Please correct the text to that end it meets the analysis in the figure.	Government of Switzerland, Federal Office for the Environment FOEN
5792	32	8	32	8	Clarify sentence to say "Climate change is the result of increased GHG emissions caused by decades of...."	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11626	32	8	32	8	Instead of "decades", "centuries" would be more appropriate. It started with the Industrial Revolution at the latest, but unsustainable practices and discernible climate impacts can be dated to earlier.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15346	32	8	32	8	The key message of this paragraph can be improved and streamlined. Consider adding a second sentence after the first line to say: "Adverse impacts of climate change increasingly threaten the health and livelihoods of people around the globe, and the stability of many environmental resources." This reminds policymakers WHY this report makes this statement, rather than just asserting it. It might be good to cross-reference the WGII AR6.	Government of United States of America, U.S. Department of State
1138	32	8	32	9	Unnecessary and rhetorical commentary on already stated findings.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6186	32	8	32	9	This sentence would probably benefit from rewording. "the result of decades of unsustainable" appears a little odd: shouldn't it be "a result", or "one of the consequences of", because unsustainable practices have broader consequences? Furthermore, it is climate change at a given point in time that results from "decades" of emissions and LUC. The sentence may be read as relating to principles (because it does not say "current climate change"); in that case, there is no need for decades of emissions to cause (some) climate change.	Government of Belgium, Belgian Science Policy Office - Belspo
6692	32	8	32	9	As we learned in the WGI ( WG I TS.2.2) Livestock husbandry as another main cause of climate change which should be mentioned here as well.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12704	32	8	32	9	Replace "decades" by "more than a century and a half" and replace "unsustainable" by "fossil-fuel based" and after "land-use" insert "change". Reason: All unsustainability is not related to climate change.	Government of India, Ministry of Environment, Forests and Climate Change
13300	32	8	32	9	Add "land-use, UNSUSTAINABLE production and consumption patterns."	Government of Switzerland, Federal Office for the Environment FOEN

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3386	32	8	37	11	In the context of the least developed countries, there is also a very serious problem: the demographic dynamics and their food autonomy vs SDG. These points do not appear and should be underlined somewhere. This also affects, already now and in the very short term, the problems of access and use of water, one of the major problems that will be exacerbated by climate change which is addressed by the WG2 report. In fact, the effects of demographic trends are little discussed except for an aging trend, Ch 7, Table 7.2 DEMOGRAPHY : "The world's population is expected to become older, more urbanised and live in smaller households". Pour tenir compte de l'effet inverse notamment en Afrique il faudrait ajouter un petit texte et une réf dans ce tableau dans Economic and cultural factors permettant alors de reprendre ce point ici ou plutôt en D.1.5 où c'est de plus souligné en High confidence... et qui me semble très important touchant l'insécurité alimentaire et migrations (voir proposition dans le ch 7). We suggest to add this sentence : "Among the indirect drivers, the demographics dynamics will be a specific trade-off, particularly in Africa {7.3}"	Government of France, Ministère de la Transition écologique et solidaire
5798	32	9	32	11	Would be good to highlight some of the challenges which are posed by linked mitigation with sustainable development here.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
7030	32	9	32	11	The paragraph should be more inclusive, considering all countries, although it is relevant keeping the reference to challenges for least developed countries and vulnerable populations. Based on this comment, the text should be read as following: "Climate change is the result of decades of unsustainable energy production and use, land-use, production and consumption patterns. Linking mitigation with sustainable development poses challenges to all countries, in particular for least developed countries and vulnerable populations with limited institutional and financial capacity and skilled human resources."	Government of Brazil, Ministry of Foreign Affairs
11628	32	9	32	12	What is the overall point that these two sentences are trying to make? Consider re-ordering them. i.e. 1st point - climate action is a key component in meeting the SDGs 2nd point - there are particular challenges for LDCs, vulnerable populations etc. Also, why does the final sentence say "climate action" rather than mitigation? Is the paragraph trying to make a point about vulnerable populations being the key beneficiaries of (other peoples') mitigation, while not being the people who have to mitigate the most themselves? If so, say this more clearly.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12716	32	9	32		Insert at the beginning before the word "production", the following: "high fossil-fuel based" and after the word "patterns" insert " vary significantly across regions and countries."	Government of India, Ministry of Environment, Forests and Climate Change
13616	32	10	32	10	this is also true of developing countries as well	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
12718	32	10	32		After "for" insert the following: "developing countries who cannot access their fair and equitable share of the global carbon budget ", delete "least developed countries".	Government of India, Ministry of Environment, Forests and Climate Change
3062	32	11	32	11	"Skilled human resources" is ambiguous and would be strongly criticised in vulnerability studies and works that link vulnerability, capacity and development. The term is not politically and ideologically neutral. It would be preferable to replace it with a more consensual and less situated formulation: with restricted access to institutional and financial resources, reduced social and economic capital and limited individual agency.	Government of France, Ministère de la Transition écologique et solidaire
6188	32	11	32	11	As non-native English speakers, we have the impression that the word "skilled" is unclear as to the kind of skills, and potentially inadequate (all humans have "skills"). Do you mean "specific technical skills", or "education"?	Government of Belgium, Belgian Science Policy Office - Belspo
11630	32	11	32	11	This should probably be "high confidence"	Philippe Tulkens, European Union (EU) - DG Research & Innovation
1140	32	11	32	12	Suggest the language here needs to be more measured. There is an opportunity to align actions towards achieving the SDGs rather than climate action being key component, as addressing climate change is itself one of the SDGs. It can be better stated	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12720	32	11	32		Replace "a key component" by "one of the components".	Government of India, Ministry of Environment, Forests and Climate Change
11632	32	12	32	12	Add 7.2 and 7.3 to the list of chapters the paragraph refers to.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
420	32	13	32	15	D1.2: Add the term "and adaptation" to the following statement "There are synergies between mitigation actions and the pursuit of the SDGs as well as potential trade-offs which can be compensated or avoided with additional policies, investments and financial partnerships." as adaptation also plays an important role in pursuit of the SDGs	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
13078	32	13	32	15	We request the change of the word "compensated" in line 14 with the word "mitigated", because policy trade-offs are not compensated but mitigated. The word compensation gives the sentence a monetary conotation, which is not necessarily the case with policy trade-offs.	Government of Switzerland, Federal Office for the Environment FOEN
15350	32	13	32	15	This is not necessarily the case. This sentence overstates knowledge about what and how trade-offs can be avoided or compensated for.	Government of United States of America, U.S. Department of State
5800	32	13	32	17	Mitigation is part of the SDGs (under SDG13 Climate action), and, as D.1 states, is essential to the achievement of sustainable development. It is therefore odd that it is in some places discussed as something that is separate from it. Perhaps this should say 'pursuit of other SDGs'?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9826	32	13	32	17	This statement may be true, but is too vague and general to have any policy meaning.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11634	32	13	32	17	D1.3 - The statement that there are synergies between mitigation actions and SDGs as well as trade-offs is generic and aggregate. It is also repeated many times, such as in Figure SPM.9. To make the message more policy relevant and linked to the Ch. 17 ES p. 4, Line 9-10), it is suggested to add as follows: 'Supplementing this aggregate view with detail-rich studies involving SDGs can build support for transitions within and across countries'	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12722	32	13	32		Delete the word "potential".	Government of India, Ministry of Environment, Forests and Climate Change
9584	32	14	32	14	which "can be" should change as: which "need to be", because there is no consensus that the trade offs are "always and/or automatically" compensated or avoided.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12724	32	14	32		Replace "can" by "cannot" and "with" by "without".	Government of India, Ministry of Environment, Forests and Climate Change
15352	32	15	32	15	Insert "public acceptance and support for policies as well as" before "scale." The SPM does not give sufficient attention to the role of the public, in democracies at least, to successful policies and transitions. Without public support, transition to more sustainable development will not happen.	Government of United States of America, U.S. Department of State
12726	32	16	32		Before "interactions" insert "inequalities and".	Government of India, Ministry of Environment, Forests and Climate Change
5802	32	17	32	17	To add 'and implementation' after 'policy design' since the delivery part of policy design is often mistakenly omitted. Given the nature of the action-oriented Report, this small change helps balance policy-implementation linkages.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11636	32	17	32	17	Add 7.4 and 7.6 to the list of chapters the paragraph refers to. The paragraph is likely also relevant for most other chapters.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12728	32	17	32		After policy design add "including climate justice, and means of implementation for climate mitigation and adaptation as well as independently for the SDGs".	Government of India, Ministry of Environment, Forests and Climate Change

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5776	32	18	32	22	As an example demonstrating strong synergies, I would suggest addition of following to this para. "Widespread adoption of modern, clean cooking has high potential to benefit social development, climate mitigation, adaptation and natural resources".	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5804	32	18	32	22	Can you clarify this sentence a bit, e.g. what is it about urban planning/what kind of urban planning provides synergies and what kind of synergies (similarly to the last sentence)? What about about energy efficiency (improvements in...)? Also line 18 'most forms of renewable...'? Are there renewables with no synergies? Could you also give examples of demand side mitigation? 'shifts to public transport' - does this include walking and cycling? Maybe 'non-motorised transport' is a more inclusive term? Could shifting diet (in some countries) also be mentioned here as an example of mitigation/health synergies?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5806	32	18	32	22	Paragraph D.1.3 would be helpful to make explicit reference to which SDGs the synergies are referring. Drawing from Chapter 17 p55 lines 8-13 shows where these synergies (SDG7) and trade-offs are strongest (SDG 2, 6) are strongest.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9586	32	18	32	22	If D1.3 mentions synergy, it should also mention trade-offs in a separate paragraph. For example, in SOD Chapter 3, page 10, lines 23-25, the following statement should be inserted  Areas of potential trade-offs include, for example, employment, food deprivation, biodiversity loss, water stress and energy access/affordability.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12026	32	18	32	22	D.1.3: Please also highlight and elaborate on the benefits and synergies from phasing out fossil fuels, e.g. regarding health etc.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
14098	32	18	32	22	Please keep the following sentence in SPM D.1.3: "Areas of potential synergies include energy efficiency and most forms of renewable energy, urban planning and demand side mitigation (high confidence). Electrification combined with low carbon energy, and shifts to public transport can enhance health, employment and equality. In industry, energy efficiency, material recycling and electrification contribute to reduced air pollution and increased employment and business opportunities (medium confidence).	Government of Norway, Norwegian Environment Agency
422	32	19	32	19	The statement in D.1.3 is focused on energy sector and neglects all other sectors. This also neglects the overlapping effects in the industrial sectors where we need to bring in the lifecycle principles so as to attach emissions to non-fossil end materials.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
414	32	19	32	20	The following statement in D1.3 "Electrification combined with low carbon energy, and shifts to public transport can enhance health, employment and equality". It must be rewritten with an associated confidence level.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
426	32	19	32	20	The use of the term "can" in the following statement in D1.3 "Electrification combined with low carbon energy, and shifts to public transport can enhance health, employment and equality". It must be quantified as to ensure scientific accuracy.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
11638	32	19	32	20	Can the link with equality be explained?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
3064	32	20	32	20	We suggest justify the use of "equality" in the sentence, as 8.2 mainly deals with "equity"	Government of France, Ministère de la Transition écologique et solidaire
15354	32	20	32	20	In addition to shifts towards public transport, mention active transportation and other forms of shared human power, and e-mobility.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9588	32	20	32	22	In Chapter 11, p. 81, line 3-5, it says "Exploiting material efficiency usually requires new business models and provides potential co-benefits of increased employment and economic opportunities", Therefore, it seems more precise to say "potential increase in employment and business opportunities", instead of "increased employment and business opportunities".	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
3066	32	21	32	21	We suggest to replace "reduced air pollution and increased" by "reduce air pollution and increase"	Government of France, Ministère de la Transition écologique et solidaire
3068	32	22	32	22	We suggest to referred to Figure SPM 10 as well.	Government of France, Ministère de la Transition écologique et solidaire
13672	32	23	32	23	The phrase "avoided deforestation and reforestation" could be misunderstood, but can easily be addressed by changing the order to "reforestation and avoided deforestation".	Government of New Zealand, Ministry%20for%20the%20Environment
14102	32	23	32	23	Please add "Agroforestry" to the glossary.	Government of Norway, Norwegian Environment Agency
6694	32	23	32	25	In D.1.4, including the protection of natural ecosystems as a land-based option would be another valuable example for the reader, as it provides high co-benefits and cost efficiency (see chapter 7, 42, line 42ff). In this paragraph, it can also broaden the view beyond agricultural examples and link to other sectors, e.g. biodiversity protection.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14100	32	23	32	25	Please consider to add sustainable forest management here as it seems from e.g. figure SPM 8 that forest management has a large mitigation potential in the short term and forestry will also be crucial to provide the amount of biomass needed in other sectors. .	Government of Norway, Norwegian Environment Agency
14104	32	23	32	25	Please consider to align the text with figure SPM 9 were e.g. "Agroforestry" is not mentioned.	Government of Norway, Norwegian Environment Agency
2394	32	23	32	27	This seems to be the only mention in the SPM of the benefits of avoided deforestation. Suggest the SPM make a more explicit mention of the importance of conserving existing forests.	Government of Australia, Department of Industry, Science, Energy and Resources
11640	32	23	32	32	D1.4 & 1.5 These paragraphs, while undoubtedly true, are very generic and add little compared to previous assessments. Are there any more specific messages that can instead be lifted from the underlying report? For example, on ways to safeguard or enhance food security and livelihoods while pursuing land-based options. If the underlying report does not provide more detailed evidence of this kind then a statement on the value of conducting more local studies (as in our comment on D1.3) would be useful.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12730	32	23	32	24	Delete from "such as...." to ".....livestock management".	Government of India, Ministry of Environment, Forests and Climate Change
2482	32	24	32	25	instead of "land productivity", the term "soil productivity" is preferred.	Government of Hungary, Ministry of Innovation and Technology - Climate Policy Department
3070	32	24	32	25	We suggest to add either "sustainably enhancing" or "enhancing sustainable productivity"	Government of France, Ministère de la Transition écologique et solidaire
408	32	25	32	25	D.1.4: Required action: change "avoiding" to "minimizing" to stay in line with enables of SDG 7 (Ensure access to affordable, reliable, sustainable, and modern energy for all).	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
3072	32	25	32	25	The wording "resilience" is unclear, resilience to what should be specified (ecosystem, population...), especially as the degree of confidence varies according to the system considered.	Government of France, Ministère de la Transition écologique et solidaire
3074	32	25	32	25	We suggest to add "capturing these land-based option" for more clarity"	Government of France, Ministère de la Transition écologique et solidaire
5808	32	25	32	25	Suggest replacing the word 'avoiding' with 'managing' since the essence of mitigation and adaptation investment decisions requires an acceptance that there will always be trade-offs and synergies. This is especially the case when SDG13 climate mitigation is considered against other SDGs. It also links with the word 'managed' in line 28.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15356	32	25	32	27	Identification of the specific practices and optimal scale of implementation is crucial for policymakers in the agricultural sector to know what to prioritize for maximum mitigation benefits.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15358	32	25	32	32	Add information on trade-offs between mitigation and SDGs. The text suggests that this only occurs in AFOLU, and does not speak to energy access for LDCs. Alternatively, move this sentence to D.1.2 since these dependencies are true for more than just the land-based options <u>referenced in this paragraph</u> .	Government of United States of America, U.S. Department of State
5810	32	26	32	26	To add after 'specific practices' the additional words of 'such as wide stakeholder engagement in the early policy-to-implementation design phase'. The reason for this addition is to emphasise the critical need for early engagement with the widest set of stakeholders, especially local engagement, to seek the appropriate balance of trade-offs and synergies related to the policy or investment definition of success.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
3076	32	27	32	27	The literature is more precise: scientific works in social sciences speak rather of communities, and in the case of cities, of citizens rather than "people"	Government of France, Ministère de la Transition écologique et solidaire
5812	32	27	32	27	After 'and the sharing' add 'of a framework for measuring, monitoring and reporting benefits'. The reason for this is that currently there is insufficient emphasis on the need for accurate and visible management of the trade-offs and often the definitions of the benefits and disbenefits are poorly defined, monitored and reported.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12732	32	27	32		Replace "the involvement" by "acknowledgment as key stakeholders".	Government of India, Ministry of Environment, Forests and Climate Change
14106	32	28	32	29	The part of this sentence stating "especially those that do not displace existing land uses" is somewhat difficult to grasp, seeing as many of the options mentioned in the SPM would result in some form of displacement of existing land use. It may be interpreted as if policymakers need to refrain from all land-based mitigation options that displace existing land uses, regardless of the existing land use and how it is managed? Please consider nuancing or exemplifying the statement if possible.	Government of Norway, Norwegian Environment Agency
1142	32	28	32	30	This is a rather narrow sample case. The 1.5 and 2.0 scenarios involve very significant land use change, and explicit displacement of (livestock) food production. So a little disingenuous here that the trade-offs can be avoided.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
7032	32	28	32	30	Please, include the word "sustainable" between the words "existing" and "land" in line 28. The text should be read as following: "Well managed land-based mitigation options, especially those that do not displace existing sustainable land uses, can avoid potential trade-offs in terms of employment, water stress, land use, resource rivalry, biodiversity, and access to, and the affordability of, energy, food, and water".	Government of Brazil, Ministry of Foreign Affairs
740	32	28	32	32	The confidence level is not consistent with the underlying report, in which "medium evidence, high agreement" is given to lines 40-43, page 55 of Chapter 12. The authors are requested to check and modify.	Government of China, China Meteorological Administration
3444	32	28	32	32	It seems that the idea of this paragraph is to convey the message that when land-based mitigations options should be well managed in order to avoid negative impacts, which is a very useful and policy relevant result. However the wording of the paragraph should be more clear, active and conclusive in terms of what policy implications it entails – the current paragraph is too synthetic which defeats the purpose of sending a clear message. For example for the first sentence, instead of just listing the trade-offs, it should also detail what is the kind of "well-managed options" which can avoid these trade offs (what do we mean by well-managed, are we talking about sustainable intensification for example?). On the second sentence, instead of starting with a passive wording, it should state that bioenergy is subject to sustainability constraints, and then detail these constraints (as was done in the SR1.5 report). In this case, there is not only an influence of these sustainability criteria on bioenergy – bioenergy also represents a threat and a risk to these criteria, and there is a balance to find to preserve biodiversity and food security. The whole paragraph should thus be inverted in order to have a clear logical flow : first the paragraph should detail what risks and impacts are entailed, then detail how they can be well managed through adequate mitigation options and the impacts of inadequate options.	Government of France, Ministère de la Transition écologique et solidaire



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3446	32	28	32	32	<p>This relates to a larger comment on the balance between natural and land-based solutions and technology-based bioenergy solutions throughout the SPM. There is a clear imbalance between the treatment of technological CDR options, on which a strong and optimistic emphasis is made, and the treatment of "natural" options related to protection, sustainable management and restoration of natural sinks, as well as societal and demand related options, the stakes of which are barely covered. This is the case in particular for solutions related to the AFOLU sector, which lack detail throughout the SPM (not all AFOLU options are equivalent, and neither are all land-based CDR options – the report emphasizes mostly on BECCS and barely details existing soil carbon sequestration options) as well as nature based solutions and ecosystem based approaches. The underlying chapters indicate clearly that without a protection of natural sinks efforts will have to be compensated by additional mitigation action. This seems self-explanatory but it is not covered in the SPM and there is a risk of misunderstanding, in particular from the biodiversity community, if this is not addressed.</p> <p>There is a second imbalance, between the treatment of the potential of CDR and that of its feasibility and sustainability constraints, which was clearly summarized in the SPM of SR1.5 and in the underlying chapters : (SR1.5) "CDR deployment of several hundreds of GtCO2 is subject to multiple feasibility and sustainability constraints (high confidence)." This is all the more problematic since the contribution from WG1 to the AR6 report introduced in its SPM the notion of risks, impacts, and sustainability implications on biogeochemical cycles and biodiversity without exploring them with the understanding that volume 2 and 3 would address it : (WG1 SPM) Potential negative and positive effects of CDR for biodiversity, water and food production are methods-specific and are often highly dependent on local context, management, prior land use, and scale. IPCC Working Groups II and III assess the CDR potential and ecological and socio-economic effects of CDR methods in their AR6 contributions. Not providing more details would fail on delivering on this point and provide an incomplete picture of this critical subject throughout the AR6.</p>	Government of France, Ministère de la Transition écologique et solidaire
3448	32	28	32	32	<p>As in the rest of the current SPM of volume 3, the current paragraph it does not provide sufficient detail and restricts itself in listing the fact that CDR methods vary in terms of impacts, risks, constraints, without indicating the direction of these impacts and risks and proposing an actionable conclusion which can be understood by policymakers – such a listing is not policy relevant. In other instances, the listing is also lacking references to crucial impacts, such as on biodiversity – for example the notion of pressure on land is mentioned several times when referring to impacts of some CDR options such as BECCS, but the pressure and impact on biodiversity is not mentioned (although it was in chapters) – a similar statement can be made on socio-economic impacts.</p> <p>Here below are some more detailed comments sending back to references from the chapters on the matter, which can also inspire some more detailed edits:</p> <ul style="list-style-type: none"> <li>- At the end of the last sentence of para. D.1.5, the following should be added after 'scale of deployment' : ", with larger scale and higher expansion rate generally translating into higher sustainability risks". This addition is important, as the current formulation of D.1.5 "The sustainability of bioenergy is context-specific and influenced by [...] scale of deployment" does not correctly reflect the findings in the referenced sections 3.7 and 7.4, which find that larger-scale deployment of bioenergy usually lead to higher sustainability risks. Specifically:</li> <li>- Section 7.4.4 p. 7-81 finds "While governance has a critical influence on outcome, larger scale and higher expansion rate [of dedicated biomass production for bioenergy and BECCS] generally translates into higher risk for negative outcomes for GHG emissions, biodiversity, food security and a range of other sustainability criteria (Rochedo et al. 2018; Daioglou et al. 2019; Junginger et al. 2019; Galik et al. 2020; Searchinger 2017; Vaughan et al. 2018; de Oliveira Garcia et al. 2018; Stenzel et al. 2020)."</li> <li>- Section 3.7.6.2 (p. 3-108) states: "large-scale deployment of some climate mitigation and land-based CDR measures could have deleterious impacts on biodiversity "</li> </ul>	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3450	32	28	32	32	<p>*And in addition, section 12.5.3 (p. 99-100), states that regarding: "Mitigation options that are based on the use of biomass, that is, bioenergy/BECCS, biochar, wood buildings, and other bio-based products" [...] governance has a critical influence on outcome, but larger scale and higher expansion rate generally translates into higher risk for negative outcomes such as competition for scarce land, freshwater and phosphorous resources, displacement of natural ecosystems, and diminishing capacity of agro-ecosystems to support biodiversity and essential ecosystem services, especially if produced without sustainable land management and in inappropriate contexts (Popp et al. 2017; Dooley and Kartha 2018; Hasegawa et al. 2018; Heck et al. 2018; Humpeöder et al. 2018; Fujimori et al. 2019; Hurlbert et al. 2019; IPBES 2019; Smith et al. 2019b; Drews et al. 2020; Hasegawa et al. 2020; Schulze et al. 2020; Stenzel et al. 2021) (medium evidence, high agreement)."</p> <p>This addition to D.1.5 also serves to provide overall coherence in the SPM, namely with regards to para. D.2 ("However, land and aquatic ecosystems can be adversely affected by mitigation actions, depending on their implementation, especially if deployed at a large scale (high confidence)").</p>	Government of France, Ministère de la Transition écologique et solidaire
14108	32	28	32	32	<p>Please consider to add the following sentences to SPM D.1.5 (from T.S.-66, Line 3-4): Urban green and blue infrastructure can mitigate climate change through carbon sinks, avoided emissions, and reduced energy use while offering multiple co-benefits (high confidence).</p>	Government of Norway, Norwegian Environment Agency
12734	32	28	32	29	<p>Replace "especially those that do... can avoid potential" by "are essential to manage".</p>	Government of India, Ministry of Environment, Forests and Climate Change
5814	32	29	32	29	<p>After 'can' add 'reduce or'. This aligns better with line 14 above that uses 'compensated or avoided'. The key point is that mitigation is never binary, there will always be some trade-offs.</p>	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2484	32	30	32	30	<p>instead of "bioenergy", the term biomass-based energy production is suggested.</p>	Government of Hungary, Ministry of Innovation and Technology - Climate Policy Department
3078	32	30	32	30	<p>The particular issue of drinking water, which poses the problem of quality, should be added. This is a major problem in some countries, including developed ones. The Millennium Goals talk about access to a safe water source.</p>	Government of France, Ministère de la Transition écologique et solidaire
11642	32	30	32	30	<p>It is unclear what is included in the "sustainability of bioenergy". In any event, from a mitigation perspective, it would be most important to highlight that the GHG performance of bioenergy is also context-dependent. Before investigating the interactions between mitigation and other SDGs, it would be important to ensure the mitigation benefits themselves. In that context, the biggest risk to mitigation is not that bioenergy could have adverse side effects, but that it may not contribute to mitigation and, if poorly implemented, it may even increase emissions.</p>	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5816	32	30	11	32	<p>Can this say what specifically makes for sustainable biomass?</p>	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
1356	32	31	32	31	<p>Water-related mitigation would also seem to be relevant in this context (such as preservation and restoration coastal ecosystems, not least: salt marshes, mangroves, kelp forests, seagrass meadows), and the "land management" could correspondingly be amended to "land and water management", as appropriate. Albeit small global potential, water-related mitigation options can be significant in many regions, and carry a number of co-benefits.</p>	Government of Sweden, Swedish Meteorological and Hydrological Institute
12706	32	33	32		<p>Insert the word "potential" at the beginning of the sentence and after the word "can" insert "if they achieve scale,"</p> <p style="text-align: right;">Reason: The following</p> <p>technologies and methods mentioned are still speculative and at preliminary stages of development. The statement assumes a linear relationship between utilisation of CDR methods (like biochar and soil carbon sequestration) without acknowledging the trade-offs and challenges that exist related to the implementation of these. It is also unclear how a high confidence level has been ascribed to the sentence on the basis of modelling results.</p>	Government of India, Ministry of Environment, Forests and Climate Change

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3080	32	33	32	33	<p>The first sentence of D.1.6 should be modified by eliminating the words "soil amendment with biochar".</p> <p>This in order to correct the incorrect claim that "biochar [...] can enhance SDGs through improved biodiversity": the claim that biochar improves biodiversity is not substantiated in the sections referenced (3.7 and 17.3), and is contradicted in sections 12.5.3, as detailed in table 12.10 which notes that impacts and risks for "Biochar addition to soil" include "Land use competition if biochar is produced from purpose-grown biomass. Loss of forest carbon stock and impacts on biodiversity if biomass is harvested unsustainably. {12.5.3}" (also see 12.5.3 p. 12-99 and 12-101); and in section 7.4.3.2 (p. 7-63). These negative impacts of biochar on biodiversity are further reiterated in Table TS.7. Biochar may have a potential impact on food security when deployed at large scale (SRCCL, Panel B, Figure SPM3).</p> <p>Soil amendment with biochar" as an efficient CDR method is still intensively debated in the soil community.</p>	Government of France, Ministère de la Transition écologique et solidaire
15360	32	33	32	33	D.1.6 contradicts the AFOLU statements in Section C.	Government of United States of America, U.S. Department of State
2454	32	33	32	34	This sentence could be red like amendment of biochar improves biodiversity. Isn't that very difficult/wrong to state with the current studies/knowledge on this matter?	Government of Denmark, Danish Meteorological Institute
5818	32	33	32	34	I can't find evidence in 17.3 or chapter 3 that supports this statement. However 7.4.3.2 contains this "Critical assessment and conclusion. Biochar has significant mitigation potential through CDR and emissions reduction, and can also improve soil properties, enhancing productivity and resilience to climate change (medium agreement, robust evidence)." So please add 7.4.3.2 to the references in row 36.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5820	32	33	32	34	Neither 3.7 nor 17.3 seem to support the claim that biochar can "enhance SDGs" by improving biodiversity and soil quality. Suggest deletion of this sentence.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6696	32	33	32	34	In the underlying chapter on Biochar (7.4.3.2) no evidence for positive impacts of biochar application on biodiversity can be found. Please delete "soil amendment with biochar" here or make clear that only soil carbon sequestration can have positive impacts on biodiversity. If biochar is mentioned, potential negative impacts such as increasing land demand for biomass production (see Ch.7 p. 64, l. 22-23) should be added as in the following sentence on forest mitigation measures by adding to this sentence "...but may increase demand for biomass production".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13306	32	33	32	34	What is meant by "enhance the SDGs"? SDGs are goals. Goals can be achieved or can be met. They cannot be enhanced?	Government of Switzerland, Federal Office for the Environment FOEN
7034	32	33	32	35	Paragraph D.1.6 on CDR methods should be more positive, like paragraph D.1.3 on energy. The text "but may negatively impact food production" (line 35) should be removed, because the consideration of trade-offs with access to food is more balanced and comprehensive in page 34 (lines 17 – 26).	Government of Brazil, Ministry of Foreign Affairs
1358	32	33	32	36	CDR methods that are applied in the aquatic environment can also improve biodiversity and water quality and at the same time benefit food production.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
2396	32	33	32	36	D.1.6 says soil amendments/ biochar can enhance SDGs. However D.2.3 seems to contradict this and uses biochar and afforestation as examples that can reduce biodiversity. Both can be correct – the context is important. Suggest adding to D.1.6 that this conclusion is context-specific and depends where feedstock is from.	Government of Australia, Department of Industry, Science, Energy and Resources
3082	32	33	32	36	<p>Para D.1.6 seeks to provide an overview of sustainability synergies and trade-offs of several CDR methods, yet it has a major omission: it does not mention BECCS – a CDR measure which many models project deployment at large scale, and yet whose large-scale deployment is described as raising negative impacts on food security, biodiversity, and other sustainability measures (see Section 7.4.4 p. 7-81, Section 3.7.6.2 (p. 3-108), section 12.5.3 (p. 99-100)).</p> <p>Authors should redress this omission by including in D.1.6 a mention of the trade-offs and synergies of BECCS.</p>	Government of France, Ministère de la Transition écologique et solidaire
3088	32	33	32	36	This paraphrap D.1.6 highlights the need to introduce here the notion of Nature-based solutions, which is present in the chapters as well as in the WG2 contribution and corresponds to a situation when both biodiversity and climate benefits are met, while enhancing SDGs and without negative impacts on social dimensions. It is important to precise when, how and why negative impacts can happen and what are the conditions for them not to happen	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3452	32	33	32	36	<p>Instead of "biochar", it would be more relevant and representative to use the term soil carbon sequestration techniques or agricultural management practices enhancing soil carbon sequestration. Indeed, throughout the SPM, regarding specific description and representation of land-based CDR options in the AFOLU sector, these options are most of the time reduced to biochar (which are partly technology based). It would be more balanced and reflective of the diversity of options outlined in the chapters to refer to these options as soil carbon sequestration techniques – as these techniques refer not only to biochar, but also to soil carbon sequestration through agroecology, non-tillage, agroforestry, among others.</p> <p>Furthermore the potential trade offs of biochars with some SDG as SDG2 when deployed at large scale, or when made from biomass contaminated with pollutants, and the energy consumed to produce it should be taken more into account.</p> <p>"soil amendment with biochar" as an efficient CDR method is indeed still intensively debated in the soil community. As biomass based option, biochar can also have negative effects, that depend from the source of biomass (12.5.3).</p> <ul style="list-style-type: none"> <li>• Biochar could lead to land use competition if produced from purpose-grown biomass.</li> <li>• Loss of forest carbon stock and impacts on biodiversity if biomass is harvested unsustainably. {12.5.3}. It could also have positive effects, but this is already noted.</li> </ul>	Government of France, Ministère de la Transition écologique et solidaire
3454	32	33	32	36	<p>Some additions would be useful in this paragraph D1.6 and they apply also to paragraph D2.2.</p> <p>The below suggestions can also be highlighted for consistency with the SPM of SRCCL :</p> <p>To be consistent with panel B of figure SPM 3 of the SRCCL, the potential impact on food security when deployed at large scale should be mentioned.</p> <p>To be consistent with B3.1 of SRCCL SPM the "increase demand for land conversion" when deployed at scale should also be mentioned.</p> <p>To be consistent with B5.2 SPM SRCCL ("The application of certain biochars can sequester carbon (high confidence),and improve soil conditions in some soil types/climates"), the addition of "certain" before biochar would be appropriate. Or the sentence "mitigation and agronomic co-benefits depend strongly on biochar properties and the soil to which biochar is applied" from 7.4.3.2. could be used.</p> <p>Furhtermore, Para D.1.6 seeks to provide an overview of sustainability synergies and trade-offs of several CDR methods, yet it has a major omission: it does not mention BECCS – a CDR measure which many models project deployment at large scale, and yet whose large-scale deployment is described as raising negative impacts on food security, biodiversity, and other sustainability measures (see Section 7.4.4 p. 7-81, Section 3.7.6.2 (p. 3-108), section 12.5.3 (p. 99-100),).</p>	Government of France, Ministère de la Transition écologique et solidaire
4138	32	33	32	36	<p>It's unclear why only biochar and soil carbon sequestration are mentioned in the first sentence, and then ecosystem restoration and afforestation/reforestation are the only approaches mentioned in the second sentence when all four of these approaches can improve biodiversity and soil quality. By splitting the sentences, this main positive message is diluted. Suggest rewriting the first sentence to make the point that all four of these CDR approaches can enhance SDGs though improving biodiversity and soil quality. Then the second sentence could start with "However" and make the point that ecosystem restoration and afforestation/reforestation may negatively impact food production.</p>	Government of Canada, Environment and Climate Change Canada
5824	32	33	32	36	<p>As the section primarily focuses on synergies and trade-offs between climate change mitigation and sustainable development, SPM D.1.6 seems a little out of place. Would suggest rewriting to include CDR and developmental links or removing.</p>	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6698	32	33	32	36	<p>In D.1.6, the direct and indirect trade-offs of biochar (feedstock; biodiversity implications) and unsuitable afforestation (monocultures; afforestation in non-forest ecosystems; non-native species) should be reflected to provide a balanced view on the potentials and risks of these approaches (see for biochar chapter 7, p.63ff; for afforestation chapter 7, p.49ff).</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6700	32	33	32	36	<p>The proposed biodiversity benefits appear to relate to biochar as well. Nevertheless, chapter 7 (p.63ff) does not mention any biodiversity benefits through biochar application. The sentence is, therefore, not correct. Please revise.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6702	32	33	32	36	The way it reads is that there is a negative impact on food productions due to sequestered CO2 (which improves soil and biodiversity and subsequently improves the soil for food production). Perhaps what is rather meant is that food production (better yet, crop production) could be impacted negatively as land is reclaimed for afforestation/reforestations, hence reduced land available for food production. If this is the intended message, it should be made clear that sequestering CO2 is not the problem, but the competition of land. Perhaps it should read something along the lines of .. "While ecosystem restoration and afforestation....., it may negatively impact food production due to competition of available (agricultural) land.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6980	32	33	32	36	The options presented here (which, broadly speaking, involve nature, i.e. biodiversity, afforestation, reforestation etc.) would be limited in their capacities with ongoing climate change? Please add this very important caveat that needs to be taken into account when considering these options.	Government of Jamaica, Meteorological Service Division
11644	32	33	32	36	The different options would require a more differentiated and balanced treatment. Some issues: * "Biochar" is often associated with the mentioned benefits, but the evidence is inconclusive and there are negative cases, e.g., where soil conditions are worsened in terms of texture, nutrient availability or drier, warmer conditions (due to the darkening of the soil). There is also a risk of contamination, which is why "biochar" application is not universally accepted. * Afforestation may or may not improve the soil (should not be stated as a certainty) and in many cases reduce biodiversity, perhaps even seriously (e.g., when natural grasslands are converted to plantations). In fact, even carbon sequestration benefits are conditional on where and how afforestation is done. E.g., afforesting peatlands can significantly increase CO2 emissions. * It is appropriate to highlight potential risks to food security, but there can also be benefits, especially when the measures are considered in a landscape context (like stabilising soils and hydrology through restoration of water catchments). Whilst all combinations of risks and co-benefits cannot be addressed in an SPM, it would be important to avoid simplistic messages that can mislead the reader.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15362	32	33	32	36	The order of the CDR options in this point needs to be reversed. Biochar should not be the leading example. The science base is much stronger for afforestation/reforestation, particularly when GHG emissions associated with char production are included.	Government of United States of America, U.S. Department of State
15364	32	33	32	36	The statement that afforestation and reforestation "may negatively impact food production" does not adequately acknowledge that communities that live on the forest edge depend on forest ecosystems for food security. Also consider potential opportunities for ecosystem restoration coupled with agricultural production (e.g., plain ecosystem restoration coupled with bison production).	Government of United States of America, U.S. Department of State
12028	32	34	32	34	D.1.6: It's important to note that the carbon stored by afforestation and reforestation can become increasingly at risk of loss due to climate related impacts as temperature rise increases.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
842	32	34	32	35	It is not clear what biodiversity improvement means? Biodiversity itself needs restoration taking into account its natural potential for certain types of natural ecosystems. Through this, we can restore self-regulating ecosystems. This is important for GHG cycling as well, including sequestration.	Government of Russian Federation, Institute of Global Climate and Ecology

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3086	32	34	32	35	<p>The current second sentence of D.1.6 should be replaced by the revised version: "Ecosystem restoration and afforestation/reforestation sequester CO2 and may improve soil and biodiversity, but inappropriate deployment at large scale may negatively impact biodiversity and food production."</p> <p>This replacement is of key importance, as the current 2nd sentence of D.1.6 incorrectly asserts that afforestation improves biodiversity, and the sentence more broadly is oversimplified in a biased manner which fails to reflect well the data throughout the sections referenced (TS.7, 3.7, 17.3) and across other AR6 WGIII chapters.</p> <p>Specifically, stating that afforestation/reforestation improves biodiversity "but may negatively impact food production" is a biased simplification of the information in TS.7, which notes that a co-benefit of A/R could be 'improved biodiversity' but also notes that "Inappropriate deployment at large scale can lead to competition for land with biodiversity conservation and food production."</p> <p>Furthermore, the claim that afforestation improves biodiversity is not substantiated in the other sections referenced by D.1.6: Section 3.7 does not specifically address afforestation but notes that "large-scale deployment of some climate mitigation and land-based CDR measures could have deleterious impacts on biodiversity" (3.7.6.2 p. 3-108); Section 17.3 has no literature that substantiates the claim that afforestation improves biodiversity. In addition, other chapters state afforestation deployment poses risks of having negative impacts on biodiversity, 3.3.2.2 notes the "possible consequences of land use related to consequences of land use related to biodiversity loss and food security (BECCS and afforestation)"; and 3.4.6 notes "Large land transformations, such as afforestation/reforestation and widespread planting of energy crops, can have implications for biodiversity and sustainable development."</p>	Government of France, Ministère de la Transition écologique et solidaire
3382	32	34	32	35	<p>Afforestation/reforestation does not always sequester CO2 while improving soil and biodiversity. Afforestation on non previously treed ecosystems can be disastrous in terms of biodiversity. For instance in grassy biomes. This should be highlighted because it could be disastrous for policy makers.</p> <p>See section 7.4.2.2. Afforestation, reforestation and forest ecosystem restoration (Chapter 7: Agriculture, Forestry and Other Land Uses (AFOLU)): "Afforestation, when well planned, can help address land degradation and desertification by reducing runoff and erosion and lead to cloud formation however, when not well planned, there are localised trade-offs such as reduced water yield or biodiversity (Teuling et al. 2017; Ellison et al. 2017) . The use of non-native species and monocultures may have adverse impacts on ecosystem structure and function, and water availability, particularly in dry regions (Ellison et al. 2017)."</p>	Government of France, Ministère de la Transition écologique et solidaire
15366	32	34	32	35	Suggest adding "for CDR" or similar. Need to be extremely careful about characterizing all ecosystem restoration and afforestation/reforestation as CDR.	Government of United States of America, U.S. Department of State
6704	32	34	32	36	Afforestation/reforestation may have adverse impacts on ecosystem structure and function if not well-planned and include the use of non-native species and monocultures (see Ch. 7.4.2.2, p. 7-49, l. 21-30). In addition, dietary shifts could help reducing pressure on land (see Ch. 7.4.5.1, p. 7-81, l. 30-33). In summary, we suggest to rephrase as follows: "[...] quality. Ecosystem restoration and afforestation/reforestation sequester CO2 and, if well planned, using native species and avoiding monocultures, can improve soil quality and biodiversity, but need to go hand in hand with dietary shifts to guarantee food security."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9590	32	34	32	36	<p>"Ecosystem restoration and afforestation/reforestation sequester CO2 while improving soil and biodiversity, but may lead to competition for land with food production"</p> <p>As indicated in Table TS7, afforestation/reforestation may have trade-offs with food production in terms of land resources. "Negatively impact" could suggest broader effects than those regarding land resources.</p> <p>cf Trade-offs and spill over effects: Inappropriate deployment at large scale can lead to competition for land with biodiversity conservation and food production (Table TS.7)</p>	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12738	32	34	32	36	Add after "soil quality": ", provided trade-offs, not all of which may be known today, are capable of being managed".	Government of India, Ministry of Environment, Forests and Climate Change
3084	32	35	32	35	We suggest to specify after "but may negatively impact food production..." "especially in areas where land use pressure for agriculture is very high."	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11646	32	35	32	35	It should read: "... Improving soil health and biodiversity, ..."	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15368	32	35	32	35	Recommend replacing "negatively impact" with "reduce the land available for food production" to make explicit and conscribe the potential trade-off.	Government of United States of America, U.S. Department of State
5822	32	35	32	36	Suggest "but may negatively impact food production" be replaced with "but may require some agricultural land to be taken out of food production". Unless there is clear evidence of an impact on food production, it should not be assumed - it may be possible to still achieve adequate food production, for example by dietary changes and/or less food waste.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
3090	32	35	33	35	Please consider writting "improving soil quality" or " improving soil health" instead of "improving soil" alone.	Government of France, Ministère de la Transition écologique et solidaire
12736	32	35	32		Replace the word "may" by "will definitively, without scientific and technological advance,".	Government of India, Ministry of Environment, Forests and Climate Change
2398	33	0	33	0	Figure 8 includes fuel switching as a mitigation option however the synergies and trade-off for fuel switching are not included in Figure 9. Suggest an assessment of fuel switching is included in Figure 9.	Government of Australia, Department of Industry, Science, Energy and Resources
3336	33	0	33	0	In the figure, if "Bioenergy" refers to biofuels produced by agriculture, there should be tradeoff with SDG 14 and 15 (life on land and below water), due to the well-demonstrated impacts of intensive agriculture on biodiversity. This is supported by section 6.4 clearly which specifies "Large-scale bioenergy production will require more than wastes/residues and cultivation on marginal lands, which may raise conflicts with SDGs relevant to environmental and societal priorities [...] These include competition with food crops, implications for biodiversity, potential deforestation to support bioenergy crop production," (6.4.2.6. p. 6-42).	Government of France, Ministère de la Transition écologique et solidaire
3338	33	0	33	0	There needs a stronger visual to separate "synergies" from "trade-offs", the vertical line between the two could be darker or thicker. Otherwise it is not obvious that we are looking at the same SDGs in 3 different ways.	Government of France, Ministère de la Transition écologique et solidaire
3340	33	0	33	0	The difference between medium and low confidence with a small and big square is not obvious at first glance in the figure. Perhaps the two could be differentiated using shading or hatching.	Government of France, Ministère de la Transition écologique et solidaire
3342	33	0	33	0	This table is highly relevant for policy makers wishing to understand the link between the SDG framework and the Paris agreement framework. In order to improve its readability and applicability for trade-off management, it could be relevant to give a sense of the dominating direction in case of coexistence of synergies and trade-offs. Indeed, for some mitigation options the numbers, quality and magnitude of trade-offs may largely dominate the synergies - in such case, a policy-maker should be able to differentiate when a special attention should be given to a potential trade-off or when it can be considered negligible.	Government of France, Ministère de la Transition écologique et solidaire
3344	33	0	33	0	This table presents a whole series of technical measures, which are essential, but which in no way reflect the social and cultural measures necessary to put them in place: proximity, changes in practices, education, methods of using the space, solidarity, etc. Moreover, decision-makers are now looking for transversal actions that do not exist in this chapter D: for example the relationship between urban transport, urban form, housing and short circuits. A paragraph is missing on the necessary cross-functionality in decision-making in relation to climate change	Government of France, Ministère de la Transition écologique et solidaire
3346	33	0	33	0	Figure SPM.9 is quite clear and provides very policy-relevant information. We recommend to add in the caption the meaning of "no information" as done in Chapter 17, page 50 lines 40-42 : "In cases where no information about the links between specific mitigation options and SDGs are indicated, this does not imply that there are no links, but rather that the links have not been assessed by the literature."	Government of France, Ministère de la Transition écologique et solidaire
3348	33	0	33	0	Figure SPM.9 should include synergies and trade-offs of large-scale deployment of CDR measures on the different SDGs.  Such an inclusion would seem warranted by the extensive references throughout AR6 WGIII to these synergies and trade-offs (e.g. on BECCS and land-based CDR see Section 7.4.4, Section 3.7.6.2, section 12.5.3).  Such an inclusion would allow for greater societal debate on the impacts of large-scale CDR on SDGs and therefore help inform the desirability of emission reduction pathways that depend on large-scale CDR deployment.  Excluding CDR options from the analysis de facto obscures the synergies and especially the trade-offs with SDGs.	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6706	33	1	33	1	Even though there are no "trade-offs" for SDG 17, for the sake of completeness, we would like to map the column for SDG 17 for "trade-offs" as well.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14096	33	1	33	2	Please consider to reflect in the title of the figure that there are variations related to the knowledge about synergies and trade-off for different mitigation options. This is illustrated by the level of confidence, and we believe that the value of the figure is more connected to the broader picture than the synergies and trade-off for individual mitigation options. In our view the description for some of the individual mitigation options may be disputable, and therefore a qualification in the figure title may increase the acceptability of the figure.	Government of Norway, Norwegian Environment Agency
12030	33	1			Figure SPM.9: We fully support the inclusion of "fossil fuel phaseout" as a mitigation option in this figure. While the term is used throughout the report and especially in Chapter 6, it should be ensured that it is clearly defined in the glossary. The same goes for Figure SPM.10.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12032	33	1			Figure SPM.9: "healthy" diets is subjective and unclear and should be reworded (to e.g., "diets with reduced animal protein", as in Figure SPM.7). Also for this option, it is important that at the beginning of section D it is clearly outlined how the report defines "sustainable".	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12034	33	1			Figure SPM.9: Regarding the mitigation option "nuclear power" we would like to ask the authors to verify that the only trade-off is in fact with SDG6 clean water and sanitation, as it seems that the issues of nuclear waste disposal and potential fallout from a nuclear accident would have many more trade-offs including with SDG3 good health and wellbeing, SDG15 life on land, etc. Would fossil fuel phaseout not have benefits for SDG6 (clean water and sanitation) and SDGs 14, 15 and 16 (given problems associated with resource extraction)? Also for SDG5 (gender equality) there could be synergies (and possibly also trade-offs) associated with fossil fuel phaseout, bioenergy and wind, especially when considering changes in lighting and cooking fuels. Some of the results in this figure are a bit misleading, especially with regards to the confidence level for the "both synergies and tradeoffs" column. For example, shifting to bikes, ebikes and non-motorised transport has clear, well documented health benefits and yet a "medium confidence" square is placed in the "both synergies and trade-offs" column. Does this mean that there is medium confidence for both synergies and trade-offs or medium confidence that both apply? It would be good if a less ambiguous way of visualising this could be used. Please revisit!	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
430	33	1	31	1	Figure SPM.9 provides synergies and trade-offs between mitigation options and sustainable development goals, the Mitigation Options listed under Energy Systems should precisely reflect the list in the underlying chapter (Chapter 9, Page 22-48).	Government of Saudi Arabia, Sustainability Advisor to the Minister of Petroleum and Mineral Resources
1360	33	1	33	1	The heading of the figure speaks of "synergies" and "trade-offs". Would it be correct to call these "potential synergies and potential trade-offs"? Here, the implementation is probably significant for which consequences arise.	Government of Sweden, Swedish Meteorological and Hydrological Institute
4140	33	1	33	1	We have concerns with how SDG scores for Nuclear are presented, as not separating nuclear between 'existing;' and 'new' does not allow for a representative evaluation of the benefits/barriers of these energy options. Is it possible to be more specific with regards to the scope and scale of how these scores are derived? We would also like to differentiate if possible between existing nuclear designs (needing water) and new nuclear designs (such as SMRs) that may not require any water for cooling (SDG 6 is a trade-off for nuclear here and may not need to be).	Government of Canada, Environment and Climate Change Canada
5826	33	1	33	1	While this figure is caveated (context and scale dependant) I find it overly general and some of the links are unclear/mis-leading eg why does CCS have a synergy with SDG 3 on health and wellbeing?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5828	33	1	33	1	This figure is very difficult to read - the text and boxes are too small. Finding the SDG numbers are especially tricky. Would suggest the design is adjusted a little to address this. Perhaps could remove the 'Both synergies and trade-off' column and capture it in the 1st two/removing the 'Chapter source' and adding to the caption? (Seems strange to have only trade-offs for some options and SDGs (particularly given so much depends on context - other than perhaps nuclear/SDG6? E.g., for wind and solar - 6.3/4 doesn't seem to mention the trade-offs noted for SDG12 - it also seems odd that there are no identifiable synergies with responsible production at least. It is similarly odd that there are only trade offs for Afforestation, reforestation and restoration for SDGs 2 (zero hunger) and 8 (Decent work and economic growth), or for example Building design and performance for SDG9.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6190	33	1	33	1	Figure SPM.9: This figure is not easy to read. Could it be possible to move the content of the fourth column ("Both synergies and trade-offs") to the second and third ones ("Synergies" and "Trade-offs", which would then become non-exclusive)?	Government of Belgium, Belgian Science Policy Office - Belspo
6192	33	1	33	1	Figure SPM.9: This figure might be misleading, as each synergy or trade-off is either present or absent, with no nuances. Readers might take one or two lines or columns in isolation and suggest that the IPCC assessed that this or that technology is good or bad for sustainability. Consider for example trade-offs with SDG12 regarding energy systems: it is a trade-off for solar energy but not for nuclear energy; is this unambiguously assessed as such?	Government of Belgium, Belgian Science Policy Office - Belspo
6708	33	1	33	1	Figure SPM.9: The headline refers to "trade-offs associated with some option especially when implemented at scale"? What scale is meant here? We expect that the same scale is used for all mitigation options, otherwise a comparison does not make sense to us. We think a reasonable scale would be a mitigation potential of Gt of CO2. Please clearly state the scale used for this comparison. If the figure shows the synergies and trade-offs of mitigation options at different scales please add the information on the scale for each mitigation option to assure transparency of this assessment.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6710	33	1	33	1	Figure SPM.9: We would find this figure clearer if there was one column per SDG and different symbols indicating synergies/trade-offs/both. Please consider redesigning.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6712	33	1	33	1	SPM Fig. 9 - Potentially some trade-offs missing e.g. for CCS, certainly there would be more trade-offs affecting other SDG, such as SDG 15? (As stated in D2.)	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6714	33	1	33	1	There are positive synergies of 'shipping efficiency, logistics optimization, new fuels' with SDG 14: life below water, especially when ships have more efficient propellers, which have less underwater noise, and cleaner fuels, or less fuels. Please check the underlying report change the figure accordingly.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9594	33	1	33	1	The positions of the blocks of fossil fuel phaseout in Figure. SPM.9 should be replaced from synergies to tradeoffs or both synergies and trade-offs. There must be clear trade offs in phasing out of least expensive energy options particularly in developing world.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9828	33	1	33	1	Generally, the scores on SPM 9 raise many questions, suggest a high level of precision of the assessment, while at the same time being very hard to comprehend for policy makers. E.g. why is CCS under energy the only option with a trade off with poverty reduction, while this is not the case under industry? Moreover, it is not clear if/what trade-offs are policy dependent. Generally, it seems more useful to have a more simple table qualitatively indicating the most salient opportunities and risks for SDG of the various (main) mitigation options if applied at an effective scale, including dependency on location and policy implementation.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
14110	33	1	33	1	Figure SPM9. In our view, for CCS there are more relevant synergies and trade-off associated with SDGs than currently listed in this figure. Please consider if this study regarding CCS and the SDGs was published by IEA GHG Desember 2020 could be a valuable source of information to the figure SPM9. Reference: IEAGHG Technical Report 2020-14 December 2020 Carbon Capture and Storage and the Sustainable Development Goals - [ref: <a href="http://documents.ieaghg.org/index.php/s/YKm6B7zikUpPqGA?path=%2F2020%2FTechnical%20Reports">http://documents.ieaghg.org/index.php/s/YKm6B7zikUpPqGA?path=%2F2020%2FTechnical%20Reports</a> ]	Government of Norway, Norwegian Environment Agency
14116	33	1	33	1	We highly appreciate the "Chapter source"- references to where you can read more about the sectors in figure SPM.9. We also like how the sectoral and system mitigations options are more structural divided here. Perhaps this division can be used in figure SPM. 8 as well?	Government of Norway, Norwegian Environment Agency
14118	33	1	33	1	Please separate "forest management" and "fire management" and highlight that this is about "sustainable forest management" .	Government of Norway, Norwegian Environment Agency
14120	33	1	33	1	Please increase th readability by making the horizontal lines more visible.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15370	33	1	33	1	Under "Transport", Biofuels tradeoff with "Life on land" should be labeled as "High confidence" rather than "Medium confidence", so that it aligns with the findings of Figure 10.23 in Chapter 10 (page 10-95). Chapter 10 states with high confidence that impacts on land use and biodiversity are barriers to biofuel deployment.	Government of United States of America, U.S. Department of State
15372	33	1	33	1	Figure SPM.9 should address SDG Goal 16 synergies and trade-offs (e.g., access to justice) respecting indigenous and local communities.	Government of United States of America, U.S. Department of State
15374	33	1	33	1	The Transport and Industry sections of this Figure SPM.9 come across as incomplete. Some of the synergies aren't apparent and aren't described in detail in the associated chapters, and it seems like insufficient trade-offs have been identified. For instance, it's unclear how "electric light duty vehicles" would support the "no poverty" goal, or how electrification in industry would support "zero hunger". More of the options would have "affordable and clean energy" as a trade-off (e.g., CCS) since many of them will increase the price of energy. Chapter 11 actually states that CCS puts SDG 7 at risk. Also, having a category under Industry on "fuel switching" would be good.	Government of United States of America, U.S. Department of State
15376	33	1	33	1	Nuclear Power in the Figure SPM.9 should have synergies with SDG 7, especially as small modular nuclear reactors are a useful solution to ensure affordable energy access for all.	Government of United States of America, U.S. Department of State
15378	33	1	33	1	It seems surprising that the entire ""trade-offs"" section is blank for Industry: (1) Low carbon fuels/feedstocks is missing as a driver in the list, and the trade-offs for the use of those materials are the same as use of biofuels in aviation (for example). (2) Industrial CCS will certainly have trade-offs; for example, ""Life on land"" could be affected by the large scale build out of CCS infrastructure.	Government of United States of America, U.S. Department of State
6716	33	1	33	2	In this figure for several mitigation options trade-offs with SDGs are missing and should be added. Bioenergy: trade-offs with SDG 15 "life on land" (see Ch. 6.4.2.6, p. 6-42, l. 11-18, implications for biodiversity, potential deforestation to support bioenergy crop production). Afforestation, reforestation, restoration: trade-offs with SDG 15 "life on land" (see Ch. 7.4.2.2, p. 7-49, l. 25-28, biodiversity trade-offs from afforestation). In addition, please explain in the caption why some boxes are empty.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6718	33	1	33	2	While Ch.6 states that health impacts from the normal operation of nuclear power plants are comparable to renewables (see 6.4.2.4, p.6-35, ll. 41-42), it also acknowledges the low but highly detrimental potential for major nuclear accidents and radiation exposure (ll. 25-26), especially with conventional nuclear power plant designs. Against this background, as well as given the recent price trends observed, it is recommended that trade-offs of nuclear energy with "good health and well-being" and with "affordable energy" are acknowledged here.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6982	33	1	33	2	The fossil fuel phaseout option included here represents a critically important assessment. The term should be clearly defined and explained here. The synergies assessment would need to be expanded though to include clean water (SDG6), life on land (SDG15) and below water (SDG14) resulting from ceasing to extract fossil fuels from an environment (esp. e.g. brown coal, tar sands)?	Government of Jamaica, Meteorological Service Division
6984	33	1	33	2	It would seem that the tradeoffs with nuclear power would go beyond SDG6, e.g. extend to SDG14 and SDG15 considering storage/disposal implications of radioactive waste?	Government of Jamaica, Meteorological Service Division
9596	33	1	33	2	Regarding all transport options, this exhibit shows there are synergies with SDGs 17. However, all of transport options do not have any direct effect on the SDGs 17 neither receive positive feedback from the SDGs 17. All of these check boxes should be removed.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9598	33	1	33	2	Regarding all transport options, this exhibit shows there are both synergies and trade-offs with SDGs 16. However, all of transport options do not have any direct effect on the SDGs 16, neither receive positive feedback from the SDGs 16. All of these check boxes should be removed.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9600	33	1	33	2	Chapter 10 says " Growing concerns about resource availability, labour rights, non-climate environmental impacts, and costs of critical minerals needed for LIBs." At the column of trades offs of electric light duty vehicles, there should be check boxes at SDGs 8,10, and 15.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9602	33	1	33	2	The positions of the blocks in Figure. SPM.9 should be reconsidered in comparison with the main text of the current assessment. For instance, according to this figure, there are both synergies and trade-offs between "Wind energy" and "Hydropower" vs. SDG14 (Life below water) and SDG15 (Life on land). In contrast, the section of 6.4.2.2 "Wind Energy" in the main text of the assessment mentioned just negative impacts on biodiversity between L25 on P6-30 and L13 on P6-31. Likewise, the section of 6.4.2.3 "Hydroelectric Power" mentioned only negative impacts on biodiversity between L19 and L34 on P6-33. Thus, we are not sure what are the synergies between "Wind energy" and "Hydropower" vs. SDG14 (Life below water) and SDG15 (Life on land). If the main text cannot mention such synergies, the blocks on the figure should be moved from the column of "both synergies and trade-off" to those of "Trade-offs", though the confidence degree could be simultaneously changed.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11648	33	1	33	2	Fig SPM.9 has a number of counter-intuitive relationships (or missing ones), including: * It is unclear why "bioenergy" and "biofuels have drastically different profiles, when the latter is part of the former. * Specifically, why would "bioenergy" have a negative impact on hunger with medium confidence, whilst biofuels a mixed impact with low confidence? If a difference can be argued at all, one could expect the opposite. * Why would afforestation have a negative impact on decent work and/or growth, rather than positive or at least mixed? * Whys is CCS in energy so different (and more negative) than CCS in industry? * Why would CCS (in industry) have no trade-offs with SDGs other than health (and why would health be a mixed impact)?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11650	33	1	33	2	Fig. SPM.9. Surprising that 'shift to bikes ...' should not improve good health...Please check!	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13066	33	1	33	2	More info and clarity on the synergies specifically as regards SDG 17 and some of the sectors such as AFOLU. This is relevant for LDCs.	Government of Gambia, Department of Water Resources
13398	33	1	33	2	It would be good to have an explanation about the lack of synergies for 17 in energy systems and AFOLU particularly because there are gaps here with data paucity especially in developing countries such as Kenya and others.	Government of Kenya, Kenya Meteorological Service
14112	33	1	33	2	Please add sustainable forest management to the figure (see e.g. box 7.11)	Government of Norway, Norwegian Environment Agency
14114	33	1	33	2	Figure 9 – We would appreciate an explanation related to why bioenergy has no trade-offs with SDG 15-Life on land. Could this not be indicated as "trade-offs" or "both synergies and tradeoffs"? Section D2 says "However, land and aquatic ecosystems can be adversely affected by mitigation actions, depending on their implementation, especially if deployed at a large scale" but this seems not to be reflected in figure 9 which has trade offs for SDG 15 only indicated for two mitigation options. One of them is "Biofuel", but e.g there is no trade off for "Bioenergy". Could this please be clarified in the figure caption?	Government of Norway, Norwegian Environment Agency
14244	33	1	33	2	In the figure SPM.9, in accordance with the underlying report, we think that the nuclear should be shown as in synergy with the No poverty, Clean water and sanitation, Affordable and Clean Energy, Decent work and economic growth, Climate action, Life on land objectives. - With regard to Industry, innovation and infrastructure, we do not understand why nuclear is a tradeoff.	Government of Romania, National Meteorological Administration
5830	33	1	33	3	The concern with the description/title of SPM.9 on Page SPM-33 is that it does not explicitly state that the table makes the assessment against SDG13 - Climate Change. For example, the casual observer would not identify that the synergies columns have all SDGs except SDG13. It is proposed to provide increased clarity the title is changed to: 'Mitigation (SDG13 - Climate Change) options have synergies with the other 16 Sustainable Development Goals, but there are trade-offs associated with some options especially when implemented at scale. The synergies and trade-offs vary widely and depend on the context.'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15380	33	1	33	3	The synergies column in Figure SPM.9 seems to only place renewables under "clean and affordable energy". Without a definition or criteria, this could leave out technologies like nuclear and CCS that are very likely to play important roles in a decarbonized electricity sector.	Government of United States of America, U.S. Department of State
2188	33	1	34	29	The Fig. SPM.9 is quite complex and takes lots of time to digest. Please consider if it could be simplified in order to convey central messages more efficiently. As an example, modification towards the Fig. SPM.4 in SR1.5 would improve the readability. However, maybe many interesting linkages could be lost with that kind of change and thus please consider if some more sophisticated analysis would enhance the main messages and still sustain the elements/data contained in the current figure.	Government of Finland, Finnish Meteorological Institute (FMI)
9592	33	1	34	29	Since the rationale is unclear, it should be clearly stated how synergies, trade-offs, and synergy trade-offs were classified.As in SR1.5, if the classification was based on the number of papers, it should be clearly stated.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
15382	33	1	34	31	Not clear what the reader is meant to glean from this Figure SPM.9, given the confidence scales are somewhat low and the "synergies" trade-offs are very context-specific.	Government of United States of America, U.S. Department of State
15384	33	1	34	31	Suggest redoing Figure SPM.9 using different icons for synergies vs trade-offs versus both synergies and trade-offs. For example, use squares, circles, and diamonds. This way all the SDGs need to be displayed only once as column headings, instead of displaying a partial list of the SDGs under the trade-offs and synergies and trade-offs categories.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15386	33	1	34	31	Figure SPM.9 represents an ambitious attempt to summarize a great deal of information, but it does not succeed in providing a clear, unambiguous, and accurate synthesis that could/should be usable by policymakers and other readers. The value of a table or figure is in making complex information simple and easy to understand for the non-expert reader, and Figure SPM.9 does not serve that purpose. Meeting these standards, including assuring its accuracy through peer review, is not achievable in the time available for adoption of the WGIII AR6 SPM. First, the table is very difficult to read and to understand, in large part because of the volume of information it tries to provide. Second, many of the individual entries are debatable, or are incomplete, and it is unclear that the underlying chapters contain sufficient information to support entries more comprehensively and accurately conveying all the relevant synergies and trade-offs in a wide array of pertinent contexts. Some of the categories in the table are so broad as to be uninterpretable (e.g., "Life on land", "Industry, innovation, and infrastructure"), while others include unscientific, subjective notions (like "responsible consumption" and "decent"). None of the individual items can be understood without referring to the underlying chapters, defeating the purpose of summarizing it in the SPM. The table has not been through earlier expert and public reviews but is being unveiled for the first time in this draft. In light of these concerns, and in the interest of shortening the SPM, strongly recommend deleting Figure SPM.9.	Government of United States of America, U.S. Department of State
12272	33	6	33	45	It is better to compare the methods in a table.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12270	33	37	33	38	It is better to visualize the result in a diagram.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
4144	33		33		Does this figure need a combined synergies and trade-offs column? It might be easier to see whether there are synergies and trade-offs and the different confidence levels.	Government of Canada, Environment and Climate Change Canada
13578	33				The option "fossil fuel phaseout" is very welcome and will be supported. However, we would like to propose that the assessment is reviewed, as we would see further areas of synergies, particularly with SDGs 6, 14, 15, and potentially others.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13580	33				There are several points with regards to the assessment of the nuclear power mitigation option that requires reassessment in our view. That there is only one area of trade-offs, with SDG6, seems unlikely given potential dangers from disposal of nuclear waste or nuclear accidents, which would pose trade-offs with several other SDGs.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
4142	33		33		In Figure SPM.9 the relationships with SDGs can be puzzling. For example, it is not clear how CCS compromises "No poverty" and bioenergy compromises "clean water and sanitation". Could it be that these relationships were not all based on equal amounts and diversity of evidence? Maybe important to revisit if time permits.	Government of Canada, Environment and Climate Change Canada
11652	33		33		The Transport category does not include waterborne transport, which should be added.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11654	33		33		Circular economy has synergies with SDG14.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11656	33		33		Figure SPM 9 is extremely difficult to get an overview of.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12740	33		33		Delete Figure SPM 9. Redesign and replace by an understandable and less cluttered presentation. Also, the synergies and trade-offs of mitigation options with the SDGs seems to be contextual to the global north. The table is not a comprehensive representation of the synergies and trade-offs.	Government of India, Ministry of Environment, Forests and Climate Change
9604	34	1	34	1	According to our understandings, this table does not show the comprehensive assessments on synergies and trade-offs, but does show the synergies and trade-offs described in this WG3 AR6. It would be better to add this point at the note, and to change the figure captions to "(...) mitigation options and the SDGs described in this report."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9830	34	1	34	1	In focusing on the SDG implications of individual mitigation options, the overall trade-offs and synergies of different mitigation strategies are not well covered in SPM.9. These are clearer from the illustrative scenarios and evaluating these against SD goals could better indicate trade-off and synergies. Could these be added to the Figure?	Government of Netherlands, Ministry of Economic Affairs and Climate Policy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3350	34	5	34	6	The key point "overlaps may exist in the mitigation options assessed and presented by sector and system, and interlinkage with the SDGs might differ depending on the application of that option by sector" should be emphasised more clearly in the main text and decision to decision-makers.	Government of France, Ministère de la Transition écologique et solidaire
2148	34	8	34	10	Please explain more about the context and scale of implementation that create the property of interactions of mitigation options and SDGs. The policy makers will get benefits if they have some idea that which factors are main driver of synergy, trade-off or both.	Government of Republic of Korea, Korea Meteorological Administration
6720	34	8	34	10	This information is very clearly reflected in the legend of the figure and can be omitted from the caption, as it does not contain any additional information.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2150	34	12	34	15	In this context, what does confidence level mean? High confidence means the strong effect of synergy and trade-off? I understand that the confidence level explain the robustness of this analysis. Can we have some indicators that show the degree of interactions, in other words, can we show how big the synergy or trade-off?	Government of Republic of Korea, Korea Meteorological Administration
4146	34	12	34	12	Figure SPM.9: Suggest noting here why SDG 13 is omitted from the table (the climate action SDG).	Government of Canada, Environment and Climate Change Canada
1362	34	13	34	13	The "solidity" sounds a bit strange. "Degree of filling" or suchlike might be an option.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
5832	34	14	34	15	Do the confidence levels refer to the potential for these synergies or trade-offs? Could the wording be changed to clarify this please. Can anything be said about the magnitude of the synergy/trade-off (similarly to SPM4 in SR1.5)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9606	34	17	34	26	There is still concern that Figure SPM.9 oversimplifies the assessment of mitigation options. This figure does not indicate that the magnitude and severity of trade-offs varies from region to region. It may lead readers to underestimate the large potential of synergies due to small-scale trade-offs. Therefore, it may be better to add the following sentence at the end of this paragraph. It should be noted that the figure does not indicate the scale of synergies and trade-offs.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
13310	34	18	34	26	The sentences starting with "In particular, ...and their specific contexts." are less of a description of the figure but more so an interpretation and analysis. If ist the latter then the authors should consider adding that information into the text. This information is not suitable for a figure caption.	Government of Switzerland, Federal Office for the Environment FOEN
14122	34	20	34	20	Please consider to add sustainable forest management to the caption text.	Government of Norway, Norwegian Environment Agency
5834	34	23	34	23	Replace 'avoiding' with 'reduce or avoid'. The rationale for this is that for infrastructure investments there will never be an absence of trade-offs, such as use of steel or concrete, and it must be emphasised that investment decisions will always need to be weighed against the synergies and trade-offs in an increasingly complex system of causes and impacts, compounded against a widening gap of investments needed across all the other 16 SDGs.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5836	34	24	34	24	Replace 'relate to' with 'include' because there are many other trade-offs and synergies, so the examples are indicative, not provided in totality. It is therefore suggested 'include' is used as a more accurate replacement.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11658	34	28	34	29	Add XWG Box 3 in Chapter 12 to the list related to the figure caption.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
3352	34	28	34	28	A reference to Fig. TS.29 could be added (see page TS-134)	Government of France, Ministère de la Transition écologique et solidaire
444	35	0	36	0	The following statement from CH7 P121 L24-25 "Nature-based solutions (NbS) with safeguards has immense potential for cost-effective adaptation to climate change; but their impacts will vary by scale and contexts (high confidence)." must be added to the SPM as demonstrates the potential of NbS.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
446	35	0	36	0	The following statement from Ch8 P25 L20-21 "As for trade-offs, some mitigation efforts may increase exposure to stressors such as flooding and the urban heat island (UHI) effect (see Glossary), thereby reducing the adaptive capacity of citizens." must be added to the SPM as it demonstrates possible implications of mitigation efforts.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
448	35	0	36	0	The following statement from Ch8 P25 L23-25 "There are also concerns that some mitigation efforts may diminish adaptive capacity of urban poor and marginalized groups through increasing costs of urban services and/or eroding livelihood options." must be added to the SPM as it demonstrates concern of the negative impacts of mitigation efforts on marginalized groups.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
450	35	0	36	0	The following statement from Ch8 P25 L25-27 "Environmental policies designed to meet mitigation targets through phasing out old vehicles may erode livelihood options of poor households, thereby decreasing their adaptive capacity (Colenbrander et al. 2017). " must be added to the SPM as it demonstrates concern of the negative impacts of mitigation efforts on marginalized groups.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
454	35	0	36	0	The high confidence statement included in the Technical Summary Page 142 Lines 15-16 should be added to the paragraph to address equity and justice along the transition to sustainability. "Accelerating the transition to sustainability will be enabled by explicit consideration being given to the principles of justice, equality and fairness (high confidence)."	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
3094	35	1	35	1	The term co-benefit, present above, could be reintegrated in the sentence "mitigation actions are strongly linked to adaptation"	Government of France, Ministère de la Transition écologique et solidaire
3096	35	1	35	1	The sentence "mitigation actions are strongly linked to adaptation" may give the impression that mitigation benefits from adaptation. it should be clear that in most case, mitigating now is adapting tomorrow.	Government of France, Ministère de la Transition écologique et solidaire
5840	35	1	35	1	Use of "strongly linked" in the first sentence could be read as implying mitigation actions always have adaptation potential and vice versa which is not the case. Is it trying to convey that "Mitigation actions can have adaptation potential or imply the need for additional adaptation" (which the following text implies) in which case suggest rephrasing or removing.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9832	35	1	35	1	D.2: It can be questioned if the link between mitigation and adaptation is indeed as strong as stated. Only part of the mitigation options fit in adaptation and there are clear trade-offs as well (e.g. more fossil fuel use due to enhanced air conditioning). Proposed text: There are many opportunities to integrate mitigation and adaptation options.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
15388	35	1	35	1	Insert "some" before "mitigation" since, as stated, it is not universally true.	Government of United States of America, U.S. Department of State
6722	35	1	35	26	Please include one introductory sentence explaining the choice of examples: Paragraphs D.2.1-2.3 focus on urban, land and biodiversity in a detailed manner, whereas other sectors (health,...) are not mentioned.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12742	35	1	35	3	Delete first three sentences of D 2. Replace by " The burden of adaptation depends on the extent of rapid and effective mitigation action, which is exacerbated by inter-regional distributions of both with high vulnerable regions with high adaptation needs and substantial development deficits being distinct from regions whose high mitigation action is necessary".	Government of India, Ministry of Environment, Forests and Climate Change
742	35	1	35	31	Considering the limited subjective and objective capacity of countries to act and the impact of the COVID-19, the future uncertainty remains high. Therefore, compared to mitigation, this report should further elaborate on adaptation measures and actions. It is suggested to add descriptions of urban resilience for populated urban areas.	Government of China, China Meteorological Administration
6724	35	1	35	31	D.2 seems to be formulated very generic. We would encourage the authors to give policymakers more advice on integrated policy designs and in enhancing strategic decision making by linking mitigation with adaption (and other SDG goals). Esp. Chapter 13 offers some opportunities here.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6726	35	1	35	31	To give more advice on integrated policy design we propose to add at least the conclusion from TS p112 line 23-29, respective ES in Chp13: "The co-benefits and trade-offs of integrating adaptation and mitigation are most usefully identified and assessed prior to policy making rather than being accidentally discovered (high confidence). This requires strengthening relevant national institutions to reduce silos and overlaps, increasing knowledge exchange at the country and regional levels, and supporting engagement with bilateral and multilateral funding partners." .. {13.8} - Suggestion to add on SPM-35 after Line 7	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6728	35	1	35	31	We see the need to give more strategic advice on linking adaptation and mitigation. Therefore, we suggest to add the conclusion with very high confidence from Chapter 8, ES, P8-5, Line 27-33: "Given the dual challenges of rising urban GHG emissions and future projections of more frequent extreme climate events, there is an urgent need to integrate urban mitigation and adaptation strategies for cities to address climate change and withstand its effects (very high confidence). Mitigation strategies can enhance resilience against climate change impacts while contributing to social equity, public health, and human well-being. Urban mitigation actions that facilitate economic decoupling can have positive impacts on employment and local economic competitiveness." We suggest to add on SPM-35 straight before SPM D.2.1 .	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11660	35	1	35	31	D.2 - it is a good opportunity to also include the options that are also with strong biodiversity co-benefits.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
3092	35	1	35	5	Authors should consider harmonizing terms 'mitigation actions' 'response options' 'mitigation options', or further (1) justify why such different terms are used in the same paragraph in a seemingly interchangeable way, or (2) better explain the differences between these terms.	Government of France, Ministère de la Transition écologique et solidaire
4148	35	1	35	7	Mitigation and adaptation are linked in terms of approaches and also in terms of effectiveness. At higher GWLs, adaptation and adaptation approach such as ecosystem based approaches becomes less effective. Consider reflecting some GWL scenarios in the synergies and trade-offs.	Government of Canada, Environment and Climate Change Canada
5838	35	1	35	7	It is unclear what the focus of this section is - is it synergies and trade-offs between adaptation and mitigation? Or mitigation risks and trade-offs for biodiversity? Feels like the latter would work better in D.1. (as would D.2.3).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12282	35	1	35	7	Ch5.P62-63.L36-5. It can be argued that the benefit of shared accomodation relies in the fact that each individual uptakes smaller space regardless of the sharing nature, In this case, the same outcome can be obtained by smaller housing.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
13312	35	1	35	7	This para or subsection D.2 refers to the relationship between mitigation and adaptation. We miss a comparison between the costs of mitigation vs. the costs of adaption.	Government of Switzerland, Federal Office for the Environment FOEN
14124	35	1	35	7	The summary focuses on the possible adverse effects of mitigation responses, but adaptation programs (implementing without safeguards) can also negatively affect people and nature. For example, some adaptation programs may benefit one group to the detriment of another—as might be the case for coastal fortifications that protect one community while exposing another to a greater risk of erosion and flooding. Source: UNEP report: climate_change_and_human_rights.pdf (columbia.edu). Please consider to include this perspective.	Government of Norway, Norwegian Environment Agency
15390	35	1	35	7	There are two problems with the D.2 header. First, it omits the key point that the more one mitigates the less one needs to adapt. Second, it's useful to highlight a cross-sectoral approach to capitalize on synergies and minimize trade-offs.	Government of United States of America, U.S. Department of State
14126	35	1	36	13	Where possible, it would be useful if the SPM draw a line from important findings regarding natural ecosystems and the nexus between ecosystem-based management, ecosystem conservation and natural carbon uptake and storage in the reports/SPMs of WGI and WGII to the WGIII SPM.	Government of Norway, Norwegian Environment Agency
14128	35	1	36	13	It would be useful if important themes listed below could be better addressed with quantifications and scientific evidence/findings in the SPM: 1) cross-benefits of conservation and restoration measures and carbon uptake and storage, 2) the importance and potential for carbon uptake and storage in coastal and marine ecosystems, e.g. contributions from conservation and restoration measures., and 3) nature-based solutions and ecosystem-based solutions and services's potential for contributing to mitigation of climate change.	Government of Norway, Norwegian Environment Agency
438	35	1	36	14	In Chapter 17, L15-18, Pg. 4, states "A strong link exists between sustainable development, vulnerability and climate risks, as limited economic, social and institutional resources often result in low adaptive capacities and high vulnerability, especially in developing countries. Resource limitations in these countries can similarly weaken the capacity for climate mitigation and adaptation." This text should be included in the SPM, as it discusses resource limitation in developing countries in the capacity for climate mitigation and adaptation.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
440	35	1	36	14	In Chapter 17, L30-32, Pg. 5 states "The urgency of mitigation might overshadow some of the other priorities related to the transition, like climate change adaptation and its inherent vulnerabilities." This text should be included in the SPM, as it discusses the implications of mitigation related to transition.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
826	35	2	35	2	Suggestion: to replace 'and land management' with 'and land management, including nature protection measures'	Government of Russian Federation, Institute of Global Climate and Ecology
1364	35	2	35	2	In order to acknowledge also water-related mitigation (such as preservation and restoration coastal ecosystems, not least: salt marshes, mangroves, kelp forests, seagrass meadows), "land management" could be amended to "land and water management", as appropriate. Albeit small global potential, they can be rather significant in many regions, and carry a number of co-benefits.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
5842	35	2	35	2	I'm not sure what is meant by 'settlements and land management' - the settlements management bit is confusing or very broad. Does it mean any form of human housing anywhere, or is this specifically referring to urban areas or communities? It would be useful to be clearer here.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5844	35	2	35	3	Would be simpler to say "Mitigation limits global warming and associated risks to biodiversity, however, land and ..."	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6730	35	2	35	3	"Deploying mitigation options also limits global warming...." is somewhat of a given :). In order to stress the interaction with biodiversity, please consider re-phrasing "Also, deploying mitigation options both limits global warming and associated risks to biodiversity."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15392	35	2	36	13	D.2 and D.3 should address the importance of engaging indigenous and local communities, and integrating indigenous and local knowledge, in the choice of mitigation options, particularly to optimize adaptation co-benefits, capture synergies, minimize adverse impacts of mitigation actions, avoid trade-offs, and ensure just and equitable transition.	Government of United States of America, U.S. Department of State
5846	35	3	35	3	The primary purpose of mitigation options is to limit warming, so it sounds a bit odd to say they 'also' do that. Could just say 'several mitigation options can also deliver adaptation outcomes, especially in settlements and land management. Mitigation options can help reduce risks to biodiversity through limiting global warming; however, depending on the scale and implementation of mitigation options, ecosystems can also be adversely affected.'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15394	35	3	35	3	Need to change global warming to climate change (since referring to more than just temperature) and add something about adaptation to the third sentence ending on this line to tie it into the topic of Section D. Add: "Deploying mitigation options also limits climate change and associated risks to biodiversity, and potentially reduces adaption needs."	Government of United States of America, U.S. Department of State
14130	35	3	35	7	Very important points, please keep.	Government of Norway, Norwegian Environment Agency
3098	35	4	35	4	We suggest to mention that "land and aquatic ecosystem can be adversely affected by mitigation actions..." because of the competition	Government of France, Ministère de la Transition écologique et solidaire
12710	35	5	35	5	Line 5: Replace "high confidence" with "medium confidence" Reason: Confidence level mentioned as "high confidence" is not supported by level of confidence as mentioned in the referred sections 3.7. In the referred cross-reference chapter 3, section 3.7, the sub-section 3.7.6.2. (line 21 to line 23; page 3-110), it states that "large-scale deployment of some climate mitigation and land-based CDR measures could have deleterious impacts on biodiversity (Santangeli et al. 2016; Hof et al. 2018)", but without any mention of confidence level. However, initial remarks in the section 3.7, precisely in the sub-section 3.7.1 (line 21 to line 25; page 3-99), where it is mentioned with "medium confidence" that areas of trade-offs for mitigation actions include food access, habitat loss and mineral resources, which is further supported by the example of mitigation efforts requiring large quantities of CDR (depending upon type & usage), negatively impacts both food availability and areas for biodiversity. Also, the subsequent sub-section remarks in the SPM, section D.2.3 indicates "medium confidence" for large scale deployment of mitigation efforts such as bioenergy biochar, and afforestation reduces biodiversity and adaptive capacity, if not carefully managed (however, risks and impacts are scale and context specific). Hence, this particular statement (SMP-35, Line 3 to Line 5) w.r.t. adverse impact of mitigation actions on land and aquatic ecosystem should be labelled separately with "medium confidence".	Government of India, Ministry of Environment, Forests and Climate Change
1366	35	6	35	7	Trade-offs and synergies also beyond mitigation and adaptation would seem to be relevant to mention here, for example protection of biodiversity and ecosystems.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute



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11662	35	7	35	7	Add XWG Box 3 in Chapter 12 to the list	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12334	35	8	35	14	In explaining the concept of productivity in the agricultural sector, it is necessary to provide points about virtual water and its effects on adaptation to climate change.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12336	35	8	35	14	Relationships between international conventions on the protection of wetlands, which have been ratified by the international community over the past decades, should be mentioned in this section.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
3100	35	8	35	10	We suggest to add at the end of first sentence "depending on the context"	Government of France, Ministère de la Transition écologique et solidaire
6732	35	8	35	10	Please consider adding the term "nature-based solutions as well as a mix of grey and green infrastructure" to not only refer to specific examples but highlight the broad range of options available here. Perhaps it could read something along the lines: "Nature-based solutions as well as a mix of green and grey infrastructure e.g. green roofs, green facades, networks of parks and open spaces, protection of urban forests and wetlands, urban agriculture, and water-sensitive design can deliver both mitigation and adaptation benefits in settlements." (compare p.43 II.8-9)	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12712	35	8	35	10	This particular statement should be labelled separately as "medium confidence". Reason: Green roofs, green facades, networks of parks and open spaces, protection of urban forests and wetlands, urban agriculture, and water sensitive are a subset of urban NBS (urban green and blue infrastructure). Confidence level mentioned as "high confidence" for this particular statement is not supported by the level of confidence in most of the text mentioned in the referred sections 8.2 or 8.4. However, as stated in the referred cross-reference chapter 8, section 8.4, sub-section 8.4.4.1. (line 8 to line 12; page 8-66) where it is mentioned as medium agreement with limited evidence, for mitigation co-benefits for urban trees. Also, coming to sub-section 8.4.4.2 (page 8-70)- "Benefits of green roofs, green walls, and greenways", it mentions low evidence for emissions reductions from urban NBS mitigation measures in terms of soft solutions such as improving green connectivity for cycling.	Government of India, Ministry of Environment, Forests and Climate Change
14134	35	8	35	11	Please keep the following sentences in SPM D.2.1: "Green roofs, green facades, networks of parks and open spaces, protection of urban forests and wetlands, urban agriculture, and water-sensitive design can deliver both mitigation and adaptation benefits in settlements. These options can also reduce flood risks, pressure on urban sewer systems and urban heat island effects. [...]"	Government of Norway, Norwegian Environment Agency
5848	35	8	35	14	There could be a better distinction between adaptation and mitigation activities. "There could also be trade-offs" is preceded by a discussion of adaptation actions with mitigation benefits but is followed by deployment of conventional air conditioning systems, which is purely an adaptation action.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5850	35	8	35	14	Reduction in flood risks etc. are examples of adaptation outcomes mentioned in the first sentence, rather than something they 'also do' (could just remove 'also') - perhaps the mitigation benefits could also be articulated. Would it also be possible to mention health and biodiversity synergies? It is not immediately clear how bio-materials relate to settlements, please could you clarify.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11664	35	8	35	14	The measures listed here seem primarily related to adaptation (which is a good thing of course). But do they really provide significant mitigation benefits? If so, it would be useful to explain this (e.g. does urban greening provide significant reductions in energy use for heating and cooling?).	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14132	35	8	35	14	This paragraph deals with factors that often are referred to as "naturebased" or "ecosystem-based". Even though the definitions of these terms are sometimes debated, we believe it would be preferable to include and refer to these terms here even so, (e.g. with footnote explaining a bit more about the discussions) rather than avoiding them.	Government of Norway, Norwegian Environment Agency
15396	35	8	35	14	Several mitigation actions that are strongly linked to adaptation are listed here. This may be captured under "water-sensitive design" but arguably from a transportation perspective reducing the area of land dedicated to surface parking would likely fall squarely into the example actions included. Suggest adding a parenthetical example "water-sensitive design (e.g., attention to surface permeability)" in order to address.	Government of United States of America, U.S. Department of State
3102	35	8	35	8	Please consider modifying for: "Green roofs and green facades in climatic regions that allow it"	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5852	35	9	35	9	Add 'are examples that' before 'can deliver both mitigation and adaptation benefits in settlements'. The addition of 'are examples that' is proposed to ensure balance with 'these options' in line 10, that might be interpreted by the reader as being a finite list – thus accuracy is increased to emphasise that the list provides a reference group of ideas to help explain the described concept.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2486	35	10	35	11	The options listed in the previous sentence cannot reduce flood risk in general. However, those can influence and reduce pluvial flood risks. Therefore, we suggest to write: These options can also reduce pluvial flood risks, pressure on urban sewer systems and urban heat island effects.	Government of Hungary, Ministry of Innovation and Technology - Climate Policy Department
3104	35	10	35	11	We suggest to replace the sentence "These options can also reduce flood risks, pressure on urban sewer systems and urban heat island effects" by "(...) in settlements. These options can also reduce urban runoff events, pressure on urban sewer systems and urban heat (...)", because the above development options are primarily concerned with reducing urban runoff and not with reducing overall flood risk.	Government of France, Ministère de la Transition écologique et solidaire
6734	35	10	35	11	Please consider not only referring to "flood risks" but also "drought risks" here as green infrastructure can also act as water storage. The options named here contribute to climate resilience and water security. Suggestion: "These options can also reduce flood and drought risks, pressure on urban sewer system... They help to enhance climate resilience and water security in urban areas." (compare p.33, figure SPM.9 naming of SDGS related aspects).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15398	35	10	35	13	Better describe the benefits and costs of actions with mitigation-adaptation synergies. Be explicit about what the benefits and costs are for both mitigation and adaptation.	Government of United States of America, U.S. Department of State
5854	35	12	35	13	This is not necessarily a trade-off if its non-fossil energy sources involved so perhaps insert "fossil-fuel based" before "energy consumption".	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11666	35	12	35	13	The use of the air conditioning example should be re-considered. Is it really an exemplary adaptation action? The WG2 SPM seems to define any adaptation that increases emissions as "maladaptation". On the other hand, how significant would air conditioning emissions be in a sustainably electrified future? Or could the need for conventional air conditioning be substantially reduced through smarter building design and urban planning. The air conditioning reference in D2.1 should either explore some of these issues, or else be omitted.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15400	35	12	35	13	For the air conditioning example, it is unclear how this is mitigation (but clear how this is adaptation). Suggest revising to: "For example, conventional air conditioning systems, if deployed widely as an adaptation action, could significantly increase energy consumption and households' electricity expenditure."	Government of United States of America, U.S. Department of State
550	35	12	35	14	The sentence structure here implies that the example should be related to trade-offs between mitigation and adaptation measures. The current example on conventional air conditioning systems (referenced from Chapter 3.7.4.2) does not adequately explain the trade-offs between mitigation and adaptation benefits. Suggest to reframe it such that: "For example, conventional air conditioning systems, if deployed widely, could provide relative thermal comfort, but, significantly increase energy consumption and household's electricity expenditure."	Government of Singapore, Ministry of Environment and Natural Resources
2078	35	12	35	14	Using the air-conditioning deployment as an example does not seem a good example to understand the trade-offs of mitigation strategies.	Government of Republic of Korea, Korea Meteorological Administration
2400	35	12	35	14	Suggest rephrasing to make it clearer the trade-off described is between mitigation and adaptation rather than between comfort and cost. Suggest: 'For example, adapting to hotter climates through widespread adoption of conventional air conditioning systems could significantly increase emissions through refrigerant leaks and higher energy consumption in regions reliant on fossil fuel-powered electricity.'	Government of Australia, Department of Industry, Science, Energy and Resources
4150	35	12	35	14	We feel this statement does not merit the inclusion of a high confidence qualifier. It is simply giving an example of a situation with potential trade-offs and states that IF conventional air conditioning is widely deployed, it could increase energy consumption and costs. We believe this is a conditional statement of fact.	Government of Canada, Environment and Climate Change Canada
1144	35	13	35	13	The text should not conflate energy use with wasteful or unnecessary activity. Use of the term "conventional" is doing a lot of heavy lifting here, the energy source is important and innovative design (in building design and products) have the potential to reduce the trade-off or even negate it. Expenditure on air conditioning which improves quality of life, and addresses extreme stress may reduce expenditure on additional health services. Nuance required (more than just using the word "could").	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
11668	35	14	35	14	The XWG Box 3 in Chapter 12 does not fit here, it can be removed from the list	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11670	35	15	35	15	Suggest inserting "potential" before "co-benefits for adaptation". Some of these are largely untested or have mixed impacts. E.g., biochar can dry the soil and make the microclimate warmer by darkening the soil (reducing albedo, also a rebound for the supposed mitigation benefits). Perennial crops grown for mitigation (supposedly high productivity energy plantations) can reduce biodiversity and increase water scarcity.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5856	35	15	35	16	Cover crops and intercropping are not first and foremost understood as mitigation options, if anything they are more adaptation options with benefits for soil preservation, biodiversity etc. - please review this paragraph for accuracy.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11672	35	15	35	16	Add agroforestry to the list of mitigation response options	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14136	35	15	35	16	Please consider to give an example of perennial crops with varieties that are commercially available.	Government of Norway, Norwegian Environment Agency
1368	35	15	35	17	Agroforestry might also be relevant to mention here.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
3106	35	15	35	17	A key aspect is missing in the first sentence: agroforestry can deliver both on mitigation and adaptation aspects.  This was clearly highlighted in the IPCC SR on Land.	Government of France, Ministère de la Transition écologique et solidaire
3108	35	15	35	17	This strategy should perhaps be mentioned in D.1.6	Government of France, Ministère de la Transition écologique et solidaire
3384	35	15	35	17	A key aspect is missing here: agroforestry can deliver both on mitigation and adaptation aspects.  This was clearly highlighted in the IPCC SR on Land. See section "7.4.3.3. Agroforestry" (Chapter 7: Agriculture, Forestry and Other Land Uses (AFOLU)) See also Figure SPM.3 in Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems --> un peu vague comme référence.	Government of France, Ministère de la Transition écologique et solidaire
3114	35	15	35	20	Using the widely used umbrella term nature-based solutions would explicitly link climate and biodiversity issues.	Government of France, Ministère de la Transition écologique et solidaire
6736	35	15	35	20	In D.2.2. the list of approaches should be extended by nature-based solutions in general, as NbS with safeguards can also contribute to mitigation as well as adaptation, while providing further benefits (see chapter 7, p.121, line 24).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6738	35	15	35	20	Mitigation effects by restoration of degraded bogs is missing (high sequestration potential). Please check the underlying report.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12344	35	15	35	20	Due to decrease of fresh water resources as a result of climate change in developing countries, use of alternative practices of agriculture such as Haloculture and alternative crops is proposed to adapt with water scarcity.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
2402	35	15	35	29	Suggest including language noting that land-related mitigation can include market-based incentives for the protection and sustainable management of natural/remnant/threatened ecological systems in private lands (agricultural stewardship, environmental stewardship). These mechanisms could provide both mitigation and adaptation benefits.	Government of Australia, Department of Industry, Science, Energy and Resources
828	35	16	35	16	It is essential replace 'natural vegetation' with 'natural vegetation and ecosystems'	Government of Russian Federation, Institute of Global Climate and Ecology
3110	35	16	35	16	"biochar application" should be deleted from this paragraph listing the practices with no trade offs to other topics. If kept, it should be mentioned i) with caveats such as "certain biochars in some soil types/climates" to be consistent with with B5.2 SPM of the SRCCL and ii) and with a link to D2.3 of this present SPM.	Government of France, Ministère de la Transition écologique et solidaire
4152	35	16	35	16	Suggest including "protecting existing ecosystems (old growth and other carbon-rich ecosystems)" before .....restoring natural vegetation,....	Government of Canada, Environment and Climate Change Canada
3112	35	17	35	17	Afforestation and reforestation as well could be plantation on degraded land if made with a mix of tree species	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
1370	35	18	35	20	In addition to those measures that have already been mentioned, preservation and restoration of marine-based ecosystems would also seem to be of relevance here, such as kelp forests and seagrass meadows, and could be added if covered in the assessed literature.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
5858	35	18	35	20	Update the sentence starting 'Restoration of mangroves...' to 'Restoration of mangroves and coastal wetlands as carbon sequestrers also provides benefits of reducing coastal erosion and protects against storm surges, thus reducing the risks from sea level rise and extreme weather (high confidence)'. The justification for this proposal is that the meaning was confused. The amendment illustrates more clearly the additional benefits of both carbon sequestrers, as well as protection from coastal erosion.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11674	35	20	35	20	Add XWG Box 3 in Chapter 12 to the list	Philippe Tulkens, European Union (EU) - DG Research & Innovation
460	35	21	35	21	The text in D.2.3, states "deep reductions in global emissions...". The text should state "reductions and removals in global emissions" to ensure balance. Include "and removals" and remove "deep".	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
452	35	21	35	22	The following statement in D2.3 "Deep reductions in global emissions reduce risks to biodiversity associated with increasing temperatures." does not have a confidence level associated with it. It need to be rewritten with an associated confidence level.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
14138	35	21	35	23	The summary indicates that some mitigation responses that rely on land use can increase competition for scarce resources, including land, water, and biomass. In addition to this, mitigation responses, implemented without safeguards, may lead to human rights violations, such as land grabs that displace people who lack adequate legal protections and land tenure. Please consider to include this important aspect of mitigation options that rely on land use.	Government of Norway, Norwegian Environment Agency
744	35	21	35	25	The confidence level is not consistent with the underlying report (line 37, page 56 to lines 1-10, page 57, Chapter 12, and lines 6-39 page 33 to lines 1-14, page 36, Chapter 17) and the Technical Summary (TS, pages 94-97). The underlying report indicates that unreasonable measures are adopted, including the impact on biodiversity caused by unreasonable large-scale afforestation. In addition, the underlying report considers both the advantages and disadvantages of different measures, including risk and impacts of different measures, and their co-benefits. It is suggested to elaborate on the advantages and disadvantages of different measures and their confidence in the SPM in an objective and comprehensive way according to the underlying report.	Government of China, China Meteorological Administration
11676	35	21	35	26	D2.3 - it would be useful if this paragraph could say something more detailed than the usual "if carefully managed" caveat. Chapter 7 says: "The agriculture and forestry sectors can devise management approaches that enable biomass production and use for energy in conjunction with the production of food and timber, thereby reducing the conversion pressure on natural ecosystems" - which is essentially the same point but with a very different emphasis. It would be more useful to point out where readers can inform themselves about how to apply such "careful management" approaches in practices.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11678	35	21	35	26	D.2.3. a reference to the precautionary principle would be useful.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14140	35	21	35	26	D.2.3 this section is very important and should be kept.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3116	35	22	35	25	<p>At the end of the last sentence of para. D.2.3, the following should be added after 'context specific' "", with larger scale and higher expansion rate generally translating into higher risks".</p> <p>This addition (drawn from section 12.5.3 (p. 12-99) and referring to biomass-based systems and other mitigation options), better reflects the findings in section 12.5 that larger-scale deployment of land-based mitigation options usually lead to higher risks for biodiversity and other environmental resources (this is also detailed in section 3.7.6.2, p. 3-108). On its own, the current vague phrase "risks and impacts are scale and context specific" fails to express this important specification.</p> <p>This addition also serves to further reinforce the message included in para. D.2 "However, land and aquatic ecosystems can be adversely affected by mitigation actions, depending on their implementation, especially if deployed at a large scale (high confidence)" (which refers back in part to part 3.7) as well as detailed in the explanatory title accompanying Figure SPM.9 on page SPM-33.</p>	Government of France, Ministère de la Transition écologique et solidaire
3118	35	23	35	23	We suggest recommend to add "and may have negative effects on biodiversity and ecosystem functioning." after "biomass"	Government of France, Ministère de la Transition écologique et solidaire
3120	35	23	35	23	We suggest to add "including food", after "biomass".	Government of France, Ministère de la Transition écologique et solidaire
6740	35	23	35	23	Please add the term "soil" in the sentence "...for scarce resources including land, soil, water and biomass."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6742	35	23	35	26	We encourage the authors to specify more clearly what "carefully managed" entails. Some mitigation options may reduce biodiversity in the short or long-term. Please explain important management aspects of "careful management" that need to be considered in order to be aware of or avoid negative impacts on biodiversity.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
746	35	24	35	25	"Bioenergy" and "biochar", which are different emission reduction initiatives, should be juxtaposed. So, it is suggested to change it to "bioenergy, biochar".	Government of China, China Meteorological Administration
9608	35	24	35	26	<p>"Examples include the large-scale deployment of bioenergy, biochar, and afforestation, but these risks and impacts are scale and context specific"</p> <p>It would be better to delete "biochar". As indicated in Table TS7, currently, the role of biochar in mitigation pathway is limited. It appears strange to exemplify biochar here with an assumption that it could be deployed in such a large scale as affecting biodiversity and adaptive capacity.</p> <p>cf Trade-offs and spill over effects: Environmental impacts associated particulate matter; competition for biomass resource Role in mitigation pathways: In development – not yet in global mitigation pathways simulated by IAMs.(Table TS7)</p>	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11680	35	26	35	26	Add XWG Box 3 in Chapter 12 to the list	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5860	35	27	35	31	This paragraph is not specific. Please could the paragraph be written to provide further clarity on the types of coordination and resources?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6744	35	27	35	31	It would be valuable for the reader to provide more examples on how integration of mitigation and adaptation and balancing trade-offs across sectors could look like. Mentioning Nature-based Solutions with safeguards in D.2.3 could shed more light on this issue (see chapter 7, p.121, line 24).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11682	35	27	35	31	D2.4 - I don't think this paragraph is necessary since it largely repeats previous statements. Any unique messages from this paragraph could be merged into D1.1-1.3 somewhere. If retained at all, then add, after climate action in line 28: "whereas how such integrated policies would contribute to the progress on the SDGs has still limited evidence."	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5862	35	28	35	28	Add 'reduce or' before 'avoid'. As discussed before, it is not binary, trade-offs will always be required and vary in type, scale and time.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13400	35	28	35	28	Suggestion to phrase as 'reduce' rather than 'avoid' trade-offs because in reality some of potential interactions and feedbacks are barely understood/remain unknown so 'avoid' might give the impression of certainty to some degree. This also seems to be the language in the TS e.g TS-135 (30-32) and could be useful here.	Government of Kenya, Kenya Meteorological Service
5864	35	29	35	29	After 'Limited economic, social,' add 'environmental'. This becomes collectively exhaustive in definition. For example it might be access to water, or building materials such as wood.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5866	35	29	35	31	It would be good to tie this point in more clearly to sustainable development and the SDGs. The point seems to be drawn from capacity as a developmental issue and limit on mitigation/adaptation actions so would be good to highlight this link more clearly.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15402	35	29	35	31	Recommend deleting D.2.4. This is redundant with other paragraphs.	Government of United States of America, U.S. Department of State
5868	35	30	35	30	After 'capacities' add 'and capabilities'. This combination is needed because, for example, institutional limitations are often capability driven, due to skills/expertise shortages	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5870	35	33	35	33	Please clarify - 'shifts in development pathways' are towards/as a result of what?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6746	35	33	35	33	The term "shifting development pathways" is mentioned without explicit explanation in the last sentence of paragraph D.3.4 and A (p.3, line 5). We find it is not apparent what is meant by this (even with the definition of "development pathways" in the Glossary). Please briefly introduce the meaning of "shifts in development pathways".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12708	35	33	35	34	Delete from "such as..... economic structure" and replace by: ", including, but not restricted to, long term slow down or stagnation of industrial growth, large scale changes in employment patterns and job creation, exacerbating international inequities in trade and investment and increasing the socio-economic vulnerability of substantial part of the global population.	Government of India, Ministry of Environment, Forests and Climate Change
442	35	33	35	36	In the headline statement, equity is presented as enabler for social change, however, it was not discussed as a transition pathway. The statement from Chapter 4.5 and included in the Technical Summary Page 36 Lines 30-34 "Equity can be an important enabler, increasing the level of ambition for accelerated mitigation(high confidence) {4.5}. Equity deals with the distribution of costs and benefits and how these are shared, as per social contracts, national policy and international agreements. Transition pathways have distributional consequences such as large changes in employment and economic structure (high confidence)." should be included in the paragraph,	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
5872	35	33	35	36	"The choice of mitigation options and shifts in development pathways will have distributional consequences such as changes in employment and economic structure." It would be worth clarifying that BAU/higher emissions pathways will also have significant distributional consequences.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15404	35	33	35	36	This is one of the more important findings in the SPM. All climate change policy, or lack thereof, is about distributional effects both of climate change and of policies to address it. Overall, the SPM gives very little attention to the human side of addressing climate change but arguably that is the crux of what policymakers address.	Government of United States of America, U.S. Department of State
4154	35	33	35	44	Some countries have net zero targets for CO2 only while others have targets for all GHGs. How does this influence this finding. Is it more efficient to use one of the other to limit warming?	Government of Canada, Environment and Climate Change Canada
12284	35	33	35	44	Ch 5.P33-36.L41-21. It can be noted that in the path of developemnt, many traditionally women practices including cleaning and childrasing has moved from outdoors to indoors. This transition not only leads to higher energy intensity but also reduces women's social capital(Sunikka-Blank, et al., 2019). Therefore, better energy access can reinforce climate change in two different ways; strengthening gender inequality and increasing household energy consumption.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13482	35	33	36	13	The distributional, inequality and social impacts would need more in-depth and quantified consideration here.	Government of Estonia, Estonian Meteorological & Hydrological Institute
456	35	33	36	14	The text in Chapter 3, L25-27, Pg. 96 states, "Mitigation action through thermal renovation of buildings, installation and maintenance of low-carbon generation, the build-out of public transit lead to jobs creation, while jobs are lost in fossil fuel extraction, energy supply and energy intensive sectors in mitigation pathways." This text should be reflected in the SPM, as it discusses job employment impacts of mitigation actions.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
458	35	33	36	14	The text in Chapter 3, L32-34, Pg. 96, states, "Employment effects also differ by geographies, with energy-importing regions benefiting from net job creations but energy-exporting regions experiencing very small gains or suffering from net job destruction." This text should be reflected in the SPM, as it discusses the differing employment effects by geographies.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
11684	35	33	36	14	D3 + general comment on "development pathways". The term "development pathways" is used many times in this SPM, but it needs to be better explained. To a casual reader, it would appear that "development pathways" are something like the national development plans of a government, or mitigation pathways that are sensitive to the importance of sustainable development. However, Chapter 4, cross-chapter Box 5 seems to reveal that "development pathways" and "shifting development pathways" are actually a specific terminology (is this importation of concepts from the international development field into the science of climate action?). Development pathways and mitigation pathways are quite different concepts of what constitutes a "pathway" (going beyond simply choosing between the word "mitigation" or "development" as descriptor). I would suggest checking every reference to "development pathways" in the SPM to check whether it is really intended to refer to the specific concept described in X-chapter Box 5, or whether it is a more generic reference to the fact that mitigation pathways must also pursue (sustainable) development.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
6748	35	34	35	36	While the meaning of "broad stakeholder participation" in decision-making is very clear and easy to grasp, it is less clear what "attention to equity" actually means. What does "attention to equity" imply in practical terms- when decisions need to be made? Could the term "balanced participation" of stakeholders be useful in this regard?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12744	35	36	35		After "transformative changes" insert new sentence "Operationalizing equity in sharing of the mitigation burden will be essential to sustainable climate action (high confidence) {Chapter 4}.	Government of India, Ministry of Environment, Forests and Climate Change
12438	35	37	35	41	The paragraph states that countries have different development priorities reflecting their starting points, which include social, economic, cultural, or political conditions, resource endowment, international environment, and history. It also mentioned that countries therefore have different needs in terms of enabling the economic, social, and environmental conditions for sustainable development. However, we notice that the paragraph does not mention about different environmental condition. For example, we think that the level of temperature in a country can also affect the choice of consumers and hence the level of suitability of a method of transportation in a country. For example; in general, rail users in cold and moderately cold climates may be more willing to walk farther from a rail station compared to those in hot climates.	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
434	35	37	35	37	D.3.1: Required action: change "different priorities" to "different priorities and different starting points", reflecting their national circumstances.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
5876	35	37	35	37	The use of the term 'starting points' seems like a strange wording, especially as this implies a point in time pre-development. I would suggest removing '... starting points, which include' and keeping the remaining text.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15406	35	37	35	37	Consider inserting the following sentence: "Essentially, all people seek to improve their well-being regardless of their relative levels of development." This point is important because "development" that is only about those less well off is highly unlikely to be acceptable to the middle- and more highly developed populations. This is an opportunity to acknowledge the validity of all peoples' aspirations. Although the definition in the glossary of sustainable development refers only to needs, the vast majority of governments would assert that development goes beyond needs to broader well-being. A high income country whose future generations become less well off by transferring income to a lower income country would not consider that compatible with "sustainable development". This is the crux of many of the economic arguments made by stakeholders resistant to policy proposals. It could be helpful for the IPCC to clarify this viewpoint.	Government of United States of America, U.S. Department of State
15408	35	37	35	39	What is meant by "starting points" in this context? Defining this here and in the chapters noted in D.3.1 is important. Moreover, starting points as used in the glossary (e.g., definition of scenarios) does not seem to match this statement. Suggest revising the sentence to: "Countries have different development priorities reflecting their context, ..."	Government of United States of America, U.S. Department of State
9610	35	37	35	40	"...Countries therefore have different needs in terms of enabling the economic, social, and environmental conditions for sustainable development" is absolutely right but not sufficient. The last part should be "... sustainable development and carbon neutrality" as this is the paragraph for carbon neutrality.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
5874	35	37	35	41	The overall intention/message of this paragraph is unclear - particularly the 2nd sentence could be much simplified. At the moment it seems to suggest that to enable sustainable development (SD), you need to address development needs first. Please could you clarify what is meant here. Is it 'the conditions for SD' that need enabling or is it SD (e.g. how to you enable environmental conditions for SD, isn't that itself SD?)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13314	35	37	35	41	This paragraph D3.1. is very explanatory in nature and would fit better in the text at the beginning of the document. Also, use "sustainable development" rather than "development". SEE ALSO general comment.	Government of Switzerland, Federal Office for the Environment FOEN
6750	35	38	35	38	Please add to the mentioned factors "geoeological setting" to complement the list.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
5878	35	38	35	38	After 'conditions' add 'geographic locality'. It is proposed that the geographic location is included to recognise the immediacy of action for those most at risk from impacts due to 'urgency' – how little time they have left, such as low lying islands, or 'severity', such as sub-Saharan climatic impacts on farming and agriculture.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9612	35	38	35	38	"National security" should be inserted between resource endowment, and international environment,because national security is an important consideration for policymakers.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
1372	35	40	35	40	A specific reference also to climate action would be clarifying here, e.g. "... conditions for climate action and overall sustainable development."	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
5880	35	40	35	40	After 'sustainable development' add 'and achievement of the 17 SDGs'. This is proposed to emphasise the need for linking the Triple Bottom Line to SDGs. It is recognised that new references are not required at this stage, but for completeness the two key references are included: J Elkington, 1998 'Accounting for the triple bottom line'; 2018, '25 years ago I coined the phrase "triple bottom line" (available in the Harvard Business Review). This helps the reader since the expression is well understood and simplifies the story in a exhaustive way.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12440	35	42	35	44	It is stated in the paragraph that the ambitious mitigation pathway can lead to the loss of some jobs and at the same time can create new jobs. However we are of the view that the paragraph should also touch on whether ambitious mitigation can affect or have an impact on a country's imports and balance of payments.	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
12348	35	42	36	2	It is necessary for each country to identify alternative low-carbon jobs in accordance with their available resources, cultural and social conditions, with the aim of compensating the destructive economic or social consequences of mitigation and adaptation responses.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
5882	35	42	15	43	Large change doesn't necessarily mean disruptive - what is disruptive? And this isn't inevitable, but it is a challenge policy must address	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12714	35	42	35	44	Rewrite first sentence of D 3.2 in accordance with the comment above for headline statement D 3.	Government of India, Ministry of Environment, Forests and Climate Change



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
432	35	43	35	43	D.3.2: " with significant distributional consequences including...". Indicate that the effect is higher on developing countries.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
436	35	43	35	44	D.3.2: Required action: change "high to low carbon sectors" to "high to low emissions sectors" to stay with the confines of the PA, which focuses on emissions, not sources.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
9614	35	43	35	44	The issue is not limited to job shift between sectors in one country but also job location shift between countries. This may be serious mitigation barrier. This point should be mentioned here.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12746	35	44	35		Delete last sentence. of D 3.2 Reason: Speculative, unnuanced and without evidence.	Government of India, Ministry of Environment, Forests and Climate Change
1146	35	44	35	44	The evidence for job losses in specific setors is overwhelming. Need to bite the bullet here. Some jobs will be lost e.g. coal miners. This is not to say their skills will not be required in other sectors or activities, but this transition and the training need to be acknowledges and planned/realised. There are numerous examples in the literature which support this assessment.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1374	35	44	35	44	The "While some jobs ... can also create more enduring jobs." would seem to be rather trivial and also repeat what is said in the previous sentence. Could something more be said, perhaps developing the "more enduring" or net effects?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
15410	35	44	35	44	"While some jobs may be lost, a low-carbon response can also create more enduring jobs.": This needs a confidence interval; a number of studies differentiate certain fuels and employment counts. For example, are gas station attendants included in the oil and gas sector or only producers? And, conversely, many jobs in Renewable Energy are only at the front end and not sustained over years.	Government of United States of America, U.S. Department of State
15412	35	44	35	44	Use of "enduring" is less clear in this sentence. Perhaps clarify by explaining how a low-carbon response can equip the workforce with added skills and opportunities, which can lead to increased localized and global employment growth.	Government of United States of America, U.S. Department of State
15414	35	44	35	44	Change "can" to "may". Whether jobs are more enduring or not is not empirically proven and the evidence is conflicting. Also, what exactly is a "low-carbon response"? Consider different phrasing.	Government of United States of America, U.S. Department of State
	35		35		The notion that land based mitigation options have limits for large warming levels (addressed in SRCCL and also for natural sinks in WGI) is not explicit here. Mitgation actions are linked to adaptation, and their potential can be restricted at high warming levels?	WGI Bureau,
6754	36	1	36	2	Why is "at all geographical levels" inserted in this sentence? In this context, shouldn't it be more important to consider all sectors? Perhaps "for all sectoral policies at all levels of government" captures the point? Please clarify.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12748	36	1	36		Delete "Policies... scales" and replace by: "varied policies appropriate to driving the transitions at different geographic scales".	Government of India, Ministry of Environment, Forests and Climate Change
5884	36	1	36	1	"Policies that drive transitions at all geographical scales" - not clear what this means. Does it refer to the importance of local decision-making and inclusion of local stakeholders, or simply policies which affect all areas? It's not clear how 'policies that drive transitions at all geographical scales improve the ability to integrate considerations of equity, gender concerns and justice'. Is this to do with providing an enabling environment, having more checks and balances/MRV etc. with international financial transactions involved? Key issue is equity for those countries/regions adversely impacted. Could the authors please clarify to make it more actionable for policymakers?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
462	36	1	36	13	D.3.3, D.3.4: This text should reference underlying chapters that discusses imperative factors to consider in a just transition, i.e. local contexts, regional priorities, and starting points of different countries and the speed of they want to travel. Include this important aspect of a just transition in the SPM.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6752	36	1	36	2	The term geographical scales is not understandable in the context of the sentence. If political-administrative decision-making levels (local, regional, national, etc.) are meant here, we propose to refer to them as such.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9924	36	1	36	2	(D3.2): the sentence "Policies that drive transitions at all geographical scales improve the ability to integrate considerations of equity, gender concerns and justice" is unclear and unhelpful. What multi-scale policies are those, implemented and enforced by who? How can such policies be instrumental to improve the abilities listed here? Suggest to expand and explain better what is intended or drop the sentence.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
14142	36	1	36	2	The message here is hard to comprehend, please consider to give some examples for clarity.	Government of Norway, Norwegian Environment Agency
15416	36	1	36	2	Suggest including "well-being" before "equity".	Government of United States of America, U.S. Department of State
5886	36	2	36	2	After 'equity' add '(SDGs 1-4), gender concerns (SDG5) and justice (SDG16)'. The proposed inclusion of specific SDGs to support the key thematics is to reinforce the linkage between SDG13 climate mitigation and adaptation with the systemic interrelationships across all SDGs.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
3124	36	3	35	5	If the distribution of emissions is inequitable within countries, there needs to be a coma after "mitigation policies" to make that clear.	Government of France, Ministère de la Transition écologique et solidaire
1148	36	3	36	3	Some care is needed in such general comments and statements. Is there an equitable distribution of emissions if so how is it determined even over time and geography? The science around 1.5 and 2.0C scenarios that FF carbon emissions need to be balanced at 2050, whilst those after will need to be balanced, this places a burden on those activities which cannot be avoided to pay, while those which can be avoided (in the mean time) need not pay!. Not to mention the burden on non-CO2 emission sources if these are to be used to determine the scale of negative emissions once CO2 is balanced.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1376	36	3	36	3	The start of the paragraph ("The inequitable distribution of emissions") might run the risk of being understood as the global case (in which case "inequitable" could be interpreted as a value-laden expression, and another word should be used instead). The contents of D.3.3 would rather seem to speak of national and sub-national circumstances? If the start of the sentence does refer to what happens "within countries", it would be good to clarify the fact.	Government of Sweden, Swedish Meteorological and Hydrological Institute
3126	36	3	36	3	We suggest to replace "migation policies" by "mitigation and adaptation policies"	Government of France, Ministère de la Transition écologique et solidaire
13674	36	3	36	3	Suggest for clarity that the phrase "The inequitable distribution of emissions" be replaced with "The inequitable distribution of where emissions come from" [or something similar]. Unless rephrased, it could be misunderstood to include the impact of emissions.	Government of New Zealand, Ministry for the Environment
15418	36	3	36	3	The phrase "inequitable distribution of emissions" is subjective. Authors might solve this by substituting "unequal" and adding "across countries and individuals". Make it factual, not subjective.	Government of United States of America, U.S. Department of State
14144	36	3	36	5	Please consider to include the broader conclusion about equity and just transition from ES in chapter 4 up front in this paragraph. We therefore suggest to include a new sentence in line 3: "Equity and just transition can be important enablers of deeper ambitions for accelerated mitigation".	Government of Norway, Norwegian Environment Agency
2404	36	3	36	9	Suggest including consideration of pan-national markets and industries, such as international shipping, which do not fall clearly within geographic jurisdictional boundaries.	Government of Australia, Department of Industry, Science, Energy and Resources
3122	36	3	36	9	The mechanisms of socially sustainable policy making should be better highlighted. And, again, the focus should not only be on the costs of transition, but also on those local co-benefits that need to be integrated in the consideration of redistributive effects.	Government of France, Ministère de la Transition écologique et solidaire
6194	36	3	36	9	The concept of just transition is not well known to the general public. It may be useful to add a reference to the glossary in the SPM, or a footnote to explain the term.	Government of Belgium, Belgian Science Policy Office - Belspo
12346	36	3	36	9	Given that developing countries are more vulnerable to the impacts of climate change and have less contribution to the greenhouse gas emissions, so, their commitments in mitigation should be proportional to their contributions. This should be considered in the matter of integrating the equity principles.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12752	36	3	36	9	Delete D.3.3. Policy prescriptive, intrusive in country level policy and in contradiction to D.3.1.	Government of India, Ministry of Environment, Forests and Climate Change

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13348	36	3	36	9	The text reads as if the distributional impacts were always objectively clear. However, in the political process, perceived inequalities or distributional effects are often more important than "actual ones". Maybe change/expand the formulation to emphasize that public perceptions and the communication of equity concerns is crucial.	Government of Switzerland, Federal Office for the Environment FOEN
2406	36	4	36	4	Suggest inserting 'can' before 'affect'.	Government of Australia, Department of Industry, Science, Energy and Resources
3128	36	5	36	5	We suggest to add after principles and "implement through collective and participatory decision making processes", not just dictate the main principles by governments. The terms 'democratic', 'participation' or 'collective' are largely absent from the SPM, which may suggest a techno-political prism.	Government of France, Ministère de la Transition écologique et solidaire
5888	36	5	36	5	While more of a consensus is emerging, 'just transition' is a somewhat ambiguous and politically contested concept, and therefore, although it is addressed in the glossary, this could potentially benefit from further clarification in text.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13676	36	5	36	5	The glossary includes "just transition principles" but does not include "equity principles". "Equity" is defined in the glossary, which includes reference to "the equity principle", but this is singular not plural.	Government of New Zealand, Ministry of the Environment
2442	36	5	36	6	Suggest explaining more on the concept of "integrating equity principles into policies at scale". Would it be possible to provide few examples?	Government of Denmark, Danish Meteorological Institute
11686	36	5	36	6	The sentence on just transition is probably correct, but reads like a truism.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15420	36	5	36	6	This sentence is not supported soundly by the evidence, or at best is circular. First, there is not a single set of "just transition principles". There are dozens of sets proposed by different organizations. Some do not consider the equities across a wide range of stakeholders but focus only on, say, labor; as such, they do not necessarily reflect broad equity principles or "at all scales". The studies that have evaluated actual policies and actions to address equity (particularly for workers) have found them difficult and not fully effective in meeting objectives. Suggest revising to: "Applying equity principles in policy development and implementation is ..." Using only the term "just transition" is inequitable in itself and ignores the myriad stakeholders who have put forth alternative terms that might be broadly categorized as "climate justice". Similarly, consider changing the following sentence from "National just transition commissions or task forces, and related national policies" to "Many countries, regions, and communities have established commissions, task forces, or other processes to assess and integrate equity considerations into policy development and implementation; some governments have established explicit goals with regard to their efforts."	Government of United States of America, U.S. Department of State
3130	36	6	36	8	Is it possible to have an idea of the number or percentage of countries involved if information available instead of "many countries" (I6) and "several countries" (I8)	Government of France, Ministère de la Transition écologique et solidaire
13316	36	6	35	6	Omit the buzzwords such as "system-level feasibility challenges". Explain in simple words instead.	Government of Switzerland, Federal Office for the Environment FOEN
5890	36	8	36	8	After 'engaged' add 'in seeking to expand these successes'. The sentence ended abruptly. It could be strengthened using the proposed additional words.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5892	36	10	36	10	'external finance' is not a commonly used term - is this referring to international finance? Please could this be clarified in the text or in the glossary.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5894	36	10	36	10	Para D.3.4 should be clearer about what is meant by "broadening access to cleaner technologies". Following up the references to underlying chapters does not provide answers to this question. Reference to achieving universal energy access (SDG7) here might be helpful.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12350	36	10	36	13	Self-governance in natural resources management and exploitation (water, forest, rangeland, etc.) should be promoted and hence, self-governing institutions should be empowered and recognized to engage in order to realize sustainable development of this resources.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)

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13068	36	10	36	13	D.3.4: Kindly include some regional information here. This is available in the underlying chapters as well as in the Technical Summary	Government of Gambia, Department of Water Resources
13402	36	10	36	13	D.3.4 would benefit from regional examples. For instance this is very important for developing countries, SIDs and least developed countries. There is information on this from the TS as well as the underlying chapters.	Government of Kenya, Kenya Meteorological Service
5896	36	11	36	11	After 'integrate' delete 'considerations of' to achieve additional conciseness – these two words are redundant.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12754	36	11	36	13	Delete "informal". Replace by "developing." Delete from "and act as as.....pathways".	Government of India, Ministry of Environment, Forests and Climate Change
6756	36	12	36	13	In the glossary, distinction is explicitly made between "shifting development pathways (SDP)" and "shifting development pathways to sustainability" (with corresponding, separate entries for both terms). Please revise choice of language. Please also see our comment requesting a brief definition of "shifts in development pathways".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
466	37	0	41	0	The following statement from Ch4 P59 L2-3 "likely obstacles in the short-term to accelerated mitigation revolves around undesirable distributional consequences, within and across countries." must be added to the SPM as SPM as it provides an understanding of the objections to accelerated mitigation with relation to distributional implications.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
468	37	0	41	0	The following statement from Ch4 P97 L6 "Shifting development pathways and accelerating mitigation are complex endeavors that carry risks." must be added to the SPM as it demonstrates the risks and uncertainties related to accelerated mitigation.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
470	37	0	41	0	The following table 4.10 from Ch4 P58 must be added to the SPM as it provides an understanding of the possible implications to accelerated mitigation.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
6986	37	1			Would it be possible for the authors to further specify this section with examples or regionally specific information? Any such efforts would be greatly appreciated.	Government of Jamaica, Meteorological Service Division
1378	37	1	37	1	SPM.10 this figure is difficult to comprehend. The information seems to be provided on the number of applicable barriers and enablers (drawn from the defined categories) but without taking into account for important/severe/comparable they are. Apart from the cases where there are only barriers or enablers, the message remains elusive.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
4156	37	1	37	1	Overall, Section E could discuss a broader range of policy approaches including climate risk disclosure and transitions risks for businesses. The private sector is poorly covered here but is central to mitigation activities. There are also fiscal risks for government that are insufficiently elaborated.	Government of Canada, Environment and Climate Change Canada
5898	37	1	37	25	Section E.1 could include a concluding paragraph, that notes that removing barriers and taking advantage of enabling conditions requires broad engagement across society, from the national to the regional/urban level, and including corporations, associations, and also broad engagement from within governments, so climate actions become increasingly linked across all societal decisions.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12368	37	1	37	25	It is important to also mention the role of sanctions and wars on the capacities of the countries for mitigation and adaptation.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15424	37	1	39	3	Section E.1 is very sterile, and sounds like it was written by modelers and technologists who forgot to consider the human components of systems, i.e., that economies and technologies are fundamentally human systems. The authors should look for opportunities to insert the "social and human dimensions" of change here. The barriers referred to in this section come largely from humans and their views and behaviors but aren't even mentioned. "Strengthening the response" is not possible without consideration of the human challenges to change. Policymakers are fundamentally interested in the human aspects of their constituents and stakeholders. Figure SPM.10 does not help (and is hard to read, overwhelming with information, and yet vague as to what it all means). It's an impressive summary figure, but not helpful outside of the underlying chapter. In the end, the text essentially says, "Go read the chapters if you want to understand this." Putting lengthy and dense explanatory material into an appendix is not really helpful to policymakers. What's the big takeaway or two?	Government of United States of America, U.S. Department of State
11688	37	1	39	5	E1 - ideally this section should have more explicit links to other parts of the SPM: * e.g. to Section C. Which of the more/less feasible options are nevertheless relied upon to deliver reductions in the 2°C/1.5°C pathways? * to C12 - which demonstrates the potential of low cost mitigation options. What is the correlation between this assessment of cost, and Section E's assessment of feasibility? Do feasible options tend to be cheaper? Or does infeasibility hamper deployment of options that in theory should be cost effective? * to the rest of Section E. Figure SPM.10 demonstrates that some options score low/high on feasibility enablers and barriers. So what? Does this mean policymakers should prioritise those whose 'net' feasibility is highest? Or can low feasibility scores be improved by following the advice give in the rest of section E?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
6758	37	1	43	35	_MITIGATION CONCRETE: In this section, we expect to learn more about no-regret measures and options. Also, it would be policy-relevant to understand, which options need time to be effective and therefore, would profit from immediate implementation. Together with knowledge about costs, potentials, and region or sector wise specifics of the options/measures, policy makers would be able to make reasonable decisions.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11690	37	1	43	35	Section E hardly refers to AFOLU and Industry, if at all. Thereby the message the SPM is sending to the world is that the IPCC is not able to say anything regarding strengthening the mitigation response in these sectors. This should be changed.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14146	37	1	43	35	In our view, section E, has its own jargon, where the language is compressed and heavy, which make it difficult to sometimes understand the significance in the important findings. Please consider how, and if, the language can be simplified and more understandable.	Government of Norway, Norwegian Environment Agency
14148	37	1	43	35	The important section E on Strengthening the response is in could in our view be improved to make it more suitable to inform policymakers about relevant solutions. The way this section is written makes it at times very difficult to understand e.g. in E.3. Furthermore, Section E as a whole is a bit fluffy, with little concrete information. We believe that there are several options to increase the substance and readability. One option is to add a figure by region, gas and mitigation options showing the towards 2050 (2100) perspective of actions today drawn from e.g. the National and regional mitigation pathways as shown in Table II.11 in Annex III page 80-82). Please consider to reformulate the text to bring along more substance relevant for policymakers, and to add a figure like the proposed one. Also include more information about how we can speed up the mitigation efforts. E.g. How we can build all those wind mills in only 8 years to provide the reductions shown in figure SPM8. The notion of urgency, and consequences of delayed action in implementing mitigation efforts, should be better addressed throughout Section E.	Government of Norway, Norwegian Environment Agency
12036	37	1	43	36	Section E is more of a descriptive section, even though it is appreciated that it has increased in specificity and examples since the SOD. We believe that it could be made even more specific, or be shortened somewhat. Could the section make explicit which options described would classify as no-regret-options? This would provide important guidance for policymakers. For example, it would seem that mitigation options that also contribute to sustainable development as described in section E.2 could be considered no-regret-options?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
6196	37	2	37	14	As we mentioned before (please see comment number 2), we have the impression that the word "barrier" is often used in a reductive manner in this SPM. In these two paragraphs, it is not clear what is actually at stake when using this word, and if the governance dimension is considered. References to barriers would likely benefit from being made more concrete or precise, as some barriers can be removed while others cannot, some are of ethical nature, etc.	Government of Belgium, Belgian Science Policy Office - Belspo

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11692	37	2	37	2	Before investigating the feasibility of deployment, it would be important to ensure that the options would work (for mitigation) if deployed. Some of the "options" mentioned in this section are untested concepts that may not even be effective, even if their deployment could be ensured, or could be effective only under certain circumstances. It would be important to recognise this consistently. For example, it seems premature (and thus unhelpful) to discuss ocean fertilisation as an effective option that should be facilitated by removing barriers, when many potential risks are well identified, but its effectiveness for mitigation is still far from proven. A more differentiated approach would need to be followed.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12982	37	2	37	2	E.1 "feasibility ... is shaped by barriers' – surely barriers make things INfeasible?	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
11694	37	2	37	5	E1 - this first sentence is long and simply unnecessary. It would be better to remove it. The second sentence says the same thing more concisely.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12354	37	2	37	8	Conflicts of interest (COI) in design and implementation of climate change mitigation responses, should be identified and addressed.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
9926	37	2	38	19	(E1 and Figure SPM.10): Unclear how to read, understand let alone use the feasibility assessment made here in the absence of the underlying factors. What are the the colored bars in SPM.10, what do they represent, or imply for policies to strengthen the response?	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12774	37	3	37		Delete "on a global scale" and replace by "across several regions and countries".	Government of India, Ministry of Environment, Forests and Climate Change
15426	37	4	37	4	"Lock in" is a key concept for mitigation which appears numerous times in Chapter 5 and the Social Science Primer. It does not appear in the SPM. Insert the following sentence after "institutional dimensions": "These include infrastructural, institutional, and socio cultural lock in."	Government of United States of America, U.S. Department of State
2124	37	4	37	5	The sentence "The deployment of response options depends on reducing or removing --" is very general and mild one. It can be changed into the sentence, "Both reducing or removing barriers and establishing and strengthening enabling conditions are the keys for their deployment.". "Feasibility depends on context and the scale and the speed of implementation" would be also added.. (present) "The deployment of response options depends on reducing or removing~" (change) "Both reducing or removing barriers and establishing and strengtehning enabling conditions are the keys for their deployment" + "Feasibility depends on context and the scale and the speed of implementation"	Government of Republic of Korea, Korea Meteorological Administration
12274	37	5	37	7	It is better to present it in pie-chart.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12770	37	5	37		Insert new sentence after "enabling conditions": "Both appropriate response options and their deployment vary significantly across regions and countries, depending on levels of development and regional and national circumstances. Immediate strengthened action needs to leverage the higher capacities and the stronger technological and economic dimension of regions and countries at high levels of development for deploying such response options."	Government of India, Ministry of Environment, Forests and Climate Change
11696	37	5	37	8	This sentence makes a key point, but does so quite indirectly. The argument seems to be that the best option is to undertake immediate action, and tackle the feasibility challenges. Whereas the alternative (delayed action) is riskier because it involves unplanned exposure to multiple challenges later on. This is a point that should be stated more strongly throughout the SPM (see also Figure SPM.5 & Table SPM.1, where some readers may mistakenly interpret C3b (aiming for well below 2°C despite postponing really, really steep mitigation until post-2030) as a valid policy choice. More elaboration of this high confidence statement would therefore be welcome.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
6764	37	6	37	7	Please revise choice of language and use consistent nomenclature in order to ensure distinction between "scenarios" and "pathways" according to the underlying definition of terms used (see also glossary entries "scenarios" and "pathways" resp. "mitigation pathways"). E.g., on page 37, line 6 to 7 the term "scenario" is used, while in other paragraphs as for example C.12, the term "pathway" is used.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5900	37	6	37	6	What does "system-level feasibility challenges" mean? Please clarify here and in E.1.3. Moreover, the sentence "spread out system-level feasibility challenges over time" is not very clear that this is a good thing - consider changing to something simpler like "increase the feasibility of scenarios..."	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6760	37	6	37	6	It is not clear what "system-level feasibility challenges" means in this context, e.g., does the system level to transitions, thus meaning challenges to feasibility of transitions at the system level? Please clarify.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6762	37	6	37	7	(Also valid for lines 24-25.) Please revise whether the statement should be referred to "scenarios / pathways likely to limit warming to 2 °C OR TO limit warming to 1.5 °C" as the actual description "likely to limit warming to 2 °C, OR limit warming to 1.5 °C" may be misunderstood (e.g. likely not being related to 1.5 °C). Furthermore, please specify the category of the 1.5 °C pathway (e.g. "with no or limited or high overshoot"?). In addition, it does not seem appropriate to merge	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11698	37	6	37	7	As remarked earlier the phrasing of 'scenarios likely to limit warming to 2C, or limit warming to 1.5C (high confidence)' is confusing. There are two sets of scenarios 1) likely to limit to 2 C (but less likely to limit to 1.5) and a 2) scenarios that are (likely?) to limit to 1.5. It would be good to also attach confidence to the 1.5 scenarios. Finally it seems that the high confidence refers to 'strengthened action to spread out challenges' and not to limiting warming to 1.5C? Please rephrase to clarify.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
1380	37	7	37	7	The meaning of "limit warming to 1.5oC" is unclear, as it does not specify whether there is an/some overshoot, compare C.3, and/or the likelihood, cf. Footnote 8 as well as Table SPM.1. Could this be clarified?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6988	37	7	37	7	We are unsure as to why this and several of the following statements do not employ the same "1.5°C with no or limited overshoot" wording as previous sections and would like to ask the authors to revisit and clarify the statements in question.	Government of Jamaica, Meteorological Service Division
11700	37	7	37	7	The feasibility assessment for the building sector is presented in section 9.9, therefore the citation into {.} brackets has to be changed from 9.10 to 9.9	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12038	37	7	37	7	E.1: In earlier sections, the statement "limit warming to 1.5°C" was specified with "with no or limited overshoot". Is that also the 1.5°C pathway category that applies here? In that case, this addition should be made here for clarification.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13582	37	7	37	7	Here and in other bullets, the phrase "limit warming to 1.5°C" is used as opposed to "1.5°C with no or limited overshoot" as in previous sections. Please revisit what exactly is meant here and ensure that this is consistently used throughout the SPM.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
748	37	9	37	10	According to Chapter 10, Section 8 of the underlying Report, electrified transport is of great significance to transportation, a high-emission area, and is already widely used in both developed and developing countries. It is suggested to add "electromobility" after "solar energy".	Government of China, China Meteorological Administration
11702	37	9	37	10	Why would improved forest or grassland management be "increasingly cost effective"? Increasingly compared to what?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12772	37	9	37	10	Delete from "including solar energy.... reduce food loss". Reason: No need to single out specific examples out of a large available number.	Government of India, Ministry of Environment, Forests and Climate Change
3132	37	9	37	11	Some precaution should be introduced on the high public support when the development of solar and wind is considered at a very large scale, as explained below	Government of France, Ministère de la Transition écologique et solidaire
9620	37	9	37	11	Public support for PV is not necessarily high worldwide. For example, skepticism and resistance for PV is growing in Japan, where PV density has reached highset in the world and more PV panels are covering forest and hillside areas, which causes land slide risks and destruction of natural forest. This may be the case with other island/mountainous countries. Thus "on a global scale" is misleading and should insert " in general, but it depends on local conditions".	Government of Japan, Climate Change Division - Ministry of Foreign Affairs

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11704	37	9	37	11	Energy efficiency in buildings must be added to the list of option in this sentence	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15428	37	9	37	11	Wind and energy efficiency are also "technically viable, increasingly cost effective and have relatively high public support enabling take-up on a global scale", so add them both to this list of response options.	Government of United States of America, U.S. Department of State
2408	37	9	37	13	Suggest rewording this section as it indicates that some options (e.g. solar) always have public support, whereas only options like nuclear, large-scale CDR, DAC, ocean fertilisation 'face socio-cultural and/or legal barriers.' In reality many proposed large-scale wind and solar installations now face strong public opposition and legal challenges.	Government of Australia, Department of Industry, Science, Energy and Resources
3134	37	9	37	14	The words "environmental-ecological, technological," should be included in the second sentence of para. E.1.1, after "face". This inclusion is important for two reasons: (1) The current 2nd sentence of para. E.1.1 is unbalanced and biased as it gives the impression that the key barriers to 'large-scale deployment of land-based CDR options' are only 'socio-cultural, and/or legal'. This contradicts chapter 6.4 (cited as a reference for para. E.1.1.) which finds the implementation of large-scale land-based CDR options such as BECCS faces technological barriers (6.4.2.6 p. 6-41) and environmental-ecological barriers (6.4.2.6 p. 6-40). This is reinforced further by the fact that other chapters of AR6 WGIII (e.g. 6.4.2.6 p. 6-42, 7.4.4 p. 7-81, 12.3 p. 12-39, 17.3.3.1, p. 17-33) highlight the major negative environmental large-scale deployment of land-based CDR could have, likely impacting feasibility.  2) Furthermore, the current paragraph E.1.1 offers an unbalanced message with regards to the first sentence of para. E.1: indeed, para. E.1.1 provides examples of technological, economic, socio-cultural and institutional barriers and enabling conditions shaping the feasibility of deploying response options, yet omits any example of geophysical and environmental-ecological barriers. Such an omission can give the impression that geophysical and environmental-ecological barriers are lesser.	Government of France, Ministère de la Transition écologique et solidaire
3136	37	9	37	14	Wind energy is not mentioned in E.1.1, neither as an opportunity nor as a barrier, though it experienced a significant growth during the last decade. This might be misinterpreted by the readers.	Government of France, Ministère de la Transition écologique et solidaire
3456	37	9	37	14	It would be relevant to add a sentence at the end of the 3rd sentence, to detail that in addition to socio-cultural and/or legal barriers, there are environmental-ecological barriers among others. This inclusion is important for two reasons: (1) The current 2nd sentence of para. E.1.1 is unbalanced and biased as it gives the impression that the key barriers to 'large-scale deployment of land-based CDR options' are only 'socio-cultural, and/or legal'. This contradicts chapter 6.4 (cited as a reference for para. E.1.1.) which finds the implementation of large-scale land-based CDR options such as BECCS faces technological barriers (6.4.2.6 p. 6-41) and environmental-ecological barriers (6.4.2.6 p. 6-40). This is reinforced further by the fact that other chapters of AR6 WGIII (e.g. 6.4.2.6 p. 6-42, 7.4.4 p. 7-81, 12.3 p. 12-39, 17.3.3.1, p. 17-33) highlight the major negative environmental large-scale deployment of land-based CDR could have, likely impacting feasibility.  (2) Furthermore, the current paragraph E.1.1 offers an unbalanced message with regards to the first sentence of para. E.1: indeed, para. E.1.1 provides examples of technological, economic, socio-cultural and institutional barriers and enabling conditions shaping the feasibility of deploying response options, yet omits any example of geophysical and environmental-ecological barriers. Such an omission can give the impression that geophysical and environmental-ecological barriers are lesser."	Government of France, Ministère de la Transition écologique et solidaire



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3458	37	9	37	14	In addition, the constraints in terms of moral bias and timing of deployment, outlined in the chapters ought to be better reflected. This relates to a more general comment on the treatment of CDR in this report : there is an imbalance in the treatment of scenarios compatible with 1,5°C regarding the priority and benefits of a reduction in emissions compared to a massive deployment of CDR – this is the case also in section C.3. The role of CDR in scenarios in particular in terms of timing of deployment relative to the timing of emission reductions is not explored enough. This has critical implications with relation to overshoot and related impacts : in terms of adaptation, depending on the delay of emissions reductions and thus on the extent of the overshoot, the capacity of natural carbon sinks to adapt to climate change impacts may be constrained and this will have an impact in turn on their capacity to act as a carbon sink – this is in addition to the other constraints already explored in WG1 regarding their reduced marginal storage capacity in higher emissions scenarios. The role of CDR in scenarios, in addition to the above mentioned constraints, are also explored in chapters and previous reports in terms of moral bias, an overemphasis on early implementation of CDR being likely to delay emissions reduction which are critical to avoid being on a high-overshoot track (which would in term pose new constraints as detailed above). These policy-relevant details are essential to inform the upcoming global stocktake, in particular on the credibility of net zero strategies from a science perspective.	Government of France, Ministère de la Transition écologique et solidaire
9616	37	9	37	14	As with SPM9, the basis for the description in E.1.1 is unclear. Regarding the energy system, the relationship between the size of the Enabler and Barrier for each option is indicated, but there is no such description in Chapter 6.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9618	37	9	37	14	The confidence level for direct air capture is low, and it should probably not worth mentioning it explicitly here. Moreover, the the confidence statement says "medium confidence." Also, AFOLU is lacking and land-based CDR cannot be explicitly evaluated with this figure.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11706	37	9	37	14	To also mention the positive response options (not only barriers regarding the social acceptance of large scale technologies) that have significant emission reduction potential and are socially acceptable as also promoting well-being, it is suggested to add as follows (reflecting the Ch. 5 ES messages): 'Decent living standards (DLS) and well-being for all are achievable through the implementation of high-efficiency low-demand mitigation pathways (medium confidence). Individual behavioural change and motivation is insufficient for climate change mitigation unless embedded in structural and cultural change. Yet, pilot experiments led by dedicated individuals and niche groups are central as social change agents. Bottom-up socio-cultural forces can catalyse supportive policy environments. Collective action as part of social or lifestyle movements, for example climate strikes giving voice to youth in more than 180 countries, underpins system change (high confidence)'.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14246	37	9	37	14	In the in the underlying report, which usually evaluate separately the response options, there is no robust support for this assessment which here put them together in an eclectic list (e.g., nuclear power with ocean fertilization). The criteria for separating several response options from others are not convincing. For instance, from the standpoint of technical viability the nuclear power should have been included in the category firstly described in the paragraph but it is listed with response measures which now pose technical challenges such as large-scale deployment of land-based CDR and ocean fertilization.	Government of Romania, National Meteorological Administration
14248	37	9	37	14	The term "many countries" is rather vague and misleading in this context.	Government of Romania, National Meteorological Administration
14250	37	9	37	14	The assumption that there are socio-cultural barriers such as public acceptance to nuclear power, is highly country specific and changing rapidly as underlying report shows. This criteria cannot constitute a reference for generalization.	Government of Romania, National Meteorological Administration
14252	37	9	37	14	Legal barriers needs mot clarification for nuclear power at least. Nuclear power projects are not forbidden by any current legislation.	Government of Romania, National Meteorological Administration
15430	37	9	37	14	The use of the term "increasingly cost effective" implies that they are not cost effective now, which is patently not true for many technologies. Suggest a rephrasing to something like "are currently or rapidly becoming cost effective." In addition, the use of the term "relatively" to modify "high public support" is overly hedging. Some technologies at the core of the energy transformation (solar, wind in many contexts) have unequivocally high public support. Suggest dropping or adjusting language accordingly.	Government of United States of America, U.S. Department of State
15432	37	9	37	14	As written, the statement presents two extremes, while biofuels and hydrogen fall in the middle. Recommend adding a statement or statements on barriers and enabling conditions for both hydrogen and biofuels. Both are important to the rest of the section but are not being addressed directly in terms of barriers and enabling conditions.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
10332	37	10	37	10	Please add "food waste" to "food loss"	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
9622	37	11	37	11	In section E, the word "scale" is used to express system size of implementation (e.g., E.1.3.). "On a global scale" would be replaced by a simple word "globally."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
13678	37	11	37	11	Change "take-up" to "up-take"	Government of New Zealand, Ministry%20for%20the%20Environment
3138	37	11	37	12	Socio-cultural and legal barriers mainly arise from real trade-off with other SDG. The sentence should mention it clearly, otherwise the reader might consider these barriers have no rational basis.	Government of France, Ministère de la Transition écologique et solidaire
3140	37	11	37	12	In the case of ocean fertilization the barrier is rather « ecological-environmental » than « socio-cultural » since the scientific community consider that its potential efficiency and feedbacks are largely uncontrolled (AR6 WGII). « ecological-environmental » should be added to the other mentioned barriers.	Government of France, Ministère de la Transition écologique et solidaire
464	37	11	37	13	E.1.1: Required action: indicate that the list is not an exhaustive one.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
5902	37	11	37	13	Changes in diets could be added to the list of options that face challenges. It is a lever that has a lot of potential in developed countries but is not used because of socio-cultural challenges.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6766	37	11	37	13	_TECHNOLOGY CONCERNS: Nuclear power, the large-scale deployment of land-based CDR options, direct air capture, and ocean fertilization do not only face socio-cultural and/or legal barriers. They also face as per Chapters 6 and 12 economic, technological, physical and institutional barriers. We, therefore, suggest to rephrase this sentence to: "Nuclear power, the large-scale deployment of land-based CDR options, direct air capture, and ocean fertilization face various and partly fundamental economic, technological, physical, institutional, socio-cultural and/or legal barriers as well as sustainability concerns related to environmental and/or health risks."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6768	37	11	37	13	What is the difference between large-scale and global scale?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6770	37	11	37	14	DACCS also faces technological barriers. In the DACCS section in chapter 12, it is stated: "Compared to other CDR methods, the primary barrier to upscaling DACCS is its high cost and large energy requirement (high confidence) (Nemet et al. 2018), which can be reduced through innovation." (12-43:7-9) Hence, there is still innovation needed to make this technology feasible. Also, mid or large-scale deployment is still not demonstrated ("As of 2021, there are more than ten plants worldwide, with a scale of ktCO <sub>2</sub> yr <sup>-1</sup> or smaller." 12-43:15-16)  We do not understand the barriers/enablers assessment presented in table 12.4. Even if the high energy needs are reduced by innovation, there will be still the need to build huge facilities to bring DACCS to a reasonable scale, which will be very material intensive and depending on the applied solvent, there will be limits regarding the material availability. And even if the questions around the "direct air carbon capture" part is solved, there are still many questions regarding the long-term storage (i.e., the CCS part). They are by far not solved as also found in Figure SPM.10 (CCUS has high levels of technological barriers). We strongly urge the authors to reconsider this and other statements on DACCS as they are one-sided and do not reflect the actual technological status of this technology.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11708	37	11	37	14	Ocean fertilisation faces much more than socio-cultural and/or legal barriers: inadequate knowledge to predict global consequences IPCC AR6 WGIII TS {12.3.2.3}; risks&impacts and trade-offs&spill-over effects (IPCC AR6 WGIII); environmental risks, ethical problems, governance problems.	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15434	37	11	37	14	(1) Suggest dropping direct air capture (DAC) from this list. There are challenges for all CDR approaches, but Figure 12.4 (in Chapter 12) only appears to identify socio-cultural and/or legal barriers for direct air capture with ""low"" confidence. If the authors mean geologic storage of CO2, then they should be more precise and replace DAC with ""geologic storage of CO2"". (2) Also a concern about grouping other technologies that are either currently deployed or under serious consideration (nuclear, direct air capture, land-based CDR) alongside ocean fertilization (a technique that faces significant challenges compared to the other approaches).	Government of United States of America, U.S. Department of State
10334	37	12	37	12	The inclusion of "nuclear energy" should take into account environmental impacts and security concerns.	Government of Spain, Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica
3142	37	12	37	12	We suggest to delete "nuclear power, "  Regarding Figure SPM.10, others mitigation options have more socio-cultural than nuclear power, and are not quoted.	Government of France, Ministère de la Transition écologique et solidaire
5904	37	13	37	13	Delete "and ocean fertilisation" as there is extremely limited evidence that it is a credible option and does not belong in this list. Ocean fertilisation is a geoengineering method that has multiple serious issues including that of termination, impacts on ecosystems, and its effect is poorly demonstrated.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11710	37	14	37	14	The feasibility assessment for the building sector is presented in section 9.9, therefore the citation into {...} brackets has to be changed from 9.10 to 9.9	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12776	37	15	37		Insert after "feasibility" the following "of options and the nature of options themselves,".	Government of India, Ministry of Environment, Forests and Climate Change
6772	37	15	37	15	This paragraph reads a bit like an arbitrary list. Please clarify on what "context" feasibility depends on. The aspects listed in this paragraph can be understood as examples, but do not include a more generic categorisation of "context", as for example specific to "sectors" or "regions" mentioned in the caption of Figure SPM.10 (page SPM-38 and 39). Please provide information on the selection of examples or structure clearly along "dependent on which kind of context" (time-specific, site-specific,...). Simply stating "...large-scale land use changes is highly context dependent" after opening with "feasibility is context-dependent" does not give any additional information.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
2410	37	15	37	19	Suggest including consideration of pan-national markets and industries, such as international shipping, which do not fall clearly within geographic jurisdictional boundaries.	Government of Australia, Department of Industry, Science, Energy and Resources
3144	37	15	37	19	In order to improve clarity and readability, a term such as "Examples include," should be inserted at the beginning of the 2nd sentence of paragraph E.1.2.  This as the current formulation of this sentence does not make clear that the elements listed are examples of the 1st sentence of E.1.2 ("Feasibility is context dependent."), rather than an exhaustive list.	Government of France, Ministère de la Transition écologique et solidaire
11712	37	15	37	19	E.1.2 seems rather unnecessary. Suggest deleting and replacing with other high-level findings on feasibility such as "Mitigation pathways are associated with significant institutional and economic feasibility challenges rather than technological and geophysical. The rapid pace of technological development and deployment in mitigation pathways is not incompatible with historical records. Institutional capacity is rather a key limiting factor for a successful transition." (Ch 3.8). Also, the repetition of "feasibility is context-dependent" in the current draft does not make sense. (Everything is context dependent but AFOLU is 'highly context-dependent'?)	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13350	37	15	37	19	This is very general. For policymakers it would be important to give some examples about how feasibility can be enhanced in specific contexts and under specific conditions. Good examples on how this could be done, are found in Section E, e.g., in E4.4 and E4.5.	Government of Switzerland, Federal Office for the Environment FOEN
15436	37	15	37	19	E.1.2 states "Feasibility is context-dependent" and goes on to explain why. However, it misses a critical piece of context dependency, which is that the fact that it's context-dependent means that concepts of what is feasible can change rapidly over time. This has been seen in the past 5 years as technologies have dropped rapidly in cost and net zero commitments, which were once thought of as borderline infeasible, are now common. Suggest adding this concept to this paragraph.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12778	37	17	37		After "urban development", insert "while regions with high urban development often have significantly greater capacities".	Government of India, Ministry of Environment, Forests and Climate Change
15438	37	17	37	19	Delete redundant and unnecessary statements: "spatial planning has a higher potential in early stages of urban development; the geophysical potential of geothermal is site specific; and cultural and local conditions may either inhibit or enable demand-side responses".	Government of United States of America, U.S. Department of State
3146	37	18	37	18	We suggest to add "energy and CO2 geological storage" in the sentence giving the following : "the geophysical potential of geothermal energy or CO2 geological storage is site specific;"	Government of France, Ministère de la Transition écologique et solidaire
5906	37	18	37	18	Reference to geothermal is oddly specific here - similar considerations apply to most renewables. Suggest replacing "geothermal" with "most renewables".	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11714	37	19	37	19	The feasibility assessment for the building sector is presented in section 9.9, therefore the citation into {...} brackets has to be changed from 9.10 to 9.9	Philippe Tulkens, European Union (EU) - DG Research & Innovation
1404	37	20	37	20	As feasibility depends on various things (including context, as stated in E.1.2), and "also" could be added here, to read "Feasibility depends also on the scale..." or suchlike.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
9624	37	20	37	21	Regarding the description of "Most options faces barriers when they are implemented at a large scale", the barrier will become significantly bigger when it implemented in too short timeframe. Since most of the industrial mitigation options such as batteries, solar, wind, hydrogen, CCUS requires massive scale deployment of resources and materials including rare metals, too quick deployment will bring supply shortage which must cause cost inflation of implementing those mitigation actions. This green inflation by scale and speed will become a major barrier for the quick transformation to net zero. Therefore, it must be commented that "Balancing speed/scale and supply capacity/cost must be carefully considered and realistic policies must be developed to assure stable smooth transition to net zero emission. Otherwise green inflation may bring a major cost barrier for the green transformation.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11716	37	20	37	22	E.1.3 These lines imply that large scale options are riskier and diverse portfolios are more likely to succeed. Is this really true? Obviously there are benefits to diversification, but history has shown greater progress in areas that are less reliant on coordination among multiple actors (such as decarbonising electricity) whereas theoretically cost-effective action in areas like buildings and (urban and rural) land management lags behind. The underlying report seems to admit this when it states that barriers are predominantly institutional rather than technological.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5908	37	20	37	25	The language used in Section E.1.3 is very technical and difficult to grasp. Some examples of barriers that arise at the large scale would be useful (for example, bioenergy with carbon capture and storage (BECCS)?).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15440	37	20	37	25	The impacts of scale on feasibility is very important and does not receive adequate attention throughout the SPM.	Government of United States of America, U.S. Department of State
5910	37	20	### ### #	25	This should be explicit on reducing CDR reliance as well	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11718	37	23	37	25	Maybe "system-level feasibility challenges" could be operationalised/better explained in tis paragraph rather than repeating the headline text	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11720	37	23	37	25	E.1.3 See our comments on E1. Rather than repeat the language about "spreading out" the feasibility challenge, it would be better to use these lines to explain this point more clearly.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14150	37	23	37	25	Please consider if an example could be included here.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
472	37	24	27	25	The text in E.1.3, states "...avoiding increased challenges beyond 2030 in scenarios likely to limit warming to 2°C, or limit warming to 1.5°C (high confidence)." The text should depict all degree target levels, not only focusing on either 1.5C or 2C scenarios, given that the E.1.3 is of high confidence level. Include all degree target levels and ensure policy-driven timeframes are removed.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1382	37	24	37	25	The meaning of "limit warming to 1.5oC" is unclear, as it does not specify whether there is an/some overshoot, compare C.3, and/or the likelihood, cf. Footnote 8 as well as Table SPM.1. Could this be clarified?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
12040	37	24	37	25	E.1.3: Same issue as with headline statement E.1, it should be specified here if the "limit warming to 1.5°C" refers to "with no or limited overshoot"	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
3354	38	0	38	0	Fig11 is highly policy relevant. However, the dots used to show limited or no evidence or lack of indicators are not clear enough and do not sufficiently signal when the lack of barrier or enabler is due to lack of data. This could mislead readers which would try to quickly identify which option has no barrier or no enabler. A stronger visual should be used, for example by still adding a rectangle (in this case empty) when there is limited evidence, but by highlighting the sides in grey or black for example.	Government of France, Ministère de la Transition écologique et solidaire
3356	38	0	38	0	We suggest to try to improve the colors of the figure for a better lisibility especially the pale grey and dark grey.	Government of France, Ministère de la Transition écologique et solidaire
474	38	1	38	1	Figure SPM.10 provides enablers and barriers to mitigation options deployment. The Mitigation Options listed under Energy should precisely reflect the list in the underlying chapter (Chapter 9, Page 22-48).	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
1150	38	1	38	1	Fig SPM 10 AFOLU is notably absent from this figure	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6776	38	1	38	1	If Fig.10 is kept: Please arrange the "Mitigation Response Options" in the same manner as in SPM.9 to facilitate line-by-line comparison, using the same examples. Also, please explain the criteria you used to select the mitigation option examples.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6780	38	1	38	31	If Fig.10 is kept: Pease consider incorporating nature-based solutions. It is very relevant for this section and is not mentioned anywhere in the SPM. In addition, please explain the "feasibility indicators" in more detail including their scientific robustness.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12042	38	1			Figure SPM.10: As with Figure SPM.9, the term "phaseout" of fossil fuels should be retained and strengthened; and it should be ensured that it is sufficiently defined, e.g. with a glossary entry.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12044	38	1			Figure SPM.10: For the mitigation option "nuclear", please investigate whether some of the different barriers would not have to be higher. For instance, it would seem that geophysical and environmental-ecological barriers would be higher considering the issue of nuclear waste disposal, and that socio-cultural barriers would be higher due to the "limited public acceptance" mentioned in B.4.1? Similarly, the barriers for direct air carbon capture and storage (DACCS) should be revisited as necessary implementation scales would result in a much less rosy picture for this option, for example.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
1384	38	1	38	1	The figure is rather difficult to comprehend. It is not clear how the different enablers and barriers compare (are they equally important in each case) and thus the significance of how many they are per option is rather unclear. Is a case with, for example, three barriers, always a more difficult case than all cases with two barriers? How does the net of enablers and barriers compare? Overall, the idea behind the figure is very valuable, but the figure presently struggles to provide useful information. Omitting or improving the figure would be welcome.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2186	38	1	38	1	The meaning of the light grey dots is in some cases unclear. E.g. why is there limited knowledge on economic factors of biofuels even though they have been studied and applied extensively?	Government of Finland, Finnish Meteorological Institute (FMI)
4158	38	1	38	1	The figure SPM 10 could use some refining with nuclear. If one is talking about existing nuclear designs, then the technological bar should be much more 'enabler' than 'barrier' however the economic would stay as is; vice versa if we are talking about new nuclear then the technological bar should be more 'barrier' but the economic bar should be more 'enabler'. Perhaps worth breaking out nuclear into two different categories	Government of Canada, Environment and Climate Change Canada
5912	38	1	38	1	While Figure SPM10 is very instructive, the content is difficult to read and appears to be misleading at times, and it's too detailed to be included in an SPM, so we suggest it is removed. We have set out a number of issues with the figure in more detail in our subsequent comments, but more broadly: 1) There are a number of concerns about the robustness of the underlying analysis and how the assessments of enablers and barriers have been conducted. 2) In particular, the assessments of barriers for the cross-cutting/CDR technologies at the bottom of the list appear to be missing a number of critical elements which don't give an accurate representation of the barriers and enablers especially if these technologies were to be implemented at the Gigatonne scale necessary for them to be effective. 3) Additionally, there are no uncertainty bounds/confidence levels attributed to the analysis. It could be argued that even recent developments (e.g. price reduction in offshore wind) seemed quite uncertain until they were imminent so what can we say robustly about the feasibility of developments in the late 21st Century? We suggest that the authors consider a more qualitative approach throughout the SPM in particular and describe the key results of their analysis in the SPM (e.g. Where are the major barriers? Where are conditions right for rapid transformations?) and signpost the more in depth discussion and analysis in the chapter where the nuances of the findings can be addressed.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5914	38	1	38	1	In Section E.1.1, some examples of response options that are relatively straightforward are given, together with examples of others that have substantial barriers. Could this figure give an overall assessment of the feasibility of each technology?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5916	38	1	38	1	It's difficult to relate the contents of this table to the underlying chapters. Please can you use footnotes (or some other method) to enable the reader to relate each part of the table to the corresponding underlying material? For instance, the Cross-sectoral material (which would be more accurately called "Carbon Dioxide Removal") relates to Supplementary Material 12.B and Table 12.4.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5918	38	1	38	1	DACCS: The table shows no geophysical barriers. But surely the lack of proximity to suitable geological formations is a barrier in many locations/regions? The table shows no institutional barriers, but it requires financial incentives and legal frameworks, co-ordination with the energy sector, and CO2 transport and storage infrastructure to be in place. And technological barriers are availability of sufficiently cheap low-carbon energy and feasible rate of roll-out of DAC plant and transport and storage infrastructure, have these been considered?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5920	38	1	38	1	Enhanced Weathering: The table shows no geophysical barriers. But what if potential rock sources are so far from the deployment site that the emissions associated with transporting them negate the benefits? There appear to be no institutional barriers. But the difficulty of cost-effective MRV (Monitoring, Reporting and Verification) is a major barrier for EW.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5922	38	1	38	1	Ocean Fertilisation: More enablers than barriers are depicted, which doesn't seem right, especially considering the conclusion of Fuss et al (cited in Supplementary Material 12.B Table 1 but not against Ocean Fertilisation) "This meager efficiency as a NET, combined with wide impacts on ecosystems, e.g. food web disturbances, suggests that OF is not a viable negative emissions strategy". The lack of scientific studies that demonstrate any level of permanent or semi-permanent CO2 removal from the atmosphere would also support this. The geophysical barriers seem to be small - is this correct? Are the necessary mining/quarrying/milling/shipping activities significant? Likewise the socio-cultural barriers are perhaps under-stated.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5924	38	1	38	1	Blue Carbon - the table shows more enablers than barriers. As blue carbon isn't really taking off, this doesn't seem accurate. Surely there are many barriers in the form of development of settlements and aquaculture, fishing activity etc (ie competition for sites), and institutional barriers such as a lack of incentives and Monitoring, Reporting and Verification arrangements etc.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6198	38	1	38	1	Figure SPM.10: Please consider reversing the direction of the blue bar to get "opposite" directions for enablers and barriers - this would likely facilitate the reading of the figure. We think that additional work is needed to make this figure more readable.	Government of Belgium, Belgian Science Policy Office - Belspo

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6774	38	1	38	1	<p>_FIGURE SPM.10: This figure does not seem to be scientifically robust enough for an IPCC SPM because of the following reasons:</p> <ul style="list-style-type: none"> <li>- it does not provide information for different scales of implementation for each option and for the six dimensions</li> <li>- it does not distinguish between different regions with very different conditions;</li> <li>- it does not provide information about the significance of each of the enabler/barrier;</li> <li>- there is no information on uncertainty;</li> <li>- we are not sure to what extent the authors across chapters have applied the same criteria for expert judgement;</li> <li>- it is unclear what blank fields mean;</li> <li>- the assessments of some options seem incoherent with the SPM's text, e.g. with respect to nuclear and CDR options (please see our related comment);</li> <li>- it is not obvious which message could be taken from this figure;</li> </ul> <p>We, therefore, request the deletion of figure SPM.10.</p>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6778	38	1	38	1	<p>If Fig.10 is kept: We are wondering about some odd results of the assessment presented in this figure and we kindly ask the authors to revise. Some examples:</p> <ul style="list-style-type: none"> <li>- From all energy mitigation options, nuclear has almost the lowest level of social-cultural barriers. This seems not correct in particular after the accidents of the Fukushima nuclear power plant. The value for the economic barriers seems also to low, as there are many examples of construction sites of nuclear power plants in Europe and elsewhere that will not be finalized due to their cost explosions. The question of long-term nuclear waste disposal is still nowhere solved globally.</li> <li>- DACCS, ocean fertilisation, enhanced weathering, blue carbon no or almost no technological barriers, although none of these options are actually deployed at middle or large-scales. There is still a lot of testing and innovation needed until these technologies are ready to be deployed commercially and/or at larger scales. This is a particularly odd result as bioenergy and even wind feature technological barriers in Fig.10, although these are mature technology deployed at Gt scales globally. This just cannot be correct. We urge deletion of this figure also due to other reasons, please see our related comment.</li> </ul>	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9626	38	1	38	1	<p>Figure SPM.10 seems to be a summary of the results of Chapters 6-12, but it is not clear what criteria each are used to evaluate each item. It is also misleading to generalize and present in such a way when the situation differs significantly from country to country. The evidence for evaluation, the methodology for the assessment and the criteria for quantification should be clearly presented, otherwise this figure should be deleted.</p>	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9628	38	1	38	1	<p>It seems that the rationale for Figure SPM.10 is not clear, and the explanation in the relevant figure in FGD is not understandable as the rationale for the evaluation. It is suggested to clarify the rationale carefully, or otherwise delete this figure to avoid misinterpretation.</p>	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9630	38	1	38	1	<p>With regard to the energy system, the relationship between the size of the Enabler and Barrier for each option is shown, but there is no such description in Chapter 6. The appearance of Enabler and Barrier varies from country to country, and SPM10 is misleading. It should be deleted or clarify the rationale carefully.</p>	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9846	38	1	38	1	<p>It remains problematic that the industry and AFOLU sectors are not covered. The options in these sectors don't have to be exhaustive; better to include at least some key options than non at all. The percentage range of 0-100% suggest a level of quantification that seems not warranted; better change into qualitative scale : "nil - full"</p>	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11722	38	1	38	1	<p>This is a brave attempt to summarize the pro's and con's of a set of mitigation options. Nevertheless, overall the bars look relatively similar across the set of options, and it is fairly difficult to understand the most promising technologies, where enablers are not 'blocked' by barriers. We invite to include information also on the presence of non-controversary technologies.</p>	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11724	38	1	38	1	<p>A number of missing barriers are surprising. It is unclear whether they are just not yet filled, or intentionally left blank for example:</p> <ul style="list-style-type: none"> <li>* No economic barrier to solar and wind</li> <li>* No geophysical barrier to infrastructure, waste management, enhanced weathering or DACCS</li> <li>* No environmental barrier to a whole host of options</li> </ul>	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12378	38	1	38	1	<p>Also to mention waste heat recovery from the stack gas both here and in the main technical text.</p>	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12380	38	1	38	1	<p>It is important to mentioned the bio-fuels for transportation as well both here and in the main technical text.</p>	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13702	38	1	38	1	Complicated to follow, suggest clearer division between rows and links within rows	Government of New Zealand, Ministry%20for%20the%20Environment
14154	38	1	38	1	Figure SPM. 8, 9 and 10 all looks at mitigation options, but for some reason they are structured differently, and some of the names/terms under these options are described in different manners. This somehow makes it confusing to look at the figures one after the other in order. Please consider to use a common template or the same structure and order in the three figures (e.g. the division in Figure SPM. 9). Also, there are big variations in the various options, and it would be helpful if the figure caption could explain how the totality of these options is considered in this figure. We also want to ask if this figure could convey the most important message in another way? Please consider these comments.	Government of Norway, Norwegian Environment Agency
14156	38	1	38	1	In our view, Figure SPM. 10 provides important information on enablers and barriers, but it is difficult to understand: Firstly, the combination of enablers, barriers, percentage, lack of evidence and indicators not being applicable, is confusing and not very intuitive to understand. We also question the robustness of the methodology behind, especially related to internal importance between and within enablers and barriers for the different factors (e.g. geophysical), and therefore we wonder how the importance of specific enablers and barriers are captured. Since the figure only count the number of enablers and barriers, without weighting them, e.g one barrier or enabler might be much larger than many others; for instance if one mitigation option is or may become almost forbidden or very restricted, see e.g. work under the London Protocol on ocean fertilisation. Another methodological issue is that for some mitigation options the number of enablers and barriers will significantly depend on how it is implemented, where and the scale. It would therefore be relevant to know in what scale the different mitigation options are analysed. This may lead to an unbalanced result. It would be helpful with a guidance, that also explains what barriers and enablers are, as one wonders if enablers can be negative as well, or only positive? Also, there are big variations in the various options, and it would be helpful if the figure caption could explain how the totality of these options is considered in this figure. Some mitigation options have variable production, e.g. solar energy and wind energy, and it would be useful to know if this variability is defined as an enabler or a barrier. We also want to ask if this figure could convey the most important message in another way? Please consider these comments in the caption of the figure.	Government of Norway, Norwegian Environment Agency
15442	38	1	38	1	Figure SPM.10 is missing AFOLU.	Government of United States of America, U.S. Department of State
15444	38	1	38	1	The meaning of the bars is unclear in Figure SPM.10 as a standalone graphic. Indicate in the legend (not just in text underneath) that the 0-100% bar refers to percentage of dimensions considered in this report on a numerical basis.	Government of United States of America, U.S. Department of State
15446	38	1	38	1	Recommend adding in a section for Industry in Figure SPM.10, if possible. It seems incomplete not to include it in this figure when mitigation options are discussed earlier in the report.	Government of United States of America, U.S. Department of State
15448	38	1	38	1	It is challenging to understand Figure SPM.10, in particular the dark blue and dark orange bars. Is it possible to explain this in another way or use a different way to display the data? Currently it is hard to understand what the figure is trying to convey.	Government of United States of America, U.S. Department of State
6990	38	1	38	19	We appreciate the important assessment done in this figure with regards to fossil fuel phaseout.	Government of Jamaica, Meteorological Service Division
11726	38	1	38	19	Is the ratio of environmental-ecological enablers/barriers for ocean fertilisation correct? Taking into account criteria from Annex II Part IV Section 11 and the table provided in Chapter 12, p 58, the difference should be larger.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11728	38	1	38	19	Harmonisation between SPM 9 & 10 would be welcome	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11730	38	1	38	19	It is regrettable that the figure avoids AFOLU and industry because they are considered difficult. The argument provided is unconvincing and a better justification would be useful.	Philippe Tulkens, European Union (EU) - DG Research & Innovation



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14152	38	1	38	19	Please consider to clarify how the percentages is calculated, and how you distinguish between the enablers that are counted in the number for maximum possible enablers and the enablers that are counted in the percentage, and similar for barriers. For instance, it is difficult to understand if the maximum number of enablers/barriers common list that are used for all mitigation options? Or is it the maximum possible enablers? Please include an explanation in the figure caption, if possible. Please also check the text from line 14 to 17 in the caption, because in our understanding there seems to be enablers and barriers presented in solid colors always sums up to 100% (unless a dot), but the text gives an impression that the maximum number of enablers and barriers is calculated seperately. If our understanding is correct, it is also a bit misleading to use the light colors in the horisontal bars.	Government of Norway, Norwegian Environment Agency
15450	38	1	38	19	The Figure SPM.10 caption needs work. It does not adequately explain what is meant by an enabler or barrier to have an "extent" of "100%". The dark blue and dark orange shadings do not appear to be zero-sum in any given row. The shadings presumably are meant to indicate importance, but the quantitative aspect of them in percentage terms from 0 to 100% does not make sense. Improve the explanation in lines 14-19.	Government of United States of America, U.S. Department of State
15452	38	1	38	19	Clarify in text whether each dimension in Figure SPM.10 is assessed in a purely binary fashion for each, and equally weighted across them.	Government of United States of America, U.S. Department of State
2190	38	1	39	5	We appreciate the Fig. SPM.10 for providing the information of the enablers and barriers in quantified form. We noticed that the Fig. SPM.8 contained some same elements e.g. like solar and wind energy. We would like to ask if the links between these two figures could be further strengthened and maybe, if possible, further clarified how enablers/barriers affect the cost of the mitigation options in Fig.SPM.8, or do they play a role in the uncertainty in that figure.	Government of Finland, Finnish Meteorological Institute (FMI)
11732	38	1	39	5	SPM 10 is a good attempt at conveying a lot of information, but it is hard to understand both in terms of the notation and then the contents. If retained, it will need a lot of work to make it more complete, balanced and readable.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15454	38	1	39	5	Figure SPM.10 is not immediately clear. If anything, it shows that sociocultural and economic dimensions have enormous potential for enabling mitigation responses, yet the document does not outline examples of sociocultural and behavioral mitigation options. Could the mitigation response options be weighted according to urgency or relative contribution to CO2 emissions?	Government of United States of America, U.S. Department of State
6200	38	3	38	4	The reference to six dimensions of feasibility comes from the Special Report on 1.5°C. Could you add a footnote to define these six dimensions?	Government of Belgium, Belgian Science Policy Office - Belspo
3358	38	4	38	4	The fact that AFOLU is not covered because of the heterogeneity of options is a little bit surprising especially as figure 8 showed that AFOLU has the main mitigation potential across all sectors. Therefore, inclusion of AFOLU with statement about the uncertainties or variabilities would be better than not showing information.The argument that the heterogeneity of the options makes it impossible to estimate the barriers and enablers to the deployment of these mitigation options in the AFOLU sector does not prevent an average or a new classification being proposed. This figure shows that the classification of mitigation options in the AFOLU sector groups together very different practices that would deserve a more refined classification.	Government of France, Ministère de la Transition écologique et solidaire
11734	38	4	38	5	The caption states that AFOLU is not covered. However, bioenergy and biofuels are covered, although they are hard to evaluate without considering their interactions with virtually the whole range of AFOLU. It is hard to see why one is deemed to complex whilst the other one is presented without caveats.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14158	38	4	38	5	Figure SPM10 does not include analysis of barriers and enablers for the AFOLU sector, explained in the figure cation by the heterogeneity in the sector. While we appreciate that AFOLU-related options such as bioenergy and biofuels are included in fig SPM 10. We encourage the authors to include more options like dietary changes, sustainable forest management and protection of natural systems in Figure SPM. 10. If this is not possible, we propose to better describe such options in the text in section E.	Government of Norway, Norwegian Environment Agency
11736	38	10	38	10	Add water pollution.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
9870	38	14	38	17	Unclear what is meant with "the extent to deployment", please explain more elaborately.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12364	38	20	38	29	It is better to provide quantitative numbers in charts.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13584	38				The option "fossil fuel phaseout" is very welcome and will be supported.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
13586	38				Similar to Figure SPM.9, the nuclear power mitigation option requires reassessment in our view. Given the issue of disposal of nuclear waste, one would assume higher barriers in the geophysical and other feasibility dimensions.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
1194	38		38		Figure SPM.10: Difficult to see difference between light circles (limited or no evidence) and dark circles (some indicators not applicable). Perhaps different 'shapes' could be considered e.g. circle and triangle.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1196	38		38		Figure SPM.10: a horizontal line across the figure between sections (e.g. Energy, Urban, etc.) would make it easier to navigate the many useful elements.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
1198	38		38		Figure SPM.10: Reference to chapter source (similar to Figure SPM-9) would be extremely useful here.	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
4160	38		38		SPM.10 is really challenging to interpret. The bars do not seem sufficiently different such that they could not be replaced by low, medium and high. Additionally, the interpretation of these categories as enablers and barriers is difficult to interpret.	Government of Canada, Environment and Climate Change Canada
12780	38		38		Rework Figure SPM 10 for clarity and ease of reading.	Government of India, Ministry of Environment, Forests and Climate Change
	38		38		SPM10: Is the confidence level the same for all options?	WGI Bureau,
12258	39	1	39	48	The adverse impact of economic sanctions on low carbon development must be mentioned and addressed in the report.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
15456	39	3	39	3	Recommend restating as "implementation by 2030" in terms of requiring interim actions in the years prior.	Government of United States of America, U.S. Department of State
15458	39	3	39	9	"Action can be taken now" is a thinly veiled policy recommendation and should be made more objective. Delete "can be taken now" and, in the following line, "that".	Government of United States of America, U.S. Department of State
3360	39	4	39	4	A reference to Fig. TS.31 could be added (see page TS-137)	Government of France, Ministère de la Transition écologique et solidaire
11738	39	4	39	4	The feasibility assessment for the building sector is presented in section 9.9, therefore the citation into {...} brackets has to be changed from 9.10 to 9.9	Philippe Tulkens, European Union (EU) - DG Research & Innovation
482	39	7	39	13	E.2: "Transformations" require stringent and rapid actions and human and financial resources in very short time which might not be available at this time for every country. The principle of Common But Differentiated Responsibilities and Respective Capabilities (CBDR-RC) outlined in the United Nations Framework Convention on Climate Change (UNFCCC), recognizes that countries have different duties and abilities to address the negative impacts of climate change. System transitions is more suitable implying the varying levels of resources of different countries. "System transformations" should be replaced with "system transitions".	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
5926	39	7	39	36	Many of the excellent comments made in this section are applicable to both developing and developed countries. The header of this section suggests this text is for developing countries as "development pathways" is generally used in that context. The header could be broadened to make it applicable also to the evolution of society more broadly. For example, the UK is transforming its land policy after Brexit, which is an opportunity to include land mitigation.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
5928	39	7	39	36	Section E.2 suggests a number of high-level interventions, and a few specific examples of responses, but does not identify clear policy and governance principles. Perhaps insights could be given for high-income and low-income countries, as their contexts are very different. Section E.3 feels like an extension of E.2, as it discusses actions that policymakers could use to embed mitigation efforts within their countries. The two sections could be combined.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5930	39	7	39	36	What national actions are necessary to remove barriers to international finance flows?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11740	39	7	39	36	E2 - much of this section seems unnecessary since it is too general to provide any useful insight to policymakers on its own. However, the explanation on 'development pathways' and 'shifting development pathways' is important. This needs to appear earlier in the SPM since the concept has already been mentioned several times by this point. Unpacking the 'development pathway' concept seems to be the key added value of this section (see our earlier comment on this in the context of section D3). It would be useful to clarify some basic questions e.g. * is "shifting" of development pathways part of a standard good practice toolbox outside of climate policy? Or is it a novelty being promoted in this report in the context of climate action? * what is the relationship between mitigation pathways (that an IPCC audience is more familiar with) and 'development pathways'? Is the report trying to promote the idea that successful 'shifting' can convert a development pathway into a mitigation pathway (while also achieving better sustainable development outcomes)?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12782	39	7	39	36	E2 and all sub bullets can be deleted. They provide no new information or fresh insight for policy in relation to other sections. Further, the exclusive focus on development pathways, without a single mention of transition to low carbon pathways at high levels of development is unacceptable as it provides an unbalanced and biased perspective.	Government of India, Ministry of Environment, Forests and Climate Change
13318	39	7	39	7	What do you mean by "wider development context"? Can you omit those words entirely?	Government of Switzerland, Federal Office for the Environment FOEN
14160	39	7	41	11	Policy options for AFOLU are not described under sections E2, E3, E4 (and also not in figure SPM.10). Please consider further attention to AFOLU in these sections.	Government of Norway, Norwegian Environment Agency
478	39	8	39	8	The text in E.2. states, "limit global warming to 2C or 1.5C". The text only reflects 1.5C and 2C, while neglecting to capture all degree targets. Include all degree targets for comparison and a balanced view.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
5932	39	8	39	8	Section E uses "to limit global warming to 2°C or 1.5°C", while Section C used a much longer sentence "In pathways that limit warming to 1.5°C with no or limited overshoot, or are likely to limit warming to 2°C". These need to be harmonised so the text is both accurate and readable.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12046	39	8	39	8	E.2: Please add information on which 1.5°C pathway category this refers to, i.e. "1.5°C with no or limited overshoot".	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
2134	39	11	39	12	Considering line 29-30 of E.2.3, policy, governance, collaboration would be added in the actions can be taken.	Government of Republic of Korea, Korea Meteorological Administration
11742	39	11	39	13	There is no need to repeat "can" in the sentence.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15460	39	13	39	13	Consider adding 5.2 to the line-of-sight for achieving the Decent Living Standard benchmarks for human well being.	Government of United States of America, U.S. Department of State
15462	39	13	39	13	Add "certain" before "socio-cultural". Not all socio-cultural and lifestyle changes (and their current trajectories) are compatible with GHG mitigation. But, what is the point of this statement, as the policy challenge is whether people want to make those changes and do. Consider deleting the sentence and the rest of the paragraph, as it seems redundant with other parts of the SPM, such as the section on urban areas.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
476	39	15	39	16	E.2.1: The statement "Current development pathways create behavioral, spatial, economic and social barriers to the acceleration of mitigation at all scales." reads as if attributing the existence of barriers to the acceleration of mitigation at all scales to deliberate efforts from policy makers. Rephrase to remove the connotation of negative assessment of policy prescription.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
5934	39	15	### ### #	20	What exactly about current development pathways inhibits mitigation?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
3148	39	16	39	16	We suggest to delete the term "citizen" from the list and to dedicate a specific sentence on their potential choices to influence developpement pathways as they are quite different from the other stakeholders mentionned	Government of France, Ministère de la Transition écologique et solidaire
480	39	16	39	17	The text in E.2.1 states, "Choices made by policymakers, citizens, urban planners, the private sector and other stakeholders influence societies' development pathways." There does not seem to be any relevance to this statement and reads as an opinion with no confidence level associated with it. Remove this statement.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
15464	39	16	39	17	Delete the obvious statement: "Choices made by policymakers, citizens, urban planners, the private sector and other stakeholders influence societies' development pathways."	Government of United States of America, U.S. Department of State
5936	39	17	39	18	"Address" is not quite the right word and is a bit too vague. Consider "steer", "alter", or "modify". Also "change" is not needed after "behaviour" if the comment is accepted.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12276	39	20	39	29	It is better to provide quantitative numbers in charts.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
1386	39	21	39	21	In order to acknowlegde also water-related mitigation (such as preservation and restoration costal ecosystems, not least: salt marshes, mangroves, kelp forests, seagrass meadows), "land management" could be amended to "land and water management", as appropriate. Albeit small global potential, they can be rather significant in many regions, and carry a number of co-benefits.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
14162	39	21	39	28	This is a important para with good examples, please keep.	Government of Norway, Norwegian Environment Agency
14164	39	21	39	28	Please include "conservation of forest and natural ecosystems" in line 21-22. Further more we believe it would be a good example to include conservation of forest and natural ecosystems among the examples desribed in the last part of the para. E.g. something like: Conservation of forest and natural ecosystems may protect a large amount of carbon stored, and at the same time contribute to presevation of biodiversity, sustainable development and to adaptation.	Government of Norway, Norwegian Environment Agency
6782	39	23	39	24	Please be more specific when referring to "lifestyle changes" as it is open to interpretation. Perhaps consider including "sustainable life-style choices" or similar wording. Examples could also be useful.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6784	39	23	39	28	Please provide additional information on the applicability of these examples, since they seem very specific for Western/developed countries (esp. "lifestyle changes").	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9632	39	24	39	24	This statement may apply to developed countries, but as life becomes more affluent in developing countries, emissions may increase on the contrary. It would be better to change the sentence to be more accurate.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
15466	39	25	39	20	This is a broad overstatement. Examples exist at the subnational level to the contrary.	Government of United States of America, U.S. Department of State
15468	39	27	39	27	Consider referring to housing policies as "coordinated" in this sentence. Coordinated housing policies then reflects the transportation and land use connection.	Government of United States of America, U.S. Department of State
15470	39	27	39	28	Replace "as they provide households with broader options to relocate" with "by reducing urban sprawl and making public transport more feasible".	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11744	39	29	39	36	Consider to briefly mention here again that the mitigation potential of innovation depends on how it is managed. Maybe not enough space but it would nicely link up to B4.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14166	39	29	39	36	In the reference list at the end of this paragraph, please consider including chapter 5.4, as it contains useful information on behavioural drivers and enablers such as economic, legal and social incentives.	Government of Norway, Norwegian Environment Agency
15472	39	30	39	30	Delete "multi-objective policies" as it depends on the specific policies.	Government of United States of America, U.S. Department of State
11746	39	31	39	32	"can lead to mutual reinforcement"	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15474	39	32	39	32	Replace "Depending on context, some" with "Some".	Government of United States of America, U.S. Department of State
11748	39	32	39	33	"depending on the context"	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11750	39	32	39	34	"behavioural change, may take time [...] importance of early action": Whilst it is essential to highlight considerations underpinning the urgency to step up mitigation, this sentence is just one example in the SPM written as if no mitigation action had been taken to date. It would be useful to more consistently recognise actions taken to date, however inadequate they may seem, and reflect on their lessons learned, before trying to reinvent the wheel.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14168	39	32	39	35	Why is this in bold?	Government of Norway, Norwegian Environment Agency
13320	39	32	39	36	The findings state that behavioral changes may take time to be established. What does the literature tell us with respect to launching different mitigation efforts in parallel or in sequence? We should probably not omit behavioral change all together only because it will take time. It would be important to read how behavioral change can be combined with other mitigation efforts in parallel or in sequence.	Government of Switzerland, Federal Office for the Environment FOEN
5938	39	34	39	34	Could the authors please clarify what is meant by early action here e.g. action in the 2020s resulting in rapid and deep emissions reductions this decade?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2444	39	34	39	36	how can improved access to finance be put in place in relatively short time?	Government of Denmark, Danish Meteorological Institute
14170	39	35	39	36	Please consider to also include chapter 5.4 to the line of sight.	Government of Norway, Norwegian Environment Agency
11752	39	36	39	36	Section 9.9 is covering in great details these topics and could be added here into the {...} brackets	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12784	39	38	39		Delete first sentence of E.3. Policy prescriptive and speculative.	Government of India, Ministry of Environment, Forests and Climate Change
15476	39	38	39	38	Delete tautology that policymakers will not find helpful: "Framework climate legislation linked to institutions with clear climate remits enables ambitious climate action."	Government of United States of America, U.S. Department of State
6202	39	38	39	39	The interpretation of this sentence is not fully clear to us: why are "clear climate remits" needed when policies also need to cover "multiple policy domains", as suggested in the next sentence? This line is very unclear. The word "linked" does not appear appropriate: it suggests that Parliaments need clear climate remits, which is wrong. Could it be rephrased as "Framework climate legislation enables ambitious climate action, in particular when it creates institutions with clear climate remits."?	Government of Belgium, Belgian Science Policy Office - Belspo
6786	39	38	39	42	Please replace "indigenous groups" by "local and indigenous groups" as described in the underlying report.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15478	39	38	39	42	The report authors make (medium confidence) governance judgments about the greater effectiveness of climate mitigation efforts through greater vertical and cross-sector engagement with non-governmental and private sector stakeholders that are likely true only in free, open democratic societies. Freedom House currently puts the number of "free" countries at 82 (2020). In authoritarian countries where non-governmental stakeholders have less autonomy, top-down national mandates are a necessary prerequisite to effective climate mitigation. Also should note the importance of subnational and local efforts, not just national ones, regardless of the political context. Also, authoritarian governments may have greater flexibility to reduce GHG emissions through regulatory actions and removal of fossil fuel and electricity subsidies if they are inclined to do so. The SPM should take the governance context in each country as a given, rather than advocating for or against authoritarian governments.	Government of United States of America, U.S. Department of State
15480	39	38	39	44	This section is prescriptive and, while based on some anecdotes from a few countries, does not reflect assessment of the myriad legal, governance, and other institutional arrangements that may be publicly acceptable and effective. At a minimum, change the language in lines 38 and 43 to say, "Framework legislation is one option among many ..." The existing text seems policy-prescriptive regardless of political, legal, and institutional context and capacities. And ultimately, poorly designed framework legislation would be worse than its alternatives in many respects. Alternatively, delete the sentences about framework legislation. For example, it may not be well integrated into other laws and policies regarding sectors and social objectives BECAUSE it could be a single objective law.	Government of United States of America, U.S. Department of State
5940	39	38	40	15	The critical role of evidence-based decisions and grounding on the latest science could be added in this section. Most independent national bodies have evidence-based decisions at the heart of their analysis and recommendations, maybe in E.3.2.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
13352	39	38	40	15	Somewhere in E3, maybe E3.3, institutional settings that challenge or facilitate decentralized or sub-national or regional or local action, should be mentioned. Generally, federalist or decentralized states give different room of manoeuvre to local initiatives, and to actors such as communities or municipalities. Maybe adding in E3.3, besides political system (that refers most often to democracies and other types of governing) also political structure or governance structure, might be useful.	Government of Switzerland, Federal Office for the Environment FOEN
11754	39	38	40	4	E3 & E.3.1 What is "framework" legislation (not defined in the glossary). Perhaps these paragraphs could be more specific. Many things 'can enable' mitigation (but may not in the end). Plenty of countries have cross-ministerial climate change bodies that are in theory coordinating but in practice marginalised by energy, agriculture and/or finance ministries. So in this respect, the paragraph should state more clearly how these kinds of setup can add value. This would appear to come from a combination of the Chapter 13 & 14 findings - namely that procedural commitments (whether international or domestic) do not automatically achieve anything, but they can (as Ch 14 says). "trigger domestic policies and measures, enhance transparency, and stimulate climate investments". Incidentally, it is a shame that most of the conclusions on policies in the Ch13 Executive Summary are 'medium evidence, high agreement'. It would be nice if there were some 'high evidence' findings about success factors for climate laws, specialised agencies etc.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14172	39	38	40	4	E.3 and E.3.1 contains important information, but the language is complicated and it takes time to understand the meaning and what/who it may include (e.g. "framework climate legislation linked to institutions", "legally constituted specialised agencies" and "legislation in other policy domains"). Please consider if some of the sentences can be rewritten, and if they perhaps can include examples that make the reader understand the words/sentences.	Government of Norway, Norwegian Environment Agency
15482	39	38	40	4	Framework legislation should be placed in the context of direct and indirect laws. The emphasis on framework legislation in the SPM (pages 39-40) does not reflect Chapter 13's review of legislation, institutions, and related governance issues, particularly in Section 13.2. The current SPM text implies that framework climate legislation is found to be effective, and the lack of context results in an implication that it is more effective than less comprehensive direct and indirect laws. The chapter discusses framework legislation as one type of direct law, and also gives importance to indirect law. The chapter's main finding regarding framework legislation is: "The performance of framework laws suggests a mixed picture" (page 13-10, line 11). The Chapter 13 Executive Summary more accurately captures framework legislation as a subset of direct laws (page 13-4, lines 19-26) and the SPM should be revised accordingly.	Government of United States of America, U.S. Department of State
12786	39	39	39	40	Delete the words "climate governance" and replace by "governance to achieve climate action goals" After "policy-making levels" insert: ", keeping in view the global collective action nature of mitigation and adaptation and the restrictions and constraints placed on national actions by the state of climate action by other actors at the global scale". Replace "Effective climate governance" by "Effective governance for climate action".	Government of India, Ministry of Environment, Forests and Climate Change

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6788	39	40	39	40	It is suggested to replace "link" with "align". For effective design and implementation of climate policies, national and sub-national policy-making needs to be not only linked but aligned, cp. chapter 13 (source: e.g. Rabbia M., Zopatti Á. (2021) Subnational Governance of Climate Change. In: Leal Filho W., Luetz J.M., Ayal D. (eds) Handbook of Climate Change Management. Springer, Cham. <a href="https://doi.org/10.1007/978-3-030-57281-5_52">https://doi.org/10.1007/978-3-030-57281-5_52</a> ).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
4162	39	41	39	41	'Indigenous groups' should be revised to 'Indigenous Peoples'	Government of Canada, Environment and Climate Change Canada
12788	39	43	39		Delete E.3.1 . Replace by " Governance for climate action at the national scale depends significantly on the international and global policy context. Lack of equity and the non-acknowledgement of varied national circumstances, varying levels of development and capacities and capabilities, can severely limit the scope for action for governance at the national level. Such situations are already well known in policy across other regimes such as trade, investment, finance, and security. Majority of countries in multilateral forums for climate change recognize the principles of equity and common but differentiated responsibilities and respective capabilities, in the light of national circumstances, with some variations in their interpretation".	Government of India, Ministry of Environment, Forests and Climate Change
9634	39	43	39	44	Framework legislation can enable mitigation by setting emission targets, and creating implementation mechanisms "while ensuring smooth transition process, assuring sound economic activities, which is the key pre-requisite for the sustained mitigation actions", integrating through sectoral plans...	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
3150	39	44	39	44	We suggest to replace "climate objectives" by "climate and biodiversity objectives..."	Government of France, Ministère de la Transition écologique et solidaire
12294	39		39		In Figure 9-11 which introduces the technologies that can reduce energy use in buildings, micro-Turbines and Sterling engines as micro-CHP systems and electricity and heat storage system are missing, despite their high potential in reduction of energy use in buildings	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
13322	40	1	40	1	What do you mean by "Legally constituted specialised agencies"? Can you simplify and/or explain?	Government of Switzerland, Federal Office for the Environment FOEN
494	40	1	43	35	This text should reference underlying chapters on the economic implications of transitioning that will strongly impact developing countries. Required action: Include these references in the SPM	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
5944	40	5	40	10	The description of national climate institutions applies principally to developed countries. What approaches might plausibly be adopted by less developed countries where central, and particularly local, governments are often weak?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11756	40	5	40	10	What about accountability (e.g. via MRV)? Surely the most effective of these national bodies have this at the core. E.g. the tracking of progress towards climate goals. Also links to Paris Agreement transparency discussed in Chapter 4 and the importance of the implementation gap (as well as the ambition gap) between current policies trajectories and the global climate goals.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12352	40	5	40	10	Policy coherence between policies for water and the environment, health, energy, agriculture, industry, spatial planning and land use through effective cross-sectoral coordination, should be encouraged in all climate change mitigation responses.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
13680	40	5	40	10	It would be helpful if this paragraph could also address the relationship between effective institutional arrangements providing stable regulatory/legislative environments (thus reducing uncertainties for decision-makers at all levels).	Government of New Zealand, Ministry%20for%20the%20Environment
12790	40	5	40	5	Replace "national climate institutions" with national institutions for climate action".	Government of India, Ministry of Environment, Forests and Climate Change
5946	40	6	40	6	Building consensus among political parties is also crucial and could be added to the list.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
3152	40	7	40	7	It is also important to mention that all departmental mandates have to enhance their capacity in addressing climate change and to increase their ownership; this is not just a matter of coordinating or independent bodies.	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11758	40	10	40	10	Better remove 13.7 and 13.9 in the reference bracket at the end.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
4164	40	11	40	11	'Indigenous groups' should be revised to 'Indigenous Peoples'	Government of Canada, Environment and Climate Change Canada
11760	40	11	40	11	Insert "mass media" between 'businesses' and 'youth'	Philippe Tulkens, European Union (EU) - DG Research & Innovation
6790	40	11	40	12	Please replace "indigenous groups" by "local and indigenous groups" as described in the underlying report.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15484	40	11	40	12	This engagement can have positive or negative impacts on climate change mitigation and adaptation.	Government of United States of America, U.S. Department of State
2144	40	11	40	14	It would be better to "how" multiple actors including civil society, businesses, youth, labour and indigenous groups are engaged influence political support for climate change mitigation. This can link to E3.2. effective national climate institution as a vehicle.	Government of Republic of Korea, Korea Meteorological Administration
488	40	11	40	15	E.3.3: The example on material endowments is very specific to one source and does not cover all types of material endowments. Remove the example in line 13.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
6792	40	11	40	15	The terms "ideas, values and belief systems" from chapter 13.3.3 could be added here as well because it makes the "cultural factors" more specific (or adds to them, depending on what is meant by that expression). Perhaps this sentence from the Chapter 13 executive summary is useful: "Key structural factors are domestic material endowments (such as fossil fuels and land-based resources); domestic political systems; and prevalent ideas, values and belief systems."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11762	40	11	40	15	This section E.3 and paragraph about the role of legislation and climate governance does not refer to the Ch. 17 ES findings about the role of a just transition. To better reflect the role a justice perspective can play to strengthen the response, the following language is proposed to be added: 'A justice perspective to transitions means integrating principles to protect vulnerable populations and low income groups, mitigating the negative effects of transformations, protecting employment rights, enabling social dialogue and democratic consultation and ensuring an equitable decarbonized society.'	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12792	40	11	40	15	Delete E.3.3. It is policy prescriptive.	Government of India, Ministry of Environment, Forests and Climate Change
13698	40	11	40	15	Suggest also highlighting how incorporating indigenous and sector values and interests into policy design can help to drive more effective climate change solutions.	Government of New Zealand, Ministry%20for%20the%20Environment
9834	40	12	40	14	Adjust sentence: add: "vested industrial interests", , "may affect the level of ambitious and pace of climate policy development' rather than "political change"	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11764	40	12	40	14	"Material endowments" (or natural resources) matter just as much for renewables and many other mitigation options, not just fossil fuel resources.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15486	40	14	40	14	Delete "Climate litigation is playing a growing role in shaping mitigation efforts" as it has only been applicable in a small number of high-income countries and is not relevant where judicial systems are not independent and transparent.	Government of United States of America, U.S. Department of State



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
4166	40	14	40	15	There is some inconsistency in messaging between this statement about climate litigation in the SPM and the conclusions presented on climate litigation in the Ch. 13 ES. Specifically, Ch. 13 ES page 5 line 9 states that "Climate litigation is growing and can affect the outcome and ambition of climate governance (medium evidence, high agreement)," Here, the assessment is that the number of climate litigation cases is growing. This should be straightforward to assess. However, in the SPM the assessment statement says that "climate litigation is playing a growing role in shaping mitigation efforts", and there is high confidence attached to this. Was the growing role of climate litigation in mitigation really assessed? Or should the SPM text be brought more in line with the conclusion of CH. 13?	Government of Canada, Environment and Climate Change Canada
6204	40	14	40	15	Please add a sentence concerning human rights arguments, after "Climate litigation is playing a growing role in shaping mitigation efforts (high confidence). (5.2, 5.4, 5.5, 5.6, 9.9, 13.3, 13.4)". For example, litigants have begun to use human rights arguments, with a growing receptivity among courts towards such arguments in climate change cases (Chapter 14.5).	Government of Belgium, Belgian Science Policy Office - Belspo
15488	40	14	40	15	The SPM statement on litigation seems stronger in terms of the impact of litigation as well as the confidence level than what is presented in Chapter 13. Suggest replacing the sentence with that in the Chapter 13 Executive Summary (page 13-5, lines 8-9): "Climate litigation is growing and can affect the outcome and ambition of climate governance (medium evidence, high agreement)."	Government of United States of America, U.S. Department of State
12984	40	17	40	18	E.4 The first sentence reads like a primer on policy. The point about policy packages in the 2nd sentence would be better as the first sentence.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
5942	40	17	40	22	Suggest adding reference to fossil fuel subsidies (E.4.2 lines 31-32) to chapeau E4 given its importance.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5948	40	17	40	22	The sentence on economic stimulus packages should highlight that these can enable change or create blockages.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11766	40	17	40	22	Some repetition from C.6.3.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11768	40	17	40	22	Make sure that the readers of the SPM are aware of the differences between policy packages and policy mixes. Especially since both now appear in B4 and E4 respectively. In case it is decided to just refer to policy packages here, you might want to switch the phrasing on p.41, line 5 from "mix of measures" to "package of measures" or sth. similar to avoid confusion.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14174	40	17	40	27	It is somewhat difficult to understand what kind of regulatory instruments, policy packages, economy-wide measures and market-based instruments you are referring to, and what the differences are. Please consider to include some examples, to make this clearer.	Government of Norway, Norwegian Environment Agency
12048	40	17	41	11	E.4: Could section E.4 be condensed somewhat - especially the more general statements and e.g., long lists of examples such as in the second half of E.4.4 and in E.4.5? Also, it is a bit unclear what the main message of E.4.6 is - maybe this bullet can be cut.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12794	40	18	40		Delete sentence "Policy packages...."	Government of India, Ministry of Environment, Forests and Climate Change
15490	40	18	40	18	Could the sentence be changed to "Policy packages are often more effective ..."? As it is, this statement seems quite definitive, when in fact <u>some single policy instruments like appliance standards are quite effective.</u>	Government of United States of America, U.S. Department of State
5950	40	18	40	19	It would be clearer if rewritten "Current mitigation financial flows across all sectors and regions are a factor of three to six below the average levels required until 2030 in scenarios likely to limit warming to 2 C..."	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3154	40	19	40	19	We suggest to complete the sentence : "....policy instrument when policy overlaps are integrated, exploiting..	Government of France, Ministère de la Transition écologique et solidaire
15492	40	20	40	22	Revise to: "Economy-wide measures, such as economic stimulus packages and the support for technology demonstration and commercialization efforts, can meet short- term economic goals while shifting development pathways towards sustainability and reducing emissions. However, economic stimulus can also have negative impacts on GHG emissions. It is a short-term policy intervention with potential economic side-effects and not a solution to long-term climate problems."	Government of United States of America, U.S. Department of State
12796	40	21	40		Replace the words "development pathways" with "policies and actions".	Government of India, Ministry of Environment, Forests and Climate Change
12442	40	23	40	27	The paragraph states that regulatory instruments at the sectoral level have proven to be effective in reducing emissions than market-based instruments, though they can result in higher economic costs.We are of the view that a more detailed description of the economic costs in question should be provided including examples of economic costs that arise or may arise from the measures taken.	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
15494	40	23	40	24	Delete questionable assertion that "Regulatory instruments can gain greater political support than market-based instruments". The opposite may be true.	Government of United States of America, U.S. Department of State
11770	40	23	40	25	The message is that regulatory instruments lead to higher costs than market-based instruments. In reality both are needed in combination for effective and efficient mitigation. Nor are regulatory instruments more likely to have political support. If anything, the opposite is the truth (at least when it comes to sticks). Altogether the sentence needs more sophistication and could be revised.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
14254	40	23	40	27	We propose to replace "renewable energy generation" with "low carbon energy generation".	Government of Romania, National Meteorological Administration
5962	40	23	40	32	Para E4.1 and E4.2 don't seem to reflect the key messages in Chapter 13 about the relative and synergistic contributions of regulatory and market instruments. Consider replacing with text from Chapter 13 lines 18-29.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2104	40	23	40	36	In Section 16.1 of the report mentions "technology push", "regulatory push-pull", and "market pull" as drivers for innovation. The SPM, however, uses obscure terms "regulatory and market-based instruments". It would be better to specify how regulatory and market elements affect in promoting innovation by stating "push" or "pull", as in Section 16.1. •(Present) Para E.4.1 on "regulatory instruments", para E.4.2 on "market instruments", and para E.4.3 overarching the drivers for innovation. •(Change) Two options can be suggested: i) mentioning "regulatory push-pull" and "market pull" in para E.4.1 and E.4.2, respectively, or ii) change the phrase "regulatory and market-based instruments" in para E.4.3 to "regulatory-push-pull and market-pull policies".	Government of Republic of Korea, Korea Meteorological Administration
2446	40	23	40	39	How does line 23 and line 39 relate? Line 23 states : "Regulatory instruments at the sectoral level have proved effective in reducing emissions. Suchinstruments can gain greater political support than market-based instruments, though they can result in higher economic costs (medium confidence). While line 37 states"Policy packages are more effective than single policy instruments at achieving emission reductions and promoting innovation and technology diffusion."	Government of Denmark, Danish Meteorological Institute
5952	40	23	### ### #	43	This whole section is quite confusing on regulation - it says its more costly than carbon pricing but then explains why its needed as part of a package of policies, and doesn't discuss any of the literature on how regulation can be more efficient or drive innovation, so this needs bringing in as well. It also should distinguish clearly regulation that creates markets etc from that which is about standards, bans, etc	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9636	40	25	40	27	Insert the following sentence at the end of the paragraph: "while carefully avoiding rent seeking and/or non-competitive profit opportunities, which will destroy the public support for the actions in designing the regulatory instruments."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12798	40	26	40		Insert "several" before "areas" and delete the rest of the sentence from "such as.... Reason: Singling out examples is misleading.	Government of India, Ministry of Environment, Forests and Climate Change

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15496	40	28	40	28	Replace ""are"" with ""have been"" to read ""Market instruments, including carbon pricing, have been effective."" Carbon pricing has been effective at driving low-cost (but not high-cost) mitigation in part due to the low cost of the market instruments themselves. Also the design features of the underlying policy or program. Recent developments related to international carbon markets at COP26, as well as emerging government-led initiatives focused on market reforms, could drive carbon instrument pricing dramatically upward in the coming decade(s). Unless this statement is backed by economic analysis demonstrating that the current dynamic is a fixed rule (doubtful), this line should be edited. The statement in the SPM is obsolete because it does not reflect the large run-up in voluntary carbon market prices in 2021. See: <a href="https://www.forest-trends.org/publications/state-of-the-voluntary-carbon-markets-2021/">https://www.forest-trends.org/publications/state-of-the-voluntary-carbon-markets-2021/</a> <a href="https://www.spglobal.com/platts/en/market-insights/latest-news/energy-transition/111121-cop26-voluntary-carbon-market-value-tops-1-bil-in-2021-ecosystem-marketplace#:~:text=CORSIA%2Deligible%20carbon%20(CEC),%2412.70%2Fmt%20as%20of%20Nov.">https://www.spglobal.com/platts/en/market-insights/latest-news/energy-transition/111121-cop26-voluntary-carbon-market-value-tops-1-bil-in-2021-ecosystem-marketplace#:~:text=CORSIA%2Deligible%20carbon%20(CEC),%2412.70%2Fmt%20as%20of%20Nov.</a>	Government of United States of America, U.S. Department of State
3156	40	28	40	29	This sentence should be better articulated with section C.12 of the SPM: many mitigation options cost less than USD/tCO <sub>2</sub> e 100, half of them cost less than USD/tCO <sub>2</sub> e 20. Therefore the sentence in the paragraph E.4.2 could be misunderstood: the alleged low effectiveness refer to a rather limited range of options. Carbon pricing can help to make the emissions reductions measures more attractive than business as usual measures.	Government of France, Ministère de la Transition écologique et solidaire
3158	40	28	40	29	We suggest to add at the end of the first sentence : "... higher-cost measures considering that carbon pricing levels have remained low until now."	Government of France, Ministère de la Transition écologique et solidaire
11772	40	28	40	29	"Market instruments , including carbon pricing , are effective in promoting low -cost emissions reductions measures; but less effective in promoting higher -cost measures ." The relevance of carbon pricing in the overall toolkit of policy makers seems to be underestimated, especially considered from a more cross-cutting and global perspective. There is quite extensive literature on the long term impacts of carbon pricing. Carbon pricing, taxes or emissions trading schemes, is often considered as the main climate policy instrument in a policy package, based on economic theorie and modelling. Carbon pricing promotes innovation and diffusion of new decarbonazion technologies. A recent review of the empirical literature confirms that "carbon pricing has significant and relatively large normalized effects (i.e. accounting for the low level of prices so far), in terms of emissions reduction in general (through behavioural change, technology adoption and substitution) as well as pure innovation impacts" (van den Bergh and Savin, 2021). Accordingly, carbon pricing is among the frequently indicated mitigation options in countries' NDCs (UNFCCC, 2021). Carbon pices provides ongoing mitigation incentives: In the case of standards, the pressure to reduce emissions disappears once compliance with a standard is reached, whereas prices continue to induce mitigation effort as long as emissions are positive.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
11774	40	28	40	29	This assessment could better recognise that [carbon] pricing does impact materially the amount of emissions, see differences between countries of emission intensities and the related energy/carbon taxation.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12800	40	28	40	29	Delete first sentence of E.4.2 and replace by "Market instruments including carbon pricing have varied effectiveness across different emission reduction measures".	Government of India, Ministry of Environment, Forests and Climate Change
15498	40	28	40	29	Delete questionable assertion that market instruments may be less effective in promoting higher-cost measures. The opposite may be true if carbon prices are not set too low or offset by counterproductive subsidies and preferential tax treatment.	Government of United States of America, U.S. Department of State
15500	40	28	40	29	Suggest revising to: "Market instruments, including carbon pricing and emissions trading schemes, are effective in promoting low-cost emissions reductions measures, but less effective in promoting higher-cost measures."	Government of United States of America, U.S. Department of State
15502	40	28	40	29	Recommend striking this sentence. The extent to which market instruments are effective at promoting higher-cost emission reduction measures depends on the level of ambition of the carbon constraint. As a carbon price goes higher, it will incentivize higher cost mitigation measures.	Government of United States of America, U.S. Department of State
9836	40	28	40	30	add after high-cost solutions: "important for deeper future reductions"	Government of Netherlands, Ministry of Economic Affairs and Climate Policy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14176	40	28	40	30	We believe the sentence on carbon pricing lacks some important perspectives. The text may give an impression that it is negative that emission reductions that are least costly for the society are the ones that are carried out first. Secondly, it might also give an impression that carbon pricing is an inefficient tool for targeting higher-cost measures. We believe that low carbon prices and a low share of emissions actually being priced are important drivers for the empirical evidence that carbon pricing has been less effective in promoting higher-cost measures. Higher carbon prices, as well as the expectation that these are to further increase, will give incentive to implement low emission technologies and are sometimes necessary if legal instruments are not preferable. There are also issues related to transitions costs, regional scope, predictability and the share of total emissions that are covered by carbon pricing. In our view these perspectives could be better reflected in the summary. We therefore propose something along the following: "Market instruments, including carbon pricing, are effective, and sometimes needed, in promoting low-cost emission reductions measures; but historically, less effective in promoting higher- cost measures with significant transition costs. Practical experience has helped to improve design in terms of predictability, level of carbon pricing, effectiveness, efficiency, emission coverage, distributional goals, regional scope and social acceptance."	Government of Norway, Norwegian Environment Agency
490	40	28	40	32	The following statement in E4.2 "Market instruments, including carbon pricing, are effective in promoting low-cost emissions reductions measures; but less effective in promoting higher-cost measures." Remove as discussions of carbon pricing are not within the mandate of WGIII.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
6794	40	28	40	32	Please add a key factor on the effect of a carbon pricing measure: "Their effectiveness in influencing long-term investments depends on the expectation that the policy will continue and expectations related to future tax rates or allowance prices (Brunner et al. 2012)." This reference is given in Chapter 13 - page 43 - line 41.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6796	40	28	40	32	Please add a reference to the level of marginal abatement costs when addressing the effect of carbon pricing measures: "Market instruments, including carbon pricing, are effective in promoting low-cost emissions reductions measures, where marginal abatement costs are lower than the tax/allowance price; but less effective in promoting higher-cost measures." This reference is given in Chapter 13, page 40 line 35.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6798	40	28	40	32	The currently very general proposal "Market instruments, including carbon pricing, are effective in promoting low-cost emissions reductions measures; but less effective in promoting higher-cost measures." can in our view not be justified even with the literature of Ch 13 page 40, and this is very relevant because of the great role of higher-cost measures for carbon neutrality. We suggest adding "but [at least] on their own less effective in promoting higher-cost measures." Background: According to further literature listed in Chapter 11 (esp. Lilliestam et al.), empirical evidence on the "single role" of market-based instruments for higher cost measures is still surprisingly scarce, but what exists is not very encouraging in terms of what market based policies can achieve "on their own", so that technology-promoting policies are highly relevant. According to authors such as Stiglitz (2019) and Fischer /Preonas/Newell (2017), market based instruments can nonetheless have a very important role in a policy mix, in terms of safeguarding (current and expected) demand and a "market" also for new technologies. This role is also acknowledged, for example, in the policy instrument of "carbon contracts for differences", which cover new technologies' cost differences towards an existing ETS allowance price. To avoid too high complexity in the SPM, we suggest the simple insertion "on their own" in the respective sentence.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13354	40	28	40	32	An important aspect that is missing, is the communication aspect: Citizens need to know and be informed about how these policies work.	Government of Switzerland, Federal Office for the Environment FOEN
6800	40	29	40	30	Please explain what you mean with "practical experiences".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12756	40	30	40		Insert at end of line 30: "There is also high support for promoting non-market approaches to the international cooperation for mitigation."	Government of India, Ministry of Environment, Forests and Climate Change
14178	40	30	40	30	Is there a difference behind the meaning of "efficiency" and "effectiveness" in this sentence? If so, please clarify.	Government of Norway, Norwegian Environment Agency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
484	40	31	40	32	E.4.2: Required action: delete this sentence; it focuses on singling out one source.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
3160	40	31	40	32	Such a policy needs to be linked to strong financial supports to peoples that will face increased energy cost (cf. gilets jaunes syndrom in France). This element could be add.	Government of France, Ministère de la Transition écologique et solidaire
5956	40	31	40	32	Removing fossul fuel subsidies could reduce emissions by up to 10% by 2030 while improving public revenue and macroeconomic performance' (i.e. slightly amended) would be more impactful. Also, this whole sentence is very policy relevant, direct and to the point. It should be brought to the top of the section (para E.4)	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6992	40	31	40	32	Please add more information to this statement on removing fossil fuel subsidies as this is highly policy-relevant.	Government of Jamaica, Meteorological Service Division
12050	40	31	40	32	E.4.2: The statement on fossil fuel subsidies is very welcome and needs to be elaborated on further with information from the underlying chapters. The current statement "Removing fossil fuel subsidies could reduce emissions by 1-10% by 2030 while improving public revenue and macroeconomic performance" should be complemented with this statement from the underlying chapter, namely, from 13.6.3.6 p.47 "... and yield other environmental and sustainable development benefits".	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12802	40	31	40	32	Delete. Policy prescriptive and ignores different national circumstances which is acknowledged in the rest of the SPM and the report.	Government of India, Ministry of Environment, Forests and Climate Change
13588	40	31	40	32	As we made clear in our general comment, specific and quantitative information in the SPM on fossil fuel financing including subsidies must be strengthened significantly throughout the SPM. Removing fossil fuel subsidies would have more wide-ranging effects than what is currently listed here, which can also partly be derived from the assessment of synergies of a fossil fuel phaseout in figure SPM.9. Kindly revise this sentence and provide quantitative information, e.g. on improving public revenue, where possible.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
11776	40	32	40	32	Section 9.9 is covering in great details market based instruments and carbon pricing, therefore it is strongly recommended to add here 9.9 into the {.} brackets	Philippe Tulkens, European Union (EU) - DG Research & Innovation
486	40	33	40	33	E.4.3: The statement is written with focus on sources using language, such as "low carbon". Required actions: rewrite without focus on specific source categories by replacing "low carbon" which is source focused with low emissions in keeping with the PA, which focuses on emissions.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
5958	40	33	40	35	Suggest following edit "Support for successful low-carbon technological innovation includes technology-push policies such as scientific training and R&D, complemented by regulatory and market-based (pull) instruments that create incentives and market opportunities."	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
2412	40	33	40	36	Suggesting considering the responsibilities of individuals, industry and government for funding in this paragraph.	Government of Australia, Department of Industry, Science, Energy and Resources
5960	40	35	40	36	Please add an example of one of the less mature technologies that could benefit from a push (for example, hydrogen, or batteries?).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12804	40	36	40		After "technologies" add " though the cost of deployment are correspondingly higher".	Government of India, Ministry of Environment, Forests and Climate Change
15504	40	36	40	36	Since this paragraph gives attention to technology-push, it should also provide balance by giving attention to demand-pull as an alternative or complementary set of policies to effect technology change objectives.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
492	40	37	40	37	The text in E.4.4 states, "policy-packages are more effective than single policy instruments at achieving emission reductions and promoting innovation and technology diffusion." The text deems that these policy-packages are "more effective" than single policy instruments, however, there is no confidence level associated with this statement, thus questioning how is it more effective and the basis of this statement.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
15506	40	37	40	38	Section 16.4.8 (page 16-65, lines 10-16) suggests a more mixed result related to the effects of policy mixes on technology diffusion than is indicated here. Suggest either removing "and technology diffusion" or changing to "and some aspects of technology diffusion".	Government of United States of America, U.S. Department of State
1388	40	37	40	43	If evidence has been assessed on the importance of parliamentary (shared across parties both in the government and in opposition) policies for enabling robust policy for transformation, it could be mentioned here, as it provides an additional dimension to across-objectives.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
11778	40	37	40	43	The mentioned policy packages for the building are indeed effective. But many experiences face the issue of state regulations which for instance constrain the increase of energy cost to avoid energy precarity. Doing it at a wide scale (for instance in France, the energy increase is limited by the government) and not based on conditions (lower revenue only for instance), this slows down the hurry for energy efficiency. Tacking these state policies could also be interesting to mention besides the ones already mentioned.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
3164	40	38	40	38	We suggest to add at the end of the first sentence : "... technology diffusion when policy overlaps are correctly integrated."	Government of France, Ministère de la Transition écologique et solidaire
15508	40	38	40	39	Is this sentence based on rigorous empirical analysis? Aspects are easily refutable. It would be better to be more qualified and say something like, "Some policy experts consider that ..." The examples that follow are not "packages that are comprehensive in nature" either alone or together. The best option could be to delete the paragraph and opening sentence of the section.	Government of United States of America, U.S. Department of State
3162	40	38	40	42	Mention carbon pricing as part of such policy packages. Carbon pricing is a necessary (but not sufficient) policy.	Government of France, Ministère de la Transition écologique et solidaire
11780	40	38	40	42	Why does this listing does not including pricing policies?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5964	40	40	40	40	Examples of policy packages should include energy / carbon pricing / taxation	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
498	41	0	42	0	International Dimension of Climate Risk showcases risk on fossil fuel exporting countries is presented in Chapter 15 P53 L18-28 and should be highlighted in the SPM.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
13484	41	0	42	0	Financial flows is a vague term - please be precise what is meant here - private or public investment or shift in investment, etc?	Government of Estonia, Estonian Meteorological & Hydrological Institute
9838	41	1	41	4	add: policies to promote behavior change	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
496	41	1	41	6	E.4.5 discusses the phase-out of fossil fuel as one of the options within an economy-wide package, which conflicts with the underlying chapters. There is no reference to the phase-out of fossil fuel as one of the options within an economy-wide package in response to the COVID-19 pandemic. The text is out-of-context, demonstrates policy-prescriptive language and not aligned with the IPCC principles and procedures. Similarly, there is no confidence level associated with this statement in all underlying chapters and in the SPM text. Remove "the phase-out of fossil fuels" from the statement.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
5966	41	1	41	6	This bullet is missing a message. It should say that economy-wide packages set important future pathways and can enable change or create blockages. The way the paragraph is written, it explains what those packages are but not what they can do for mitigation. The paragraph could also say that COVID packages have been predominantly brown, causing fresh obstacles, although some green measures will help innovation in some sectors.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
512	41	3	41	3	The text in E.4.5 states, "clean R&D investments and subsidies;" It is not clear what is meant by subsidies in this context, especially since the following sentence discusses phasing out. To subsidize something and phase out something does not work and conflicts with one another. Required Action: Change "clean" to "inclusive" to demonstrate a balanced statement and remove "phase out of fossil fuels" to ensure alignment with underlying chapters and the IPCC principles and procedures in keeping policy-neutral language.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
750	41	3	41	3	It is suggested to change the expression "the phase-out of fossil fuels" to "the phase down of unabated coal power and phase-out of inefficient fossil fuel subsidies," to be consistent with the facts.	Government of China, China Meteorological Administration
12052	41	3	41	3	E.4.5: The wording "phase-out of fossil fuels" should be retained; the term must be clearly defined in the report.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12806	41	3	41		Delete "phase-out of fossil fuels". This is not an economy wide package but singling out one particular action.	Government of India, Ministry of Environment, Forests and Climate Change
11782	41	4	41	5	"infrastructure investment locks in emissions trajectories over long periods of time". This is a very indirect way of referring to the lock-in and stranded asset dangers mentioned in B6. The link should be stated more explicitly.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12808	41	4	41		Delete sentence "Infrastructure investments...". Reason: Patently incorrect as the statement is too general in its description of infrastructure to be meaningful.	Government of India, Ministry of Environment, Forests and Climate Change
15510	41	5	41	5	Delete vague generality that will not be helpful to policymakers: "The mix of measures depends on development needs."	Government of United States of America, U.S. Department of State
12810	41	5	41		Delete "development needs" and replace by "of the particular climate action goals that are targeted".	Government of India, Ministry of Environment, Forests and Climate Change
2136	41	7	41	10	Two sentences would be deleted to deliver stronger message for the climate change response. "Mitigation policies can impact other countries positively and negatively" and "However, reduced demand for fossil fuels affects exporting countries negatively".	Government of Republic of Korea, Korea Meteorological Administration
13324	41	7	41	11	We suggest adding a reference to the need for economic diversification measures, so it reads: "Mitigation policies can impact other countries positively and negatively. National innovation policies and participation in international markets for emission reduction credits can bring positive spill-over effects for other countries. However, reduced demand for fossil fuels affects exporting countries negatively in the absence of economic diversification measures (medium confidence). There is no consistent evidence that emission trading schemes have led to significant emissions leakage between countries . {13.6, 13.7, 13.8, 16.2 }"	Government of Switzerland, Federal Office for the Environment FOEN
3166	41	7	41	7	We suggest to precise the geographic scale of the mentioned mitigation policies, if it is the national mitigation policies, please consider specifying it.	Government of France, Ministère de la Transition écologique et solidaire
500	41	7	41	9	The following statement in E4.6 "National innovation policies and participation in international markets for emission reduction credits can bring positive spill over effects for other countries." does not have a confidence level associated with it. Rewrite with an associated confidence level.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
752	41	7	41	9	The statement is inconsistent with the underlying report. Chapter 13, Page 6, lines 4-5: Policies to support technology development and diffusion tend to have positive spillover effects (medium evidence, high agreement). It is suggested to change "National innovation policies" to "National policies to support technology development and diffusion".	Government of China, China Meteorological Administration
754	41	9	41	10	The statement is inconsistent with the underlying report, the text from which (lines 7-9, page 57, Chapter 13) reads "For fossil fuel exporting countries, mitigation policies consistent with the Paris Agreement goals could result in greater costs from changes in fossil fuel prices due to lower international demand than domestic policy costs". It is suggested to change "affects exporting countries negatively" to "could result in greater costs".	Government of China, China Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3168	41	9	41	10	One might argue about this statement that countries exporting fossil fuel have already benefited a lot from revenues associated with fossil fuel exportations, while the social cost of CO2 emissions is supported globally (i.e. not only by exporting countries). Reduced demand for fossil fuels will indeed affect exporting countries, but the more important issue is the phase-out of fossil fuels.  One solution could be to add at the end of the sentence, "... although policies that constrain supply of fossil fuels in the context of mitigation objectives could limit financial losses to fossil fuel producers (box 13.13)"	Government of France, Ministère de la Transition écologique et solidaire
4168	41	9	41	10	Unclear what is meant here by "affects exporting countries negatively". Is this economic or environmental?	Government of Canada, Environment and Climate Change Canada
1390	41	9	41	9	Reduced fossil fuel demand would be expected to reduce export revenues, but would not such a situation also lead to efforts of diversification and transformation also in these countries, which could lead to positive effects in some relevant time perspective? Would all exporting countries face the same situation, in a changing price environment as demand changes?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
12812	41	9	41		After "other countries" insert new sentence: "The significance of non-market approaches and their essential role in provision of global public goods has been underlined by the experience of vaccine development for the pandemic". Delete sentence beginning "However....." . Reason: Deletion of the sentence as it singles out one example out of many.	Government of India, Ministry of Environment, Forests and Climate Change
15512	41	10	41	10	Suggest rephrasing to: "have or have not led to significant emissions leakage".	Government of United States of America, U.S. Department of State
3170	41	10	41	11	Carbon leakage has been limited so far considering the low level of carbon prices and the existence of exemptions or free allowances schemes. But it is not predictive of what will occur in coming years if gaps in carbon pricing widen. Effective instruments to prevent the increased risk of carbon leakage (such as border carbon adjustments) are thus considered by some economies (EU, US, Canada, UK...)	Government of France, Ministère de la Transition écologique et solidaire
4170	41	10	41	11	This sentence needs a confidence statement.	Government of Canada, Environment and Climate Change Canada
6802	41	10	41	11	Although there might be no empirical evidence for carbon leakage in a strict sense this message seems to be contrary to the message in TS 5.9 page 108, line 21 et seq: "Global commodity value chains and associated international transport are important mechanisms through which carbon leakage occurs." Without further explanation of the reasons for the lack of evidence the current sentence could lead to wrong conclusions regarding the possibility of carbon leakage. Please add: "There is no consistent evidence that emission trading schemes have led to significant emissions leakage between countries so far. With respect to markets for goods this is attributed primarily to large allocations of free allowances to emissions-intensive, trade-exposed sources and relatively low allowance prices". The last sentence is based on 13.6.6.1 .	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9638	41	10	41	11	The reason for no-evidence on leakage by ETS might be so far free allocation provide zero or very low carbon cost to the entities under EU-ETS.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11784	41	10	41	11	This is the only instance in the SPM where "emission trading schemes" are mentioned. Before addressing their effect on leakage (or lack thereof), it would seem useful to make reference to their effectiveness in achieving their core objectives and other lessons learned.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13404	41	10	41	11	Is it possible to include a confidence statement here. Also on the issue of emission leakage there isn't much data on this especially for the developing countries so this would be helpful	Government of Kenya, Kenya Meteorological Service
836	41	11	41	11	Chapter 13, Page 55-56, lines 1-2 says that there is medium evidence, medium agreement in relation to conclusion on carbon leakage. Suggestion is to add in SPM, section E, page 41, line 11 words in parentheses: '(medium evidence, medium agreement)'.	Government of Russian Federation, Institute of Global Climate and Ecology
12340	41	13	41	48	It is not clear yet what financial and technical support the developed countries provide to developing and least developed countries to adapt to climate change.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
506	41	13	14	16	The high confidence statement from Chapter 15 and included in the Technical Summary Page 121 Lines 2-5 "Finance to reduce net GHG emissions and enhance resilience to climate impacts is a critical enabling factor for the low carbon transition. Fundamental inequities in access to finance as well as finance terms and conditions, and countries' exposure to physical impacts of climate change overall, result in a worsening outlook for a global just transition (high confidence)." this should be clearly stated in the SPM as to ensure a balanced and inclusive report	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
508	41	13	14	16	The high confidence statement from Chapter 15 and included in the Technical Summary Page 123 Lines 1-2 "Global climate finance is heavily focused on mitigation (more than 90% on average between 2017-2020) (high confidence)" this should be clearly stated in the SPM as to ensure a balanced and inclusive report and to show the overall direction of the financial flows. The impact of this gap on the global transition should be included as well.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
6804	41	13	41	13	The expression "financial flows" is too generic. This could be expressed by replacing "Financial flows" in the headline statement by "financial support" or by adding "mitigation" before "financial flows" to clarify what type of financial flows you are referring to. On the other hand, in the subparagraphs to E.5 "financial flows" is used in a broader sense. Please clarify and distinguish between global "finance flows" (Article 2.1.c of the Paris Agreement) and "financial support".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
3172	41	13	41	16	headline E5. does not capture the result in chapter 14.4.1, page 41, line 15 and 16, regarding the exponential increase in climate finance from developed countries sources. Stating only that financial flows are not consistent does not provide the full picture of trends assessed in the literature. Furthermore, domestic resources mobilization challenges are not addressed in this paragraph.	Government of France, Ministère de la Transition écologique et solidaire
3174	41	13	41	16	This section does not address the very relevant point from chapter 15 on the climate risks and the overall sustainability of financial system which is key for addressing mitigation finance. The chapter points out the systemic and endogeneity nature of climate risks.	Government of France, Ministère de la Transition écologique et solidaire
5968	41	13	41	16	Headline paragraph doesn't clearly signal the need for strong enabling policy environments in the real economy, as set out in the executive summary of Chapter 15 line12 "Synergies resulting from coherent regulations in the financial sector and in the real economy can add momentum for an accelerated transformation. A reliance on financial sector regulation and momentum alone is unlikely to result in substantial progress in the near-term". Suggest some of this language is incorporated in the headline and subsequent text.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
9840	41	13	41	16	The focus on investment gaps in E.5 does not give insights in the causes of underinvestment/barriers to investments. Both sub-Saharan Africa and the Middle East show under investments, but the causes/barriers may be different. Not all investment pay off; it would be valuable to know what investments don't take place that would pay off (energy-efficiency, renewables, land management etc.).	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11786	41	13	41	16	Add "The public sector accounted for 81% and the mitigation accounted for 73% of climate finance. More financial inflow from the private sector and to mitigation is needed." after the second sentence.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12986	41	13	41	16	E.5 Speaks only to financial flows, needs to be balanced with reference to how provision of finance by developed countries is part of and can help shape wider flows.	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs
13592	41	13	41	16	This headline statement should also include information from E.5.2 on reasons why "sufficient global capital and liquidity to close investment gaps" is not mobilised to close those gaps.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
15648	41	13	41	16	This important headline statement should be further expanded. Information that should be added includes findings with regards to the international climate finance goal of USD100bn/yr as it is of the highest relevance for policymakers.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
6994	41	13	41	48	E.5 and sub-bullets is highly relevant and contains a lot of important information, much of which we would like to see expanded. The headline statement that focuses on financial flows should also include information on international climate finance flows.	Government of Jamaica, Meteorological Service Division
12054	41	13	41	48	E.5 section: The entire section including the E.5 headline statement needs to also cover international climate finance flows and progress towards fulfilling political commitments. For example, the assessment information from Box 15.4 p.26 could be used: "Notwithstanding methodological discussions under the UNFCCC, there is still some distance from the 100 billion USD a year commitment being achieved, including in terms of further prioritising adaptation. While the scope of the commitment corresponds to only a fraction of the larger sums needed (Section 15.4), its fulfilment can both contribute to climate action in developing countries as well as to trust building in international climate negotiations."	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13590	41	13	41	48	As stated in our overarching comment, the headline statement E.5 and the sub-bullets thereafter must contain more information on international climate finance flows. This also means adding more information on the USD 100 billion goal in particular, which is only briefly mentioned in E.5.3 despite its paramount policy-relevance, and current assessments on progress towards achieving it.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
15514	41	13	41	48	Chapter 15 goes substantially beyond the scientific literature in its claims. It is essential for the integrity of the IPCC that the full chapter is reviewed and all claims substantiated with evidence from the peer-reviewed academic literature. In cases where this is not possible, those claims should be removed from the chapter. Further, where significant debate remains in the policy and academic literature, care should be taken to present a balanced perspective of the relevant issues, and cited literature should be presented in context (i.e., when drawing on studies of Official Development Assistance, noting the fundamentally different nature of ODA and climate finance flows). While such claims are abundant in the chapter -- including statements related to "fundamental economic inequities", "climate investment trap", and "avoiding responsibility" -- Section 15.2.4 warrants particular attention.	Government of United States of America, U.S. Department of State
15516	41	13	41	48	No quantitative information or reference is provided on changes to multilateral finance institutions or bilateral finance flows to developing countries during the pandemic. Add relevant information and reference.	Government of United States of America, U.S. Department of State
756	41	14	41	14	Increasing mitigation finance should first and foremost imply that developed countries should intensify their obligations to provide financial support, and it is therefore suggested that a description that developed countries intensify the fulfillment of their obligations to provide financial support be added to Section E5.	Government of China, China Meteorological Administration
5970	41	14	41	14	"implies" seems a bit weak, "requires" might be better?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12814	41	14	41	14	Add after "widest in developing countries": "Since AR5 progress towards the goal of providing 100 billion USD from developed countries to developing countries continues to be a challenge. In the meanwhile, the overall needs for financing have sharply increased from when the 100 billion USD per year target was fixed " {15.1}	Government of India, Ministry of Environment, Forests and Climate Change
15518	41	14	41	14	Delete "with gaps widest in developing countries". While this may be true in some measures and in some developing countries, it is not true across the board (at least by some measures). Arguably, a country that has high emissions locked in by infrastructure (including homes, vehicles, etc.) and the size of the country could have a much wider gap in "the financial flows needed to achieve mitigation goals". The sentence without the reference to developing countries is probably okay as a general remark. If authors disagree, they should provide the evidence with regard to all countries, not just developing countries.	Government of United States of America, U.S. Department of State
5972	41	14	41	15	Chapter 15 frames the approaches to bridging the investment gap in terms of the alignment of financial flows with low GHG emissions pathways. So perhaps this sentence should read: 'Scaling up mitigation finance, through the alignment of financial flows with low GHG emissions pathways, requires clear policy choices...' 'Requires' might be more appropriate than 'implies'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5974	41	14	41	15	E.5 - The second sentence of the summary statement is unclear, consider rewording.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11788	41	14	41	15	Unclear sentence: "Scaling up mitigation financial flows implies clear policy choices by and signals from governments and the international financial community". Put "and signals from" between commas?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12372	41	15	41	18	In subsequent section of the main technical report, it is useful to mention Iran achievements in reducing GHG emissions in e.g., flare gas reduction plants, despite the sanctions and based on the national upstream legislations.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12374	41	15	41	18	And also fuel switching in Iran from liquid fuels to CNG in the transportation sector.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
11790	41	16	41	16	Add 14.4 in the reference bracket in line 16.	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
758	41	18	41	19	It is inconsistent with the text from the underlying report (line 11, page 91, Chapter 15) "current climate financial flows...increase by a factor between 3 to 6 to meet average annual needs until 2030...". It is suggested to change "mitigation" to "climate" and add an "annual" in front of "average" in accordance with the underlying report.	Government of China, China Meteorological Administration
3176	41	18	41	19	Please consider add "necessary" after levels : Current mitigation financial flows across all sectors and regions are a factor of three to six below the average levels needed up to 2030 in scenarios to likely to limit warming to 2°C (figure SPM 11)	Government of France, Ministère de la Transition écologique et solidaire
5978	41	18	41	19	the word levels could usefully be changed to 'investment needs'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5976	41	18	41	20	This sentence could be expressed more clearly. Suggest "Current mitigation financial flows across all sectors and regions are between one sixth and one third of the average levels needed between now and 2030 in scenarios to likely to limit warming to 2°C, or to limit warming to 1.5°C (medium confidence)." if this is what is meant.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11792	41	18	41	21	Findings on the size of the mitigation finance gap need to be complemented by information on 'non-green' financial flows. It is necessary to 'green the trillions' as well as adding more trillions. Why finance a renewable project in the name of mitigation if no action is being taken to mitigate the coal plant that someone else is building next door? Enough fossil fuel infrastructure has already been built/planned to exceed the 1.5/2°C thresholds. Where did the finance for this come from? Chapter 15.3 appears to provide some analysis of this: "Persistently high levels of both public and private fossil-fuel related financing continue to be of major concern despite promising recent commitments. This reflects policy misalignment, the current perceived risk-return profile of fossil fuel-related investments, and political economy constraints (high confidence)."	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13594	41	18	41	23	This bullet E.5.1 should also contain information on gaps between political commitments for international climate finance and progress towards fulfilling those commitments, particularly the USD 100 billion goal. Furthermore, investment needs for loss and damage should be explicitly mentioned here as they are assessed in Chapter 15.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
14180	41	18	41	23	Is it possible to quantify the mitigation investment gaps in the text? If so, please consider to include this in the text.	Government of Norway, Norwegian Environment Agency
510	41	18	51	23	The high confidence statement from Chapter 15 and included in the Technical Summary Page 125 Lines 29-30 "There is a mismatch between capital availability in the developed world and the future emissions expected in developing countries (high confidence)" this should be clearly stated in the SPM as to ensure a balanced and inclusive report	Government of Saudi Arabia, Sustainability Advisor to the Minister of Mineral Resources
1392	41	19	41	19	The meaning of "limit warming to 1.5oC" is unclear, as it does not specify whether there is an/some overshoot, compare C.3, and/or the likelihood, cf. Footnote 8 as well as Table SPM.1. Could this be clarified?	Government of Sweden, Swedish Meteorological and Hydrological Institute
12056	41	19	41	19	E.5.1: Please add whether the 1.5°C pathway refers to "with no or limited overshoot".	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
5980	41	20	41	20	E.5.3 final point on debt sits better in E.5.1. Something like: 'Mitigation investment gaps are widest for developing countries (especially the more debt-stressed and vulnerable)'	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15520	41	20	41	20	Insert "some" before "developing". For one thing, "developing" isn't even defined, and some middle income countries might be classified as "developing" here. Figure SPM.11 is not organized by "developed" or "developing" or -- more usefully -- by income group; the figure does not support the textual point. Besides, who is the authoritative arbiter of "needs"? This has not been analyzed consistently across countries, and is not useful to have only one category for "developing" -- to lump Singapore and Burkino Faso, and Saudia Arabia, and China, into a single category. (Why should China be classified as "developing" even though it has massive capital resources and the IMF classifies it as a middle income country? The classification scheme distorts the analysis severely and promotes certain political views.) Gaps are not necessarily "widest", depending on the resources of the country and its mitigation goals. (Arguably, some oil-producing countries have set very modest goals and so the finance gaps may not be very wide.) These broad statements are rhetorical and do not provide the fact base to help reach agreements. The paragraph beginning on line 18 seems designed more to serve political interests.	Government of United States of America, U.S. Department of State
5982	41	21	41	21	Not clear what 'general infrastructure' means. Does this refer to the incremental cost of climate proofing future infra construction? Could authors clarify?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12058	41	21	41	21	E.5.1: The statement on investment needs should be expanded to read: "When investment needs for adaptation, loss and damage, general infrastructure and climate-responsive social protection ...". The information provided in Chapter 15, p.45 supports this addition ("Challenges related to financing residual climate-related losses and damages are particularly high for developing countries. Financing losses and damages from extreme events requires rapid pay-outs; the cost of financing for many developing countries is already quite high; and the expense of risk financing is expected to increase as disasters become more frequent, intense and more costly not only due to climate change but also due to higher levels of exposure. Addressing both extreme and slow onset climate impacts requires designing adequate financial protection systems for reaching the most vulnerable.").	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
3178	41	21	41	23	As mentionned in the the section 15.1 of chapter 15 (page 9), it seems important to remind the synergies and trade-offs between mitigation and other denominated climate finance:  "while the focus is primarily on mitigation, adaptation, resilience and loss and damage financing needs cannot be entirely separated because of structural relationships, synergies, trade-offs and policy coherence requirements between these sub-categories of climate finance	Government of France, Ministère de la Transition écologique et solidaire
3180	41	21	41	23	For this paragraph and the figure SPM.11:Please consider highlight that these estimations aggregate public and private, domestic and international investment.	Government of France, Ministère de la Transition écologique et solidaire
6996	41	21	41	23	Could investment needs for loss and damage be explicitly included in the enumeration here?	Government of Jamaica, Meteorological Service Division
15522	41	21	41	23	""Investment needs"" is a questionable concept to apply to adaptation because the benefits are uncertain in whether and when they will occur and their magnitude. As a result, it is difficult to determine in advance whether an investment is likely to have sufficient net returns compared to alternative uses of the funds. This uncertainty carries through to the concept of adaptation investment gaps estimated by subtracting ""needs"" from expenditures. Maladaptation can also occur from spending too much on certain types of adaptation versus alternatives. See discussion of the difficulties in tracking adaptation finance in UNEP. 2021. Adaptation Gap Report 2021. Nairobi: United Nations Environment Program. <a href="https://unepdtu.org/wp-content/uploads/2021/01/adaptation-gap-report-2020.pdf">https://unepdtu.org/wp-content/uploads/2021/01/adaptation-gap-report-2020.pdf</a> Also see discussion of the difficulties in determining what adaptation investments that are effective and economically justifiable. Berrang-Ford, L., Siders, A.R., Lesnikowski, A. et al. A systematic global stocktake of evidence on human adaptation to climate change. Nat. Clim. Chang. 11, 989–1000 (2021). <a href="https://doi.org/10.1038/s41558-021-01170-y">https://doi.org/10.1038/s41558-021-01170-y</a>	Government of United States of America, U.S. Department of State
11794	41	23	41	23	Add confidence level	Philippe Tulkens, European Union (EU) - DG Research & Innovation
3200	41	25	41	25	As referred to in chapter 15 (15.5 Considerations on financing gaps and drivers", 15.5.1 Definition) it might be useful to add to the "barriers" list, the role of regulators and supervisors in order to shift the incentive/risk preferences in climate finance.	Government of France, Ministère de la Transition écologique et solidaire
15524	41	25	41	25	Add "mitigation and adaptation" before "investment gaps".	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11796	41	25	41	28	Could this text be made more policy oriented and more details provided? What policy actions are necessary to address these barriers?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12060	41	25	41	28	E.5.2: Considering the remaining gaps for mitigation (and adaptation) finance outlined in E.5.1, and the fact that this statement E.5.2 essentially says that the money is available, it should expand much more on the barriers and the reasons why the money is not flowing. The reasons given currently remain too short and general. Corresponding information should also be added to E.5 headline statement level.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12766	41	25	41	28	Delete the first sentence E.5.2 currently does not correctly reflect the contents of the underlying chapter. Replace with "In developing countries the costs and risks of financing often represent a significant challenge for stakeholders at all levels. This challenge is exacerbated by these countries' general economic vulnerability and indebtedness. The rising public fiscal costs of mitigation, and of adapting to climate shocks, is affecting many countries and worsening public indebtedness and country credit ratings at a time when there were already significant stresses on public finances. The COVID-19 pandemic has made these stresses worse and tightened public finances still further. Other major challenges for commercial climate finance include: the mismatch between capital and investment needs, home bias considerations, differences in risk perceptions for regions, as well as limited institutional capacity to ensure safeguards."	Government of India, Ministry of Environment, Forests and Climate Change
13596	41	25	41	28	Bullet E.5.2 covers the important issue of why sufficient global capital is not flowing, but unfortunately remains too technical and insufficient when trying to explain those barriers. Please revise and extend this bullet to adequately reflect this issue, and elevate this finding to headline statement level.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
15526	41	25	41	28	Revise to: "There is sufficient global capital and liquidity to close investment gaps, but there are barriers both within and outside the financial sector. Barriers to the deployment of commercial finance include a mismatch between capital and investment needs, home bias considerations, lack of access to debt capital due to perceived and real technology risks, differences in risk perceptions, and limited institutional capacities."	Government of United States of America, U.S. Department of State
15650	41	25	41	28	This information on barriers to close investment gaps is very interesting but should be more clearly explained as the reasons currently given are very brief and do not provide real explanations. The issue covered in E.5.2 and the message contained here is extremely important, but in its current form the paragraph does not do this justice.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
5984	41	26	41	26	the term 'commercial finance' isn't in the glossary definition of climate finance. Does it differ from private finance? Could authors please clarify?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
15528	41	26	41	28	Sentence does not sufficiently acknowledge the current and future importance of private sector investment in mitigation and adaptation. This reflects a bias that remains in Chapter 15 despite comments submitted during the Government and Expert Review of the second-order draft.	Government of United States of America, U.S. Department of State
15530	41	26	41	28	More fundamentally, the finance gaps are because financiers do not view investments as providing sufficient returns on investment or other criteria for financing. Add this point to the paragraph. Financial institutions have specific criteria for their actions, and the social interests to address climate change, however valuable, may not be compatible with those financial institutions' objectives. The other points in the sentence are fine, but less important than the fundamental nature of the large majority of finance.	Government of United States of America, U.S. Department of State
15532	41	30	41	30	Change "Accelerated financial international cooperation" to "Availability of financial resources".	Government of United States of America, U.S. Department of State
15534	41	30	41	30	Insert "future" after "low-carbon" and add an "s" to "transition" so it is plural.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15536	41	30	41	31	Discussion of just transition in Chapter 15 insufficiently captures that literature and instead conflates "Just Transition" with "Climate Justice" which is a relevant and distinct literature. Suggest adding relevant information on the importance of just transitions in the domestic context, referencing relevant literature on this topic, and drawing the appropriate conceptual distinctions between climate justice and just transitions. The origin of the "Just Transition" concept is fundamentally linked to labor issues and transitions for workers in high-carbon sectors. As such, just transition issues are critical to address in developed and developing economies; it is inappropriate to suggest that such transitions are more important in one context than another. It is unclear that the implications of a Just Transition necessitate a "larger" role for public finance, particularly given the already high relative roles of public and private climate finance and the significant need to scale up private resources.	Government of United States of America, U.S. Department of State
7046	41	30	41	32	Please, include Latin America after Sub-Saharan Africa and specify the level of confidence of this sentence.	Government of Brazil, Ministry of Foreign Affairs
13070	41	30	41	33	E.5.3: The current formulation of sentence refer to "mitigation funding for low-income and vulnerable regions", which largely refers to almost all LDCs. It would be much appreciated if a specific reference to LDCs could be made in this sentence.	Government of Gambia, Department of Water Resources
3182	41	30	41	37	It would be great to summarise the key outcomes from chapter 15 on "Blended Finance" role and limits and the needed reforms in order to materialise an efficient private-public financing. There is also a need the harmonise the "Climate Finance" common principles and accounting.	Government of France, Ministère de la Transition écologique et solidaire
11798	41	30	41	37	Similar to our comment on E5.3. While it is important to mention the need to scale-up finance, why is the need to green the post-pandemic recovery only added as an afterthought? The paragraph should be more balanced between the two (complementary) considerations.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15538	41	30	41	37	The large section of text in Chapter 15 related to grant equivalency is deeply problematic. The section does not recognize that the climate finance goal in question includes finance from a wide variety of sources, public and private, and is therefore of a different nature than Official Development Assistance. As such, the suggestion that climate finance is an "aid flow" and should be treated as such is inappropriate. Further, the historical context provided for the history of this debate in the ODA context is insufficiently specific and therefore unclear in its relevance to the section. Suggest deleting this section, or at minimum providing clarity on the different nature of the climate finance goal and the inapplicability of grant equivalence to this context.	Government of United States of America, U.S. Department of State
15542	41	30	41	37	Delete the paragraph because it is clearly written to support certain political positions about quantities and means of finance. It lacks balance -- for example, questions about capacity and governance to apply finance effectively and efficiently; transparency and accountability; and many other factors that would affect financial flows and the political and private willingness to modify existing financial flows. Or at least include those concerns, like assuring fair return on investment for private investors; greater transparency and accountability in use and benefits of the finance; investment in evaluations of the effectiveness of various financed projects and programs and public access to results; etc. A large constraint not mentioned is the public acceptability in potential donor/financial countries of public finance generally, and particularly to provide resources internationally that are not available domestically. One may not agree with those views, but they are barriers.	Government of United States of America, U.S. Department of State
15652	41	30	41	37	This paragraph touches upon many important issues, which should be expanded to some degree. First, the vulnerable regions mentioned here should be included here explicitly besides Sub-Saharan Africa; furthermore there needs to be more information on the USD100bn goal, and the issue of debt mentioned at the very end of the paragraph should be explained with more information as it is a very relevant issue for many countries.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
760	41	30	41	42	The provision of financial support to developing countries is an international consensus and should not focus only on low-income and vulnerable countries. It is suggested to change the text in line 31 to "mitigation funding for 'developing countries, including/especially' low-income..." and the text in line 41 to "support and partnership in "developing countries, including/especially" low-income..."	Government of China, China Meteorological Administration
5986	41	30	41	48	E5.3 and E5.4 cover the bulk of the policy relevant content from chapter 15 - would like to thank the authors for their efforts to condense such a large and complex policy environment into two statements! My reading is that the order of the two should be switched, with E5.4 covering global alignment of financial flows, and then E5.3 essentially expanding on the policy options for the first critical bullet from E.5.4 (support and partnership in low - income and vulnerable countries).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11800	41	30	41	48	Section 15.6.6 and Box 15.7 contain important findings about the potential contribution and green bonds and ESG - as well as the dangers of leaving these spaces ungoverned (as summarised on page 5 of Chapter 15). Some these messages should be brought into the SPM. Space could be found by shortening some of the more generic messages in these paragraphs.	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11802	41	31	41	31	"Scaled –up public grants to adaptation and mitigation..." the reference to grants should be removed and replaced with generic finance referring to all public finance instruments and not just grants. Moreover, no evidence is given to support the claim that public grants can have the highest return	Philippe Tulkens, European Union (EU) - DG Research & Innovation
502	41	31	41	32	The following statement in E5.3 "Scaled-up public grants to adaptation and mitigation funding for low-income and vulnerable regions, especially in Sub-Saharan Africa, may have the highest returns." does not have a confidence level associated with it. Rewrite with an associated confidence level.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
504	41	31	41	32	The following statement in E5.3 "Scaled-up public grants to adaptation and mitigation funding for low-income and vulnerable regions, especially in Sub-Saharan Africa, may have the highest returns." The use of the term "may" must be quantified as to ensure scientific accuracy.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
3184	41	31	41	32	The notion of "high returns" is not clear here, please consider specifying if it is about delivering highest emissions reductions or delivering most cost-effective emissions reductions. Returns seem to refer to repayment, which is not applicable to grants.	Government of France, Ministère de la Transition écologique et solidaire
12062	41	31	41	32	E.5.3: The information regarding vulnerable regions is very welcome. Please add information on other vulnerable regions, specifically small islands, which are among the most vulnerable to climate change while simultaneously having difficulty accessing finance.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13080	41	31	41	32	What is the underlying evidence for the sentence "Scaled-up public grants to adaptation and mitigation funding for low-income and vulnerable regions, especially in Sub-Saharan Africa, may have the highest returns."? What is meant with the term "returns"? Financial returns or impact or e.g. highest potential to trigger additional low-carbon domestic or private investments? Please reformulate and clarify the meaning of this sentence or delete it.	Government of Switzerland, Federal Office for the Environment FOEN
15544	41	31	41	32	Revise to: "Scaled-up public grants to adaptation and mitigation funding for low-income and vulnerable regions, especially in the Global South or non-OECD countries, may have the highest returns."	Government of United States of America, U.S. Department of State
2414	41	32	41	32	Suggest clarifying the meaning of 'returns' here. For example, whether it means impacts or returns on investment. In either case, suggest to include other regions which would generate high returns from increased adaptation and resilience funding including Small Island Developing States.	Government of Australia, Department of Industry, Science, Energy and Resources
6998	41	32	41	32	Could the other vulnerable regions to which this statement is relevant also be listed here (e.g. small islands)?	Government of Jamaica, Meteorological Service Division
9640	41	32	41	32	It seems not clear what a high return represents. It will be reader friendly to be more specific, such as "social" return.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
13598	41	32	41	32	Does this finding also relate to other vulnerable regions, specifically small island states? If that is the case, please add this to this sentence, as regional information, and particularly on small islands, is otherwise scarce in the report.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
15546	41	32	41	32	There is no empirical evidence in Chapter 15 that investments in Sub-Saharan Africa have higher returns than in other developing regions. This bias in favor of Africa over other regions remains in Chapter 15 and has in fact increased despite comments submitted on the second-order draft during the Government and Expert Review.	Government of United States of America, U.S. Department of State
15548	41	32	41	32	Delete "key". It is biased. At least as important, and probably more so because of the potential magnitude, could be greater incentives for private financing -- an option that should be added in this paragraph.	Government of United States of America, U.S. Department of State
15550	41	32	41	32	Why is there no confidence level provided for this statement?	Government of United States of America, U.S. Department of State
5992	41	32	41	33	Please amend to "key POLICY options"	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15552	41	32	41	33	There is too much emphasis on international public sector grants, especially from multilateral funds. This reflects continuing bias in Chapter 15 which was not addressed despite comments submitted on the second-order draft during the Government and Expert Review. Massive amounts of private sector finance are what has scaled up renewable energy development. This has been through loans from commercial banks, equity investments by energy companies for public-private partnerships, loan guarantees, and even green bonds in China and India. Grants or concessional loans may be more applicable for some adaptation investments that do not have a clear business model for loan repayments or equity investor returns.	Government of United States of America, U.S. Department of State
15554	41	32	41	33	The USD100 billion goal does not only include public finance. Suggest changing "increased public finance flows" to "increased climate finance flows". In Chapter 15, the 100 billion climate finance goal should be referred to accurately (i.e., as a "goal" rather than "commitment" or "target"). The elements related to SDGs are not part of the COP-15 text, as the SDGs were only adopted in 2015. Revise to reflect correct language from UNFCCC (2009). Further, the literature does not support the implementation of this goal on a grant-equivalent basis, given the significant need to scale up investment including from the private sector and alternative sources, as is widely recognized throughout Chapter 15. Remove the clause "on a grant-equivalent basis". It is also important to note that the new quantitative goal remains under deliberation. Suggest clarifying that the new collective quantified goal remains under deliberation and that it is critical to scale-up investment in climate action, including potentially through the new goal, and/or the other identified options (i.e., not necessarily considering SDGs as part of the new goal).	Government of United States of America, U.S. Department of State
2416	41	32	41	34	Current text portrays the USD 100bn goal as a public goal only, however it is made up of both public sources (bilateral and multilateral), officially supported export credits, and private finance mobilised through public interventions. The Paris Agreement (2015) also extended the USD 100bn goal to 2025 with a process to decide a new post-2025 goal recently agreed at COP26. Suggest editing to: 'Additionally, key options include increased finance flows from all sources, including meeting the joint USD 100 billion-a-year goal...'	Government of Australia, Department of Industry, Science, Energy and Resources
13082	41	32	41	36	A large share of global public lending is not extended from so called "developed" countries but from so called "developing" countries, which has a significant impact on the mentioned local capital markets development. Limiting this statement to increased public finance flows through the shift from the direct lending modality to public guarantees only to public funding from developed countries significantly limits the scope. Especially in light of the significant financial gap indicated in section E5.1, this limitation to "developed" countries and the USD 100bn goal is highly problematic. Overall direct public lending in and to developing countries should be shifted to a guarantee based approach, where possible. We therefore propose the following "[...] Additionally, key options include increased public finance flows to developing countries, shifting the direct lending modality towards public guarantees to reduce risks and deliver many times greater leverage on private flows at lower cost [...]" instead of the proposed text.	Government of Switzerland, Federal Office for the Environment FOEN
12768	41	32	41	37	Delete from "Additionally, key options include lending modality towards public guarantees to reduce risks and deliver many ...local capital markets development. A coordinated effort to green the post-pandemic recovery is essential in countries facing much higher debt cost". Reason: Policy prescriptive.	Government of India, Ministry of Environment, Forests and Climate Change
9642	41	33	41	33	As USD 100 billion-a-year commitment includes not only public finance but also private finance, the sentence can be changed to "increased public and private finance flows".	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
15556	41	33	41	33	Suggest ""at levels greater than"" rather than ""beyond"" if \$100B/year is not currently flowing, which ""beyond"" implies is the case. Statement that \$100B/year is not flowing is inaccurate. The average amount of climate finance in the 2-year period of 2019/2020 was \$632 billion/year, an increase of 10.1% over 2017/2018. The average annual amount specifically for climate change mitigation was \$571 billion. The average annual financing specifically for climate adaptation was \$46 billion. Another \$15B/year supported both mitigation and adaptation. See: Buchner, Barbara et al. 2021. Global Landscape of Climate Finance 2021. Washington, DC: Climate Policy Initiative. <a href="https://www.climatepolicyinitiative.org/wp-content/uploads/2021/10/Full-report-Global-Landscape-of-Climate-Finance-2021.pdf">https://www.climatepolicyinitiative.org/wp-content/uploads/2021/10/Full-report-Global-Landscape-of-Climate-Finance-2021.pdf</a>	Government of United States of America, U.S. Department of State
7000	41	33	41	34	This is the only time in the SPM that the climate finance goal of USD100 is mentioned in the SPM, which does not adequately reflect its relevance in the climate policy sphere and therefore must be expanded. "Beyond USD100 billion a year" suggests that this sum is already flowing, which it is not as has been widely discussed. This statement should therefore also reflect the current sums that are flowing with respect to this goal (78.9 billion in 2018, 79.6 billion in 2019), while the most recent number available should be used. This type of information is particularly relevant for regions and countries such as small islands.	Government of Jamaica, Meteorological Service Division



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11804	41	33	41	34	" key options include increased public finance flows from developed to developing countries beyond USD100 billion a year". The reference to " beyond USD 100 bilion a year" should be removed since this is a clear political indication that can have spill over effect in the context of the negotiation of the post 2025 goal. It does not give any added value to the technical-scientific analysis of the report that has not carried out any type of specific analysis on the USD100 billion a year goal.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12064	41	33	41	34	E.5.3: It is critical that the 100bn dollar climate finance goal is explicitly mentioned here. This statement then also needs to reflect the fact that this goal has not been met in 2020.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13072	41	33	41	34	E.5.3: We missed the mentioning of \$100bn goal in this sentence. Moreover, it would also be important to mention that this goal has not been achieved by 2020.	Government of Gambia, Department of Water Resources
13600	41	33	41	34	As stated earlier, information in part E.5 and sub-bullets must more prominently feature the USD 100 billion goal. The statement in E.5.3 is too brief and does not include information that the goal has not been fulfilled. Please add this information.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
3186	41	34	41	34	Please consider specify of this sentence really refer to a shift from direct lending to public guarantee or rather to a shift from grants to loans.	Government of France, Ministère de la Transition écologique et solidaire
5994	41	35	41	35	Not clear on what 'enabling operational definitions' actually means.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
11806	41	35	41	35	What are "enabling operational definitions"?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15558	41	36	41	36	Delete "is essential" and add at the end of the sentence "could also increase financial flows".	Government of United States of America, U.S. Department of State
5996	41	36	41	37	A coordinated effort to green the post -pandemic recovery is essential in all countries, not just those facing much higher debt costs	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6806	41	36	41	37	A coordinated effort to green the post-pandemic recovery is essential in all countries and not only in those facing much higher debt costs. Perhaps you might clarify by adding "particularly" before "essential".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
7002	41	36	41	37	The mentioning of countries facing debt costs is very welcome and should be expanded as this is a challenge facing many countries including small islands that is made worse by a combination of factos including worsening climate impacts and the COVID-19 pandemic.	Government of Jamaica, Meteorological Service Division
12066	41	36	41	37	E.5.3: This information on countries facing debt challenges is appreciated but should be much more explicit regarding enormous debt that some countries, including small islands, are facing, exacerbated by a combination of factors including climate change as well as the pandemic. Information could be condensed from 15.6.3 p.64-65: "Debt levels globally but particularly in developing and vulnerable countries have significantly increased over the past years with current and expected climate change impacts further burdening debt sustainability (high confidence). For low and middle income countries, 2018 marked a new peak of debt levels amounting to 51% of GDP; between 2010 and 2018, external debt payments as a percentage of government budget grew by 83% in low- and middle-income countries, from an average of 6.71% in 2010 to an average of 12.56% in 2018 (Eurodad 2020). COVID-19 has further reduced the fiscal space of many developing governments and/or increased the likelihood of debt stress. With many vulnerable countries already being burdened with higher financing costs, this limited fiscal space further shrinks their ability to actively steer the required transformation (Buhr et al. 2018). Limited progress in increasing debt transparency remains another burden (see Section 15.6.7)."	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13074	41	36	41	37	E.5.3: We welcome the mentioning of "debt challenges" in this sentence. However, we request authors to expand it further by mentioning the high level of debt which many of the least developed countries are having that has increased due to climate change and COVID pandemic.	Government of Gambia, Department of Water Resources

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13602	41	36	41	37	The statement on debt remains too brief and superficial. Many countries including small island developing states are faced with enormous debt, exacerbated by climate change and COVID-19. These circumstances of many developing countries must be elaborated on here.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
15560	41	36	41	37	This sentence borders on being policy-prescriptive rather than policy-relevant or policy-informing.	Government of United States of America, U.S. Department of State
15562	41	36	41	37	Revise to: "A coordinated effort to invest in low-carbon infrastructure and to decarbonize the post-pandemic economy is essential in countries facing much higher government deficits and debt costs."	Government of United States of America, U.S. Department of State
15540	41	37	41	37	Is it really true that mitigation funding for low income areas has the highest returns? They have the smallest emissions, and analysis says that, for example, to fully electrify that community would have negligible effects on emissions. That means it is the wealthier and larger economies that are the focus if ambition is to be raised – something that does not seem to register at all here.	Government of United States of America, U.S. Department of State
3188	41	39	41	39	Please consider explaining shortly what is a clear signaling: carbon pricing, phasing out fossil fuel subsidies, R&D public support for low-carbon innovation, shadow price of carbon in investment project assessment, sectoral regulations, etc. Or refer to chapter 13	Government of France, Ministère de la Transition écologique et solidaire
15564	41	39	41	39	To be consistent with the theme of this section, it would seem more correct if the word "finance" appeared after "international".	Government of United States of America, U.S. Department of State
9842	41	39	41	40	question: what is meant by clear signalling?	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12068	41	39	41	40	E.5.4: What does "clear signalling" mean exactly?	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
514	41	39	41	41	E.5.4: What does "clear signaling" mean in this context- not clear " Clear signalling by governments and the international community reduces uncertainty and transition risks. Investors, central banks, and financial regulators can support climate policy by increasing awareness of climate risk."	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
11808	41	39	41	47	Suggest to mention phasing out of fossil fuel subsidies explicitly (not just misaligned flows). Explicit mention of harnessing of Covid recovery measures/programmes could also be envisaged	Philippe Tulkens, European Union (EU) - DG Research & Innovation
5988	41	39	41	48	E.5.4 These bullets appear to be an abstraction of the list on page 46 (lines 7 to 22) which provides an overview of the different parts of section 15.6. I think the framing of 'key areas which can have a catalytic effect in terms of addressing existing barriers' from the underlying chapter (page 46, lines 3 and 4) is far better than the current framing about signalling to reduce uncertainty - as it's unclear what that uncertainty pertains to. The catalytic impact of these actions is important to stress. Why the list of actions in this statement differs from the aforementioned list at the start of section 15.6 is not clear.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12386	41	39	41	48	According to Ch 5.P33-36.L41-21. It can be noted that in the path of developemnt, many traditionally women practices including cleaning and childrasing has moved from outdoors to indoors. This transition not only leads to higher energy intensity but also reduces women's social capital(Sunikka-Blank, et al., 2019). Therefore, better energy access can reinforce climate change in two different ways; strengthening gender inequality and increasing household energy consumption.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
13682	41	39	41	48	It would be helpful to include in this paragraph (or elsewhere in this section) the role of climate related financial disculsures as one of the clear signals that governments can provide. There is plenty of material in Chapter 15 to support this inclusion.	Government of New Zealand, Ministry%20for%20the%20Environment
15566	41	39	41	48	There are significant monitoring costs for green banking or carbon banking. The monitoring can and is being done in the private sector, but with significant transaction costs. This section should mention governments or international communities financial support to reduce the monitoring and certification costs. A reduction in these costs will incentivize more individuals and firms to participate in these markets.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15654	41	39	41	48	A lot of relevant findings are combined in this paragraph, while the individual pieces of information are then not explained. The enumeration could be shortened and only the most important issues retained, which could then be expanded with further information that provides real insight. For instance the issue of "reducing misaligned flows of public finance" is critical but only briefly mentioned, and should be explained here.	MFA Palau, Ministry of State National Authority Bureau of Foreign Affairs
5990	41	40	41	41	The line 'Investors, central banks, and financial regulators can support climate policy by increasing awareness of climate risk.' should be a bullet alongside the other potential actions	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6808	41	40	41	41	"Investors, central banks, and financial regulators can support climate policy for example by increasing awareness of climate risk." There are a lot of methods those actors can use to support climate actions; the addition of "for example" makes this more obvious.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6810	41	40	41	41	Not only investors, central banks, and financial regulators can support climate policy by increasing awareness of climate risk. Very relevant are financial intermediaries such as banks or insurance companies too. You might want to add "intermediaries and" before "regulators".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13088	41	40	41	41	Investors, central banks and regulators not only have to be aware of the climate risks but also of the climate impacts of their investments. Therefore we propose to adjust this sentence and add "and impact" at the end. It would read: [...] Investors, central banks, and financial regulators can support climate policy by increasing awareness of climate risk and impact."	Government of Switzerland, Federal Office for the Environment FOEN
3190	41	41	41	41	The alignment with national priorities and planning vehicles, such as NDCs and NAPs, is not mentioned. It is mentioned in a relation to alignment of financial flows in section B. It would be relevant to add it for balance purposes, as it is a key tool used by international development partners to implement art 2.1.c of the Paris Agreement.	Government of France, Ministère de la Transition écologique et solidaire
6812	41	41	41	41	According to the underlying Chapter (Ch. 12, Box 15.1), "funding" should be understood as synonym for "money provided". As the approaches to ensure alignment of financial flows with "funding needs" mentioned in this paragraph cover a broader range of finance issues, including financing but also investment, please revise choice of language and consider to refer to "financing needs".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
13076	41	41	41	42	E.5.4: Once again we request authors to explicitly mention "LDCs" when mentioning "low-income and vulnerable countries". We take the opportunity to suggest a phrase "support and partnership in low-income and vulnerable countries such as LDCs....."	Government of Gambia, Department of Water Resources
15568	41	41	41	44	Revise to: "Financial flows can be aligned with funding needs through: support and partnership in low-income and vulnerable countries; reducing misaligned flows of public finance; greater support for technology development, demonstration, and commercialization; investing in first-of-a-kind technology demonstration projects; a continued role for multilateral and national development banks; unlocking debt financing through loan guarantees; lowering financing costs for underserved groups through green banks, funds and risk-sharing mechanisms; reducing financing costs through innovative instruments; focusing on transparency to close knowledge gaps and shift ..."	Government of United States of America, U.S. Department of State
6814	41	41	41	47	Please explain the criteria for the named "funding needs" and please clarify why e.g. education is not listed.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
15570	41	41	41	47	Do each of these need to be listed? It may be better to state that financial flows can align with funding needs through multiple mechanisms and leave these details in the underlying chapter.	Government of United States of America, U.S. Department of State
12816	41	42	41	47	Delete the following: "reducing misaligned flows of public finance", "focusing on transparency.....climate risk".	Government of India, Ministry of Environment, Forests and Climate Change
9644	41	46	41	46	It seems not clear about the relationship between carbon pricing and equity. It seems that this quotes the sentence "phasing -in carbon pricing and phasing out fossil fuel subsidies in a way that addresses equity and access" on p. 5, line, 45-46 in Chapter 15. Does that sentence imply carbon pricing, for example, which addresses equity among sectors?	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11810	41	46	41	46	The reference to carbon pricing overlooks its primary purpose, namely to make risk/return profiles from investments in mitigation more attractive and disincentivise investment in fossil assets. Suggest changing to something like "carbon pricing options that encourage emissions reduction while address equity"	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3192	41	46	41	47	The important points of "gender-responsive and women-empowered programs" deserve to be developed - make a separate paragraph and use the text from the first paragraph of box 5.4: "Empowering women benefits both mitigation and adaptation, because women prioritise climate change in their voting, purchasing, community leadership, and work both professionally and at home (high evidence, high agreement). Increasing voice and agency for those marginalised in intersectional ways by race, ethnicity, and other factors has positive effects for climate policy (high evidence, high agreement)."	Government of France, Ministère de la Transition écologique et solidaire
3362	42	0	42	0	Either put the axis title and units together at the top or together at the bottom, for an easier reading of the graph.	Government of France, Ministère de la Transition écologique et solidaire
3364	42	0	42	0	Please explain the range of value: minimum and maximum ratio in annual mitigation investment needs?	Government of France, Ministère de la Transition écologique et solidaire
3366	42	0	42	0	We suggest explaining the difference between "IEA data mean" and "average flows" in the graphic legend.	Government of France, Ministère de la Transition écologique et solidaire
3368	42	0	42	0	The multiplier, which is key in understanding how these estimate vary depending on mitigation scenarios, should be introduced in the legend directly and not only in the description.	Government of France, Ministère de la Transition écologique et solidaire
3370	42	0	42	0	This legend should include the caveat of the chapter 15. "The existing gaps in terms of unmet investment needs are only a single indicator to be used as part of a more comprehensive (and qualitative) assessment in order to understand the magnitude of the challenge to scale-up finance in sectors and regions".	Government of France, Ministère de la Transition écologique et solidaire
3390	42	0	42	0	The legend and the title of SPM 11 are missing an important information that it is to pursue the two degree objective (appear in the main text, in Section E, E.5.1 that refer to the figure. Such information should be added in the title of the figure giving the following : "Breakdown of average mitigation investment flows and investments needs until 2030 (USD billion) to pursue the two degree objective"	Government of France, Ministère de la Transition écologique et solidaire
9646	42	0	42	0	A significant difference between CPI data and IEA data can be seen for "Energy Efficiency" even though these values consist of the data of same period (2017-2020). The reason of the gap should be explained, or I suggest using only CPI data as other items.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
12070	42	1			Figure SPM.11: This is a very informative and critically important figure and will receive our full support. As with the other figures containing regional information, a separate category for SIDS would be able to capture the regional specifics and unique circumstances much better than including the Caribbean and developing Pacific in other categories. We understand that the UNSD M49 classification also contains a "SIDS" grouping, which we would like the authors to add.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
2080	42	1	42	1	It is very difficult to read the yearly trend of investment flows due to the IEA data mean values. In addition, some parts do not know the IEA data mean values. It is recommended to delete IEA data means or display them more distinctively.	Government of Republic of Korea, Korea Meteorological Administration
2448	42	1	42	1	unclear how IEA data mean 2017-2020 is included in the figure	Government of Denmark, Danish Meteorological Institute
5998	42	1	42	1	The choice of 'Energy efficiency' as a sector is not consistent with the rest of SPM which speaks of buildings, industry etc. Simple solution would be to add an explanation of what 'Energy efficiency' encompasses	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6206	42	1	42	1	Figure SPM.11 : The grey indications of investment needs are barely visible on inkjet printouts. Please improve the graphical presentation, especially the choice of colours, to improve readability.	Government of Belgium, Belgian Science Policy Office - Belspo
6816	42	1	42	1	Figure SPM.11: As mentioned in the caption of the figure, the multiplication factors show the ratio of yearly mitigation flows (AVERAGED FOR 2017-2020) and global average yearly mitigation investment needs (averaged until 2030). As the yearly mitigation flows are thus "averaged", please specify the description of the factors in the lower part of the figure by adding "averaged": "[...] x-fold increase between AVERAGED yearly mitigation flows to [...]".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6818	42	1	42	1	Please explain why you consider "energy efficiency" as a sector but not, e.g. "industry" or "buildings"? And please include the building sector in this figure.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
6820	42	1	42	1	SPM Fig.11 - Please consider using more contrasting colours or making the coloured bars thicker as they are difficult to distinguish.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9872	42	1	42	1	Where is the IEA data mean 2017-2020 bar?	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
9874	42	1	42	1	Suggest to consider a different way of demonstrating the investment gap between finance flows and needs. The grey bars and multiplication factors are counter intuitive and since the data can only be considered as indicative, please consider deleting the multiplication factor, at the moment these suggest a more accurate indication than is the case.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
11812	42	1	42	1	Figure SPM 1.1. Energy efficiency is not a sector. Sectors are building, industry, transport, etc.. Therefore it could be changed to "energy efficiency in buildings and industry" (in this way both sectors will be mentioned). Also electricity could be change to the power generation sector.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
15572	42	1	42	1	Because of the distortions created by the classification of countries, delete the developed/developing component of Figure SPM.11, or provide the breakdown by multiple income classes using IMF classifications.	Government of United States of America, U.S. Department of State
15574	42	1	42	1	Figure SPM.11 shows the relatively tiny amount of investment going into mitigation in AFOLU compared to other sectors, and how this investment would need to be amplified by 10-29 times in order to achieve the available mitigation potential by 2030. These multiplication factors for scaling up are quite a bit larger than those in other sectors, even though the absolute scale of investment (and mitigation) is smaller. It implies that policymakers should radically increase investments in AFOLU mitigation -- without fear that it would compete with or displace mitigation in other sectors. This take-away should be articulated in the text and perhaps highlighted in the header to this section.	Government of United States of America, U.S. Department of State
15576	42	1	42	1	Figure SPM.11 is opaque. The scale is too scrunched together to estimate actual flows in 2019 and 2020 to actually compare the numbers to the reference (Buchner et al., 2021). A solution could be to put actual numbers on expenditures on or to the right of the bar graphs. There is also no indication whether the numbers in the figure are for the sum of public and private investments or just public investments.	Government of United States of America, U.S. Department of State
15578	42	1	42	1	Figure SPM.11 presents mitigation investment flows and needs broken out into only two types of economies, developing and developed countries. It is questionable whether such a breakdown is warranted given the relatively few countries that compose the bulk of the assessed international and domestic financial flows and needs and the paucity of data on financial flows and needs in many low income countries. In this case, authors should consider using an income-based categorization of countries to better capture the diversity of financial flows and needs across countries. If the authors are unable to provide such an analysis based on the underlying assessment, they should remove the development categorization altogether and simply provide the sectoral and regional breakdowns. If an aggregate value is desired, the global total could be added.	Government of United States of America, U.S. Department of State
7004	42	1	42	21	We have already provided this suggestion with regards to figures SPM.2 and 3 and would like to reiterate that a separate regional category for small islands, which would allow to adequately reflect the characteristics and provide valuable insights for policymakers (as opposed to being part of the currently larger categories together with Latin America), would be much appreciated.	Government of Jamaica, Meteorological Service Division
11814	42	1	42	21	Ideally the figure would show not only mitigation investment per region / sector, but also total investment. This way the reader can see the extent to which it is the magnitude or the 'greenness' of the flows that is the major issue in each case.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
13084	42	1	42	21	Figure SPM. 11: Breakdown of average investment flows and investment needs until 2030 (USD billion) => We propose that the graph is enhanced by adding the current level of domestic and international investments in carbon intensive technologies and assets in the respective sectors, economies and regions. This is an important perspective to put the investment needs in relation to the current investments running against the mitigation efforts across all sectors and types of the economy. It would also indicate the economic potential of a shift from emission intensive investments to low-emission investments in the various regions and sectors.	Government of Switzerland, Federal Office for the Environment FOEN
14182	42	1	42	21	Please keep Figure SPM.11, as it provides important information on mitigation investment status and needs. Please consider replacing the legend named "Average flows" with "Average flows 2017-2019", as it seems 2020 data is not included, ref. caption. Please also consider commenting on why the IEA data on energy efficiency investment flows differ substantially from the CPI data. Also, it would be easier to separate the IEA data from the CPI data if the IEA bar was another color than blue. The "Average flows" could also be in a different color, to make it easier to separate from the "2020 blue".	Government of Norway, Norwegian Environment Agency
6822	42	1	42	3	Figure SPM.11: It is hard to understand the figure without reading its complete description in the caption. Please explain the grey bars in the figure itself. In addition, please consider shifting from a horizontal to a vertical bar chart, which might be a more understandable form of presentation.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
11816	42	4	42	4	There is a problem with energy efficiency in this line of text. Energy efficiency is not a sector. Sectors are building, industry, transport, etc.. Therefore it could be changed to "energy efficiency in buildings and industry" (in this way both sectors will be mentioned). Also electricity could be change to the power generation sector.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
6824	42	4	42	5	Figure SPM.11, upper left corner/caption: In order to allow comparability between sector classification in the different figures, please briefly describe which sectors resp. categories/areas are covered by the estimates for "energy efficiency" and "electricity". For example, "energy efficiency" in Fig. SPM.8 and Fig. SPM.9 is included within several sectors as industry, transport and building; "bioelectricity" within "energy systems".)	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
3372	42	5	42	5	Please specify what is meant by "type of economy"?	Government of France, Ministère de la Transition écologique et solidaire
1394	42	7	42	12	It would be interesting to include some remarks on how mitigation investments benefit the efforts on meeting the other SDGs, indirectly, for example by avoiding climate impacts on food security, health and so on.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6826	42	7	42	7	Please explain the abbreviation CPI and name the concrete source. Is this the same series as mentioned in footnote 11?	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
11818	42	7	42	7	meaning of CPI ?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
3374	42	7	42	8	Given that only two sources are cited here for this table, and since these two sources are an assembly of data from multiple sources, it would be relevant to broadly detail these sources so that the readers can better grasp the robustness of these estimates.	Government of France, Ministère de la Transition écologique et solidaire
12278	42	8	42	22	Like the Land Use section, it is better to name the countries with highest and lowest per capita and total GHG emissions.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
1192	42	8	42	8	Define CPI within sentence	Government of Ireland, Department of Communications, Climate Action and Environment, Climate Mitigation and Awareness Division
6002	42	10	42	11	What are Adaptation pegged transactions? Not a commonly used term.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
1396	42	11	42	11	Suggest writing out the C1:C3, i.e. what they mean in terms of warming, rather than referring to these labels.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
1398	42	12	42	12	If the "infrastructure investment" refers to such infrastructure investment that is unrelated to climate action, please specify, in order to avoid misunderstanding.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
1400	42	12	42	12	The "meeting the SDGs" could be changed to "meeting the other SDGs than the SGD on climate action", as SDG 13 refers to climate change.	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6000	42	12	### ### #	12	What's the infrastructure investment that's missing? Most definitions would include electricity etc investments	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
1402	42	15	42	16	The C1 through C3 scenarios are quite differently. It would be relevant to include some remarks on how much of the ranges (grey bars and multiplication factors) are due to the spread in the scenarios, and how much to other factors/uncertainties. Not least, could the "1.5" and "2" cases be indicated more clearly, how do they compare?	Government of Sweden, Swedish%20Meteorological%20and%20Hydrological%20Institute
6828	42	16	42	18	Figure SPM.11, caption: as the multiplication factors are also provided for the annual mitigation investment needs by region, the description "GLOBAL average yearly mitigation investment needs" is not generally valid/applicable for the regional breakdown. Please check and correct.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
3376	42	20	42	21	Is there no possibility to provide a sense of the confidence level with IPCC calibrated language?	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15580	42	20	42	21	This sentence in the Figure SPM.11 caption is critical and should go into E.5.1, in line 21 by inserting at the end of the existing sentence the following: "According to one analysis, given the multiple sources and lack of harmonised methodologies, the data can be considered only as indicative of the size and pattern of investment gaps."	Government of United States of America, U.S. Department of State
3378	42	21	42	21	A reference to Fig. TS.25 could be added (see page TS-124)	Government of France, Ministère de la Transition écologique et solidaire
13604	42				Echoing our comments made with regards to figures SPM.2 and SPM.3, please ensure that these figures make use of the same intermediate level categories for consistency. Furthermore, as we commented earlier, kindly add a category for small island developing states according to the UNSD standard.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
4172	42		42		This is an excellent figure with important information. It could also be part of a cross-section punch on investments in mitigation vs fossil fuel mentioned in B.5.4. Would it be possible to add an additional bar at the bottom of the graph showing fossil-fuel investments? That would complete the story.	Government of Canada, Environment and Climate Change Canada
12818	42		42		Delete Figure SPM 11 as it is based on a single set of reports from a single agency. Investment needs are highly model specific and do not include investments related to the SDGs and the current legend itself. Line 20-21 says that the data is only indicative. The methodologies from various sources is also not harmonized. Such a figure is misleading if not incorrect.	Government of India, Ministry of Environment, Forests and Climate Change
12314	43	1	43	36	According to the paragraph one (line 1, page 43) 'Achieving ambitious climate change mitigation goals relies on international cooperation' and 'Some international agreements, particularly related to trade and investment, reinforce the role of fossil fuels and can act as barriers to mitigation' in the line 26. In addition, various economical, trade, and scientific sanctions imposed on Iran by the United States of America exacerbated conditions leading to a significant failure of scientific collaboration in an international scale. Therefore, a paragraph on the role of political sanctions in reducing the ambitious goals to level of zero carbon emissions should be emphasized in this section.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
2138	43	1	43	1	To stress the importance of international collaboration, the sentence would be changed; International collaboration plays a critical role in achieving ambitious climate change mitigation goals.	Government of Republic of Korea, Korea Meteorological Administration
12758	43	1	43	1	Replace line 1 with: "Achieving ambitious climate change mitigation goals relies on emission reductions commensurate with equity, levels of development and national circumstances, with developed countries taking the lead as indicated in multilateral climate agreements."	Government of India, Ministry of Environment, Forests and Climate Change
13086	43	1	43	1	International cooperation is one factor to achieve ambitious climate change mitigation goals and not the only one. We therefore propose to change the first sentence in E.6 as follows "International cooperation supports the achievement of ambitious climate change mitigation goals."	Government of Switzerland, Federal Office for the Environment FOEN
13684	43	1	43	3	The language on the Paris Agreement needs to be tightened up. The Paris Agreement does more than "encourage" rising levels of ambition at the national level (for example see Article 4, paragraphs 2 and 3: "Parties shall prepare, communicate and maintain successive [NDCs].." and "Each Party's successive [NDC] will represent a progression..." ), and does more than "support" development and implementation of climate policies (for example see Article 4, paragraph 2 - "Each Party shall pursue domestic mitigation measures...")	Government of New Zealand, Ministry of Environment
11820	43	1	43	35	E.6 - for global climate change mitigation, international cooperation and development policies should have a strong technology transfer component to allow developing countries to leapfrog fossil-based systems.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12072	43	1	43	35	E.6: Could the entire section E.6 be condensed somewhat? This relates particularly to bullets E.6.2, E.6.4 and E.6.5 which have important yet somewhat general statements that could maybe be condensed.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
13356	43	1	43	35	An important aspect of international cooperation is that its effectiveness largely depends on whether the international agreements are subsequently implemented at the national level. E6 could and should make this claim more explicit.	Government of Switzerland, Federal Office for the Environment FOEN
15582	43	1	43	35	Why is there no mention of the Global Stocktake and the "ratchet mechanism" in Section E.6?	Government of United States of America, U.S. Department of State
12988	43	1	43	5	E.6 is disappointingly general. What NEW FORMS of international cooperation does the literature suggest?	Government of South Africa, Senior Policy Adviser International Climate Change Cooperation Department of Environmental Affairs

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6004	43	1	### ### #	45	More generally, can this section draw out more on what effective co-operation looks like in practice, and which sectors/areas would now most benefit from this?	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12820	43	2	43		Replace the sentence "The Paris Agreement is encouraging..." with the following sentence from Chapter 14 (p.3, line 37-38) "There are conflicting views on whether the Paris Agreement's commitments and mechanisms will lead to the attainment of its stated goals".	Government of India, Ministry of Environment, Forests and Climate Change
518	43	2	43	2	E.6: Required action: while mentioning the encouragement to raise ambition level, the sentence needs to acknowledge that following the principle of "Common but Differentiated Responsibilities and Respective Capabilities" for some countries may dictate otherwise.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20Petroleum%20and%20Mineral%20Resources
6830	43	3	43	4	The following addition is suggested to reflect the assessment in chapter 10 that there are more hydrogen mobility applications than just shipping and aviation: "Hydrogen- and advanced bio-based fuels are also a useful addition to battery vehicles in the transport sector. They have potential in land-based transport, especially commercial vehicles, in shipping and aviation, and in other specific land-based contexts. Demand-focused interventions can reduce demand for all transport services and support the shift to more energy efficient transport modes."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12822	43	6	43	8	Delete E.6.1. Reason: Factually incorrect based on the failure of fulfilment pre-2020 commitments by developed countries despite their enhanced reporting. Also, the inclusion of net-zero GHG emissions without context and in the failure of NDCs to adhere to the global carbon budget, the bullet is factually incorrect.	Government of India, Ministry of Environment, Forests and Climate Change
2418	43	6	43	9	Suggest including industry-specific international goals as an important additional set of agreements, e.g. IMO Initial Strategy.	Government of Australia, Department of Industry, Science, Energy and Resources
6832	43	6	43	9	In E.6.1, please elaborate more on the achievements of the Kyoto Protocol and the evolution to the Paris Agreement as the major multilateral agreements regarding climate change including market-based elements. Please cite from 14.4.4; 14.3.3.1; 14.3.3.2: "In theory, trading carbon assets can reduce the costs of global climate mitigation, by helping facilitate abatement of greenhouse gases at least-cost locations. This could help countries ratchet up their ambitions more than in a situation without such mechanisms (Mehling et al. 2018), particularly if mechanisms are scaled up from projects and programmes (Michaelowa et al. 2019b). Most studies have concluded that Kyoto did cause emissions reductions. In relation to the promotion of co-benefits the Paris Agreement has enhanced mechanisms for promoting co-benefits (e.g. in some cases for biodiversity conservation through the endorsement of REDD+ initiatives and activities) and linkages to sustainable development (e.g. through the Article 6.4 mechanism). Finally, in its preambular text the Paris Agreement endorses both a human rights perspective and the concept of just transitions, creating potential hooks for further elaboration and expansion of these principles in mitigation actions. In conclusion, it remains to be seen whether the Paris Agreement will deliver the collective ambition necessary to meet the temperature goal. While the Paris Agreement does not contain strong and stringent obligations of result for major emitters, backed by a demanding compliance system, it establishes binding procedural obligations, lays out a range of normative expectations, and creates mechanisms for regular review, stock taking, and revision of NDCs. In combination with complementary approaches to climate governance, engagement of a wide range of non-state and sub-national actors, and domestic enforcement mechanisms, these have the potential to deliver the necessary collective ambition and implementation."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14184	43	6	43	9	This is a useful para, at the same time the international agreements in addition to enhancing national ambition and policy development, also contributes to international cooperation and initiatives. Please consider if this also is relevant to describe in the para.	Government of Norway, Norwegian Environment Agency



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15584	43	6	43	9	First, to the extent that the literature supports a statement here not only about ambition and policy development but also about enhanced action and implementation, that should be included. Second, the first part of the sentence ("Internationally agreed goals and transparency requirements, such as those of the Paris Agreement, are driving") seems to slightly misconstrue the core link between Paris and the subsequent outcomes. While no doubt the specific goals within Paris (e.g., 2°C) and the transparency requirements are contributors, a main driver of policy ambition and implementation from PA is the periodic submission of NDCs (and arguably, to a lesser extent, even LTS). If one had an international agreement for just trying to get to 2°C, and to be transparent about policy actions, one would likely have seen a very different response. So this language should be reviewed and ideally include language reflecting the core importance of the NDC element. For example, could revise to read: "Internationally agreed goals, processes, and transparency requirements -- such as the Paris Agreement's long-term temperature goal and requirements to regularly submit and track progress towards the achievement of NDCs -- are driving enhanced national ambition and policy development..."	Government of United States of America, U.S. Department of State
12760	43	7	43		Add after first sentence in E.6.1, "The extent to which countries increase the ambition of their NDCs and ensure they are effectively implemented will depend in part on the successful implementation of the support mechanisms in the Paris Agreement, and in turn will determine whether the goals of the Paris Agreement are met" (Chapter 14, p.4).	Government of India, Ministry of Environment, Forests and Climate Change
7008	43	8	43	13	There are no references to financial needs for the mitigation costs. Mitigation generally requires higher investments. Although reduced costs can compensate the additional expenditures with savings in the future, the availability of resources for upfront investments is a very strong barrier for developing countries.	Government of Argentina, Ministry of Environment and Sustainable Development of Argentina
15586	43	8	43	8	Add at the end of the line, "in some countries, subnational governments, nongovernmental entities, private businesses , and the general public."	Government of United States of America, U.S. Department of State
6006	43	8	43	9	"International support for domestic policy implementation also leads to greater ambition" - this is useful to know, but could it draw out a more specific reference to when/where/why this is true? Policymakers would benefit from understanding more specifics here to apply this insight	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
762	43	10	43	10	The expression of "Needs-driven" is not clear as to who drive the "needs", which is not conducive to those who make decisions. It is suggested to change it to "Needs-based-country-driven".	Government of China, China Meteorological Administration
3194	43	10	43	10	We suggest to add "scientific research" after "technology development"	Government of France, Ministère de la Transition écologique et solidaire
9648	43	10	43	10	The term "needs driven" international cooperation is not generally used and also not clearly defined in Chapter 16. "Needs driven" should be deleted.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
14186	43	10	43	10	What is a "needs-driven" international cooperation on technology development? Is the "needs-driven"-part essential? In that case, please consider to explain it, and/or include it in to the glossary.	Government of Norway, Norwegian Environment Agency
15588	43	10	43	10	"Needs driven" is highly subjective and not a concept supported by most economists.	Government of United States of America, U.S. Department of State
764	43	10	43	13	The statement is inconsistent with the underlying report (line 3-7, page 67, Chapter 6). It is suggested to verify and modify.	Government of China, China Meteorological Administration
12370	43	10	43	17	It is better to highlight need for technology transfer to the developing countries, and to develop local capacities for technology developments	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
13696	43	10	43	17	Suggest also highlighting the importance of indigenous rights and values in international cooperation.	Government of New Zealand, Ministry of the Environment
12332	43	12	43	12	After "objectives" add this phrase "Without transboundary political intervention"	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
2106	43	13	43	13	In the para E.6.2, the current use of 'the policy regime' is fine in consideration of its intended meaning. Yet, though regime and institution are interchangeably used, regime refers to an issue-specific institution. In consideration of Chapter 16.5, I think it seems more appropriate to use "institutions" rather than "the policy regime" •(Present) "the policy regime" •(Change) "policy institutions" or just "institutions"	Government of Republic of Korea, Korea Meteorological Administration

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13686	43	15	43	15	Need to insert a comma after "to" and another one after "for", and delete the comma after "chains": "...International cooperation on innovation works best when tailored to, and beneficial for, local value chains when...."	Government of New Zealand, Ministry%20for%20the%20Environment
522	43	17	43	17	The high confidence statement from Chapter 16 and included in the Technical Summary Page 130 Lines 5-9 should be added to the paragraph. "Although some initiatives have mobilized investments in developing countries, gaps in innovation cooperation remain, including in the Paris Agreement instruments. These gaps could be filled by enhancing financial support for international technology cooperation, by strengthening cooperative approaches, and by helping build suitable capacity in developing countries across all technological innovation system functions (high confidence)." this should be clearly stated in the SPM as to ensure a balanced and inclusive report	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
13606	43	18	43	18	What level would this "increased public sector climate finance" would have to achieve? Please provide concrete numbers, even if the uncertainty range may be large.	Government of Saint Lucia, Department of Sustainable Development - Ministry of Education, Innovation, Gender Relations and Sustainable Development
2096	43	18	43	19	Generally agree. However, it is necessary to consider that even a small price increase can have a significant negative impact on international competitiveness if carbon neutrality is not pursued equally for each country.	Government of Republic of Korea, Korea Meteorological Administration
15590	43	18	43	19	There is too much emphasis on international public sector grants, especially from multilateral funds. This reflects continuing bias in Chapter 15 which was not addressed despite comments submitted on the second-order draft during the Government and Expert Review. Massive amounts of private sector finance are what has scaled up renewable energy development. This has been through loans from commercial banks, equity investments by energy companies for public-private partnerships, loan guarantees, and even green bonds in China and India. Grants or concessional loans may be more applicable for some adaptation investments that do not have a clear business model for loan repayments or equity investor returns.	Government of United States of America, U.S. Department of State
520	43	18	43	20	The high confidence statement from Chapter 15 and included in the Technical Summary Page 126 Lines 12-15 should be added to the paragraph. "Ambitious global climate policy coordination and stepped-up public climate financing over the next decade (2021–2030) can help redirect capital markets and overcome challenges relating to the need for parallel investments in mitigation. It can also help address macroeconomic uncertainty and alleviate developing countries' debt burden post-COVID-19 (high confidence)."	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2108	43	18	43	20	I think additional sentence can be added to the para E.6.3. •(Present) "Increased public sector climate finance over the next decade (2021-2030) can help address macroeconomic uncertainty and debt burdens, and help redirect capital markets, in the post-COVID-19 recovery period. (15.2, 15.6)" •(Change) I would like to add one more sentence. "International cooperation and coordination on climate finance by developed countries' financial commitments, climate-related bilateral development assistance, multilateral development banks, multilateral climate funds, the UN system, and private sector financing are importantly recognized. (15.2, 15.6, 14.4) "	Government of Republic of Korea, Korea Meteorological Administration
6834	43	18	43	20	Paragraph E.6.3 reiterates statements from previous paragraphs (esp. E.5.3 & E.5.4.). We suggest to delete it or incorporate it there.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
12074	43	18	43	20	E.6.3: This bullet should include an explicit statement on international public sector climate finance.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12762	43	18	43	20	Delete E 6.3. E.6.3 is policy prescriptive as it recommends particular policy moves that may be contested by other governments. All countries and several sections of stakeholders do not share these views.	Government of India, Ministry of Environment, Forests and Climate Change
15592	43	18	43	20	E.6.3 seems out of place. Delete it.	Government of United States of America, U.S. Department of State
15594	43	18	43	20	This sentence is redundant with the previous section. It is so general as to be meaningless. There is nothing to support it with analysis of efficaciousness or feasibility relative to options besides public sector climate finance, and, in this regard, it is biased. Delete it.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6008	43	18	### ### #	19	"Increased public sector climate finance over the next decade (2021–2030) can help address macroeconomic uncertainty and debt burdens" - I think this should say "Increased public sector climate finance over the next decade (2021–2030) can help address the impacts on climate policy of macroeconomic uncertainty and debt burdens"	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
516	43	21	43	21	E.6.4: The statement is written with focus on sources using the term "low carbon". Required actions: rewrite without focus on specific source categories by replacing "low carbon" which is source focused with "low emissions" in keeping with the PA, which focuses on emissions.	Government of Saudi Arabia, Sustainability%20Advisor%20to%20the%20Minister%20Ministry%20of%20%20Petroleum%20and%20Mineral%20Resources
2110	43	21	43	23	(Basis) This para of E.6.4 indicates the role of transnational partnerships or networks. Particularly, the first sentences deals with the roles played by transnational partnerships. However, this is not indicative of the importance of partnership or interplay between governments and non-state actors, which leads to hybrid governance, hybrid multilateralism, public-private partnership, etc. •(Present) "Transnational partnerships can stimulate policy development, low-carbon technology diffusion and emission reductions by linking sub-national and non-state actors, including civitives,non-governmental organisations and private sector entities." •(Change) I would like to see the addition to the first sentence. "Transnational partnerships can stimulate policy development, low-carbon technology diffusion and emission reductions by linking sub-national and non-state actors, including civitives,non-governmental organisations and private sector entities and by intensifying interplay between state and non-state actors."	Government of Republic of Korea, Korea Meteorological Administration
15596	43	21	43	23	Needs to address importance of rural areas in climate change mitigation and adaptation, not just ways to focus on urban areas.	Government of United States of America, U.S. Department of State
2420	43	22	43	22	Suggest inserting 'regions' after 'cities'.	Government of Australia, Department of Industry, Science, Energy and Resources
15598	43	22	43	30	This text could be strengthened by explicitly pointing to the uneven way that costs and benefits accrue across populations, countries, etc., as emphasized in Section A. Poor countries and poor people bear the highest costs.	Government of United States of America, U.S. Department of State
2488	43	23	43	25	We suggest the following addition to the text: "Transnational networks of city governments are leading to enhanced ambition, policy development and growing exchange of experience and best practices ."	Government of Hungary, Ministry of Innovation and Technology - Climate Policy Department
9650	43	26	43	29	Regarding the sentence "Sectoral emission reduction commitments vary, with lower ambition in aviation and shipping (high confidence).", Japan cannot agree with the evaluation that the ambition in the aviation sector is low. As stated in the ICAO Assembly resolution A40-19 "reaffirmed at its 38th and 39th Sessions in 2013 and 2016, as well as the work being undertaken to explore a long-term global aspirational goal for international aviation in light of the 2 degrees and 1.5 degrees temperature goals of the Paris Agreement", the ICAO is now in the midst of consideration for the setting the LTAG (Long Term Aspirational Goal) at the next ICAO Assembly (2022) for improving ambition in the international aviation sector. Therefore, the "Sectoral emission reduction commitments vary, with lower ambition in aviation and shipping (high confidence)." in the SPM should be deleted. At the very least, it is necessary to add "in the category of the currently set goals", and Japan believes that it should not be evaluated as "(high confidence)".	Government of Japan, Climate Change Division - Ministry of Foreign Affairs

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
9652	43	26	43	29	<p>In connection with the basis that the sentence "Sectoral emission reduction commitments vary, with lower ambition in aviation and shipping (high confidence)." of SPM is not valid, regarding the sentence in line 20-21 page 10-67 Chapter 10, "Clearly, this is a less than ideal situation for clarity of governance of international GHG emissions from both aviation and shipping.", Japan believes this is not appropriate and should be deleted.</p> <p>As mentioned in ICAO Assembly A40-19 "Whereas the Paris Agreement, which was adopted by the Conference of the Parties to the UNFCCC in December 2015, enhances the implementation of the UNFCCC including its objective, and aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by holding the increase in the global average temperature to well below 2 degrees above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 degrees above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; Recognizing the global aspirational goals for the international aviation sector of improving fuel efficiency by 2 per cent per annum and keeping the net carbon emissions from 2020 at the same level, as adopted by the ICAO Assembly at its 37th Session in 2010 and reaffirmed at its 38th and 39th Sessions in 2013 and 2016, as well as the work being undertaken to explore a long-term global aspirational goal for international aviation in light of the 2 degrees and 1.5 degrees temperature goals of the Paris Agreement;", ICAO is demonstrating governance based on the Paris Agreement.</p> <p>Regarding the sentence in line 26-28 page 10-67 "What form this goal will take is unclear until work is presented to the 41st Assembly (Autumn, 2022). It is likely, however, that new accountability and governance structures will be needed to support decarbonisation of the aviation sector.", which is newly added, for the same reasons as above, it should be deleted or replaced with the following sentence. "What form this goal will take is unclear until work is presented to the 41st Assembly (Autumn, 2022). It is expected that ICAO's governance will continue to be demonstrated."</p>	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9654	43	26	43	29	<p>In connection with the basis that the sentence "Sectoral emission reduction commitments vary, with lower ambition in aviation and shipping (high confidence)." of SPM is not valid, regarding the sentence in Line 6-11 Page 14-82 Chapter 14 "The Kyoto Protocol required Annex I parties to pursue emissions reductions from aviation and marine bunker fuels by working through IMO and ICAO (UNFCCC 1997, Art. 2.2). Limited progress was made by these organisations on emissions controls in the ensuing decades (Liu 2011b), but greater action was prompted by conclusion of the SDGs and Paris Agreement (Martinez Romera 2016), together with unilateral action, such as the EU's inclusion of aviation emissions in its Emissions Trading Scheme (ETS) (Dobson 2020).", it doesn't reflect the latest situations.</p> <p>According to the ICAO Assembly A40-19, ICAO "Resolves that States and relevant organizations will work through ICAO to achieve a global annual average fuel efficiency improvement of 2 per cent until 2020 and an aspirational global fuel efficiency improvement rate of 2 per cent per annum from 2021 to 2050, calculated on the basis of volume of fuel used per revenue tonne kilometre performed;" and "Assembly Resolution A39-3 decided to implement a GMBM scheme in the form of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) as part of a basket of measures which also include aircraft technologies, operational improvements and sustainable aviation fuels to achieve ICAO's global aspirational goals;"</p> <p>Therefore, Japan doesn't believe that limited progress was made by these organisations on emissions controls in the ensuing decades.</p>	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
766	43	26	43	31	<p>In terms of co-benefits, biodiversity conservation can be included (see Sections 14.3.3.2 and 14.5.1.1 of the underlying report).</p> <p>It is suggested to add "biodiversity loss" after "release of mercury" in line 27, and to add "or enhance carbon sinks" after "specific GHGs" in line 28.</p>	Government of China, China Meteorological Administration
2450	43	27	43	27	<p>Agreements addressing ozone depleting substances contributes to further reductions in specific GHGs but has the risk of substitution to other GHG (like f-gases) not covered by the agreements been taken into account?</p>	Government of Denmark, Danish Meteorological Institute
3400	43	27	43	27	<p>Mitigation of transboundary air pollution also targets precursors of cooling aerosols, so maybe this tradeoff should be mentioned. This aspect is also missing in the underlying discussion in Chapter 14 p67. Unfortunately fighting air pollution does not only bring benefit on climate and the dominant signal is for the moment the warming from decreasing cooling aerosols (WG1 chapter 6). It should be clearly mentioned in the chapter as well.</p>	Government of France, Ministère de la Transition écologique et solidaire

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6010	43	28	43	29	It is important that the lower ambition in these sectors, especially aviation, is noted here (no action needed).	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6836	43	28	43	29	Negotiations on strengthening the emission reduction commitments are ongoing in IMO, with the aim of aligning the ambitions with the other sectors. Proposed wording: "Sectoral emission reduction commitments vary, aviation and shipping endeavour to strengthen their commitments within the responsible UN-organisations ICAO and IMO."	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9656	43	28	43	29	The sentence in E.6.5 states that "Sectoral emission reduction commitments vary, with lower ambition in aviation and shipping," however, there are various measures in those sectors mentioned in the referred sections, especially in 14.5.2.3 International sectoral agreements and institutions - Transportation in Chapter 14. It would be better to delete "with lower ambition in aviation and shipping" or rephrase it.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11822	43	28	43	29	Would it be possible to be more precise and state if sectoral emission reductions commitments are in-line or not with required deep decarbonisation?	Philippe Tulkens, European Union (EU) - DG Research & Innovation
2112	43	29	43	29	The second sentence of the para E.6.5 refers to aviation and shipping. What is indicated in the Chapter 14 is 'international transportation in the first place. I would like to suggest a change as follows: •(Present) "with lower ambition in aviation and shipping" •(Change) "with lower ambition in international aviation and maritime shipping" or "with lower ambition in international aviation and maritime transportation".	Government of Republic of Korea, Korea Meteorological Administration
2452	43	29	43	30	Suggest moving up. The challenges of barriers between UN instruments are important.	Government of Denmark, Danish Meteorological Institute
2114	43	29	43	31	The last sentence of para E.6.5 deals with trade & investments agreement. The present sentence, however, seems to give an impression that 'general' international agreements can reinforce the role of fossil fuels and act as barriers to mitigation, though the applicable scope of international agreements are limited by 'some' and 'particularly related to trade and investment'. Therefore, I would like to suggest that the expression in the executive summary can be utilized with some modification. •(Present) "Some international agreements, particularly related to trade and investment, reinforce the role of fossil fuels and can act as barriers to mitigation." •(Change) "There are cases that trade and investment agreements as well as agreements within the energy sector impede national mitigation efforts."	Government of Republic of Korea, Korea Meteorological Administration
3196	43	29	43	31	Is there a possibility for international agreements in trade and agreement supportive of climate change mitigation, e.g. if they include enforceable sustainability clauses? If so, please ensure that the sentence is not understood as "trade and investment agreements are detrimental to mitigation".	Government of France, Ministère de la Transition écologique et solidaire
6012	43	29	43	31	A sentence of conclusions could be added to this paragraph to say that a proactive integration of mitigation measures is needed to align international agreements with global emissions trajectories consistent with climate targets.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6014	43	29	43	31	Some comment on the efficiency and usefulness of emissions trading is needed somewhere in the SPM as it is such an important instrument, particularly in Europe. This would come most naturally here, but could also have a dedicated paragraph in Section E.6.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
12460	43	29	43	31	Malaysia seeks clarification on the related international agreements quoted that reinforce the role of fossil fuels as barriers to mitigation.  In addition, Malaysia wishes to propose amendment: Some international agreements, particularly related to trade and investment, reinforce the role of fossil fuels and may act as barriers to mitigation (medium confidence). {14.5, 14.6}	Government of Malaysia, Ministry for the Environment and Water - Climate Change Division
12764	43	30	43	31	Delete "Some international agreements, particularly related to trade and investment..." Sentence is policy prescriptive. In the short-term developing countries require continued access to fossil fuel for their development. Such statements ignore this reality which is critical.	Government of India, Ministry of Environment, Forests and Climate Change
11824	43	31	43	31	Section 9.9 is covering in great details the Montreal Protocol as a key enabler for the reduction of GHG in refrigeration systems in buildings, therefore it is strongly recommended to add here 9.9 into the {...} brackets	Philippe Tulkens, European Union (EU) - DG Research & Innovation

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
4174	43	32	43	33	The first sentence here is very open-ended since there is no specificity about what kind of international cooperation is being referred to. Certainly there is international cooperation in terms of science, to understand the transboundary effects of SRM. If this paragraph is intended to be about international cooperation on governance, that should be clarified in the first sentence.	Government of Canada, Environment and Climate Change Canada
6208	43	32	43	33	Our view is that the approach of the topic is too limited and the paragraph is not appropriate in its current form. Other aspects need to be addressed, especially the risks. This is regrettable, due to the importance of the subject matter and the need to enlarge participation in such a crucial debate. A problem is that there is no status/global legal regime to "protect the atmosphere". Relevant sentences from the underlying report include the following: "Given that risks and potential benefits of SRM proposals differ substantially and their large-scale deployment is highly speculative, there is a wide array of concrete proposals for near-term anticipatory or adaptive governance. Numerous authors suggest a wide range of governance principles" (chapter 14, solar radiation, p.64 - I.1). We regret that we did not find references to the International Law Commission draft guidelines on an international status for the atmosphere, nor a related criticism of such draft guidelines and of their inherent weaknesses, as expressed in legal scholarship (see for instance P. H. SAND, « The discourse on 'protection of the atmosphere' in the International Law Commission », RECIEL (26), 2017, 201–209).	Government of Belgium, Belgian Science Policy Office - Belspo
6838	43	32	43	33	Please delete: "International cooperation currently does not consider transboundary issues associated with SRM". Since "cooperation" and "consider" are very broad terms, this is misleading. It does not harmonize with the following sentence ("agreements contain relevant provisions") and in fact there are international activities in multilateral institutions specifically on SRM, e.g. under the Montreal Protocol, UNEA 4 or the International Law Commission on the Protection of the Atmosphere. The following sentence already given in this SPM section is sufficient and more precise for indicating that there is no binding and specific governance tool.	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9658	43	32	43	33	In Chapter 14, p. 4, line 33-34, it states "International cooperation is emerging but so far fails to fully address transboundary issue associated with solar radiation modification and carbon dioxide removal". Therefore, CDR can be added as well here.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
15600	43	32	43	33	Since the technical and economic feasibility of solar radiation modification have not yet been demonstrated, it is not surprising that transboundary legal issues have not been addressed internationally.	Government of United States of America, U.S. Department of State
2116	43	32	43	35	I would like to suggest the change of E.6.6 as follows. •(Present) Current text reads "International cooperation currently does not consider transboundary issues associated with solar radiation modification (SRM)". The intended meaning of this sentence seems to be already implied in the second sentence that follows. I think it is more appropriate to delineate the role of and the necessity of international cooperation on the SRM in the first sentence of para E.6.6. • (Change) Therefore, I would like to suggest the change of the first sentence as follows: "Solar radiation modification (SRM) as a supplementary option to GHG emission reduction has potential to offset global warming and also to pose risks to human and natural systems (and concerns about inequality of participation)."	Government of Republic of Korea, Korea Meteorological Administration
3198	43	32	43	35	This paragraph is policy relevant - however, it could be more detailed based on the cross-chapter box dedicated to SRM governance, in particular to describe better the main principles outlined in the literature regarding potential risks and impacts of SRM.	Government of France, Ministère de la Transition écologique et solidaire
4176	43	32	43	35	Since this is the only paragraph in the SPM addressing SRM, it might be helpful to have a clear statement at the start that the role of SRM in meeting the Paris Agreement global temperature goal is hypothetical, based on a range of scenarios and that these are separate from the emission scenarios considered in the WGIII assessment.	Government of Canada, Environment and Climate Change Canada
6016	43	32	43	35	It looks odd to suddenly discuss the governance of solar radiation modification in isolation, without any discussion of its potential role or impacts. Please delete this paragraph.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
6840	43	32	43	35	_SRM: We do not support this paragraph on SRM: Presenting only information from WG III about international cooperation and governance approaches is incomplete and not helpful. In particular, information on SRM methods as well as their potentials and risks from WG I and II are missing. Please delete this paragraph or provide more comprehensive information from all three WGs (Cross-Working Group Box 4 in Chapter 14). In addition, the WG III SPM lacks mentioning transboundary issues associated with CDR which are assessed in the underlying report (TS-120-31).	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6842	43	32	43	35	Unlike the introduction for CDR as response option to climate change, the role of SRM in net-zero targets and 1.5/2 °C compatible pathways has not been introduced resp. explained in the SPM. Thus, it is unclear why this paragraph takes up (only) SRM and covers international governance aspects of SRM. Furthermore, in order to allow for a balanced statement, please consider to briefly introduce the potential risks, benefits, ethics and governance issues of SRM options as this would enable a better understanding of possible "transboundary issues associated with SRM".	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
9660	43	32	43	35	This paragraph needs to define what SRM does and doesn't accomplish. Insert a sentence like this: "SRM could reduce surface temperatures and potentially ameliorate some climate change risks but SRM could also introduce a range of new risks."	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9662	43	32	43	35	It seems that the second sentence of E.6.6 does not give us valuable information because this paragraph just says SRM is not currently addressed in international agreements. We suggest adding more information such as challenges of SRM which are described in 14.4.5 or information on CDR.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
11826	43	32	43	35	It is unclear why SRM is mentioned here, and why only here. If the authors consider SRM to be an option for "mitigation", then it should perhaps not be addressed at all, or addressed briefly to clarify its relation to (differences from) mitigation. Mentioning it only once in this limited context can be confusing.	Philippe Tulkens, European Union (EU) - DG Research & Innovation
12076	43	32	43	35	E.6.6: It is unclear why SRM is explicitly mentioned here for the first and only time. Transboundary issues also apply, e.g. for Ocean CDR measures, which should be highlighted here instead. Please remove SRM references here as SRM cannot be considered a mitigation option by definition.	Government of Saint Kitts and Nevis, Department of Environment - Ministry of Agriculture, Marine Resources, Cooperatives, Environment and Human Settlements
12826	43	32	43	35	Delete E.6.6. Peripheral issue. Not of immediate significance except for a minuscule section of climate community.	Government of India, Ministry of Environment, Forests and Climate Change
13326	43	32	43	35	In order to deploy and apply CDR, we would also need international cooperation? This para only speaks to the need for international cooperation for the SRM application.	Government of Switzerland, Federal Office for the Environment FOEN
15602	43	32	43	35	Suggest moving E.6.6 earlier in the SPM and clarifying that no consensus on appropriate governance approaches is specific to SRM (solar radiation modification).	Government of United States of America, U.S. Department of State
15604	43	32	43	35	Section E.6.6 on SRM might be better suited in E.1 integrated with other geoengineering and response options such as CDR and ocean fertilization (E.1.1). The integration or addition of E.6.6 into Section E.1 would also need to highlight the governance mechanisms required for SRM. At a minimum, it is very awkward and abrupt to end the SPM with a paragraph on SRM when that is its first mention in the entire document and could be regarded as a conclusion.	Government of United States of America, U.S. Department of State
6844	43	33	43	33	Please add: "and several decisions under the Convention of Biodiversity address SRM and stipulate restrictive conditions for conducting field research and deployment." The CBD decision X/33 does even define SRM. Since it is a legally relevant interpretation of the CBD-Convention this information should be given to add to and specify the statement "No international agreement specifically addresses SRM"	Government of Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
14188	43	34	43	35	Please consider if "wide range" is appropriate here, as it can be understood as if there are more literature on SRM than on other mitigation options.	Government of Norway, Norwegian Environment Agency
2118	43	35	43	35	(Basis) In the para E.6.6, I would like to suggest the change of wording on the basis of the contents of chapter 14. I think the wording of "potential mechanisms" is OK. Yet, what is intended in the chapter 14 was more about the form/options of international institutionalization rather than mechanisms. Mechanism is the term that is more related with the institutional form at the operational level. Therefore, I would like to suggest the change as follows: •(Present) "potential mechanisms" •(Change) "potential international governance forms (or options)"	Government of Republic of Korea, Korea Meteorological Administration
12296	43	39	44	2	In the district energy networks section, there is no mention of micro-grid. micro-Grid is a self-sufficient electricity systems that serves a discrete geographic footprint, such as a college campus, hospital complex, or neighborhood.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12824	43		43		Insert before "Context-specific factors, in particular..": "However, the provision of such finance and technology transfer has been contested in terms of scale, scope and speed".	Government of India, Ministry of Environment, Forests and Climate Change

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
	43		43		E6.5. Note that transboundary air pollution agreements would also target precursors of aerosols and therefore could result in a loss of the cooling effect of aerosol pollution, which is a trade off with limiting warming, unless this is approached in an integrated manner aiming also at cutting surface ozone precursors including methane (as addressed in WG1). This is an important point to make clear.	WGI Bureau,
12376	56	33	56	33	And also upgrading the gas turbine powerplants to combined cycle plants in Iran.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12302	59	4	59	4	it is better to define Nox in footnote not in parantheses	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12304	70	5	70	5	content in parantheses after air is not clear	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12306	71	21	71	21	grey should be subsituted with gray	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12308	78	15	78	15	plus before 23 at the end of line is not obvious what is its meaning	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12310	80	3	80	3	44%%	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12312	80	4	80	4	57%%	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12288	117	35	117	40	I think different amount of reductions in gas production should be suggested for different groups of countries.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12290	117	46	118	9	I think different amount of reductions in oil production should be suggested for different groups of countries.	Government of Iran, Islamic Republic of Iran Meteorological Organization (IRIMO)
12688	16		31		This section doesn't speak to the different trajectories that different countries would need to take to achieve the mentioned system transformations (especially differentiating developed from developing countries). Instead, it gives the impression that all countries would uniformly need to achieve these trajectories to meet these goals, which is neither feasible nor equitable.	Government of India, Ministry of Environment, Forests and Climate Change
5772	### ### #	21	### ### #	28	This could be clear that non market and development dimensions (equity weighting?) are missing from the assessed climate damages. And other than saying estimtes vary, this is missing a vital discussion of risk and catastrophic damages from tail risks which should be included here, see Cross-Working Box 1 in Chapter 3.	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy
5954	### ### #	### ### #	### ### #	### ### #	"A coordinated effort to green the post-pandemic recovery is essential in 37 countries facing much higher debt costs" - I think this means international effort to remove barriers presented by high debt costs? Greening the recovery is essential everywhere!	Government of United Kingdom (of Great Britain and Northern Ireland), Department for Business, Energy & Industrial Strategy



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
552					<p>The Chinese government appreciates and thanks the Bureau members, lead authors, and Technical Support Unit (TSU) of the Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR6 WGIII) for their efforts made for the preparation of the present report. In order to have a more scientific, comprehensive, balanced, accurate and policy-neutral report, we wish to make the following comments which are hoped to be adopted.</p> <ol style="list-style-type: none"> <li>1. Regarding country classification. The report uses confusing methods and different standards for classifying countries, such as dividing countries into developed and emerging economies, or confusing the use of country classification with geographical region classification. It is suggested to follow the classification criteria such as developed and developing countries or regions to avoid unnecessary disputes.</li> <li>2. Regarding the emission reduction ambition. Taking the assessment of global emissions reduction efforts in 2030 as an important element, the report considers that current nationally determined contributions (NDCs) and climate policies are not sufficient to achieve temperature rise control targets in the Paris Agreement. The report highlights the impact of fossil fuel infrastructure construction on global temperature rise, but doesn't reflect the large differences in dependence on fossil energy between developed and developing countries due to their significantly different development stages and energy structures. It is suggested that the SPM objectively and comprehensively reflects general considerations such as historical emissions, climate finance support, and the realistic demand for energy consumption in different countries and et al.</li> <li>3. Regarding comprehensiveness and balance of the SPM. The SPM should reflect each chapter of the underlying report in a comprehensive and balanced manner. Sections B and C, 25 pages in total, accounting for nearly 60% of the total length of the SPM, are mostly based on Chapters 2, 3 and 4 of the underlying report. The Chapters on Sectors (Chapters 6 to 11), which account for about 1/3 of the underlying report, are obviously underrepresented with less than 5 pages in the SPM. In addition, the presentation of progress and gaps in mitigation and finance is unbalanced, with a large number of pages and figures describing the mitigation gaps, but a very limited number for gaps and progress in finance, technology transfer and capacity building, and international cooperation. It is suggested that the author team makes corresponding revisions and additions.</li> <li>4. Regarding scientificity and accuracy of the SPM. Some of the assessment conclusions are not based on the latest data, but data only updated to 2019. In contrast, many data in the released WGI Contribution have been updated to 2020. In addition, the data and confidence of some conclusions in the SPM are not consistent with those in the underlying report. In order to ensure timeliness of the report and objectivity of its conclusions, it is suggested that the author team makes revisions according to the latest data, especially those involving GHG emissions.</li> <li>5. Regarding problems still found in the underlying report on Chinese sovereignty and improper examples. There are erroneous expressions regarding Taiwan Province and Hong Kong Special Administrative Region, China, and still inappropriate statements about China, such as singling out China as not having submitted its updated NDC, statement that activities related to the Belt and Road Initiative will slow climate action efforts of developing countries, and putting China in parallel with developed countries or developing countries, which are non-objective, unbalanced and inconsistent with the facts. To avoid unnecessary disputes, the Secretariat and author team are requested to pay great attention to the comments from the Chinese government by verifying and correcting the above-mentioned errors and to ensure that similar errors do not occur again.</li> </ol>	Government of China, China Meteorological Administration
554					Regarding country classification. The report uses confusing methods and different standards for classifying countries, such as dividing countries into developed and emerging economies, or confusing the use of country classification with geographical region classification. It is suggested to follow the classification criteria such as developed and developing countries or regions to avoid unnecessary disputes.	Government of China, China Meteorological Administration
556					Regarding the emission reduction ambition. Taking the assessment of global emissions reduction efforts in 2030 as an important element, the report considers that current nationally determined contributions (NDCs) and climate policies are not sufficient to achieve temperature rise control targets in the Paris Agreement. The report highlights the impact of fossil fuel infrastructure construction on global temperature rise, but doesn't reflect the large differences in dependence on fossil energy between developed and developing countries due to their significantly different development stages and energy structures. It is suggested that the SPM objectively and comprehensively reflects general considerations such as historical emissions, climate finance support, and the realistic demand for energy consumption in different countries and et al.	Government of China, China Meteorological Administration

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558					<p>The SPM should reflect each chapter of the underlying report in a comprehensive and balanced manner.</p> <p>1. Sections B and C, 25 pages in total, accounting for nearly 60% of the total length of the SPM, are mostly based on Chapters 2, 3 and 4 of the underlying report. The Chapters on Sectors (Chapters 6 to 11), which account for about 1/3 of the underlying report, are obviously underrepresented with less than 5 pages in the SPM.</p> <p>2. In addition, the presentation of progress and gaps in mitigation and finance is unbalanced, with a large number of pages and graphs describing the mitigation gaps, but a very limited number for gaps and progress in finance, technology transfer and capacity building. It is suggested to make revisions to reflect balance of various elements. 3. The underlying report devotes three chapters to international cooperation which is too barely (1 page) covered in the SPM.</p> <p>4. The SPM overemphasizes pathways and potential of emission reduction, and underestimates costs of and support for emission reduction in developing countries.</p> <p>It is suggested that the author team makes corresponding revisions and additions.</p>	Government of China, China Meteorological Administration
560					Some of the assessment conclusions are not based on the latest data, but data only updated to 2019. In contrast, many data in the released WGI Contribution have been updated to 2020. In order to ensure timeliness of the report and objectivity of its conclusions, it is suggested that the author team makes revisions according to the latest data, especially those involving GHG emissions and.	Government of China, China Meteorological Administration
562					The data and confidence of some conclusions in the SPM are not consistent with those in the underlying report. It is suggested to make verification to ensure their consistency as detailed in the specific comments.	Government of China, China Meteorological Administration
564					Regarding the length and charts. The SMP is too long (43 pages) with so many charts (11). It is suggested to delete unnecessary details and to streamline charts. For example, three figures on the status of GHG emissions in Section B can be integrated or modified. In addition, some discussions, which come from a single individual literature with one-sided conclusions, do not reflect policy neutrality. It is suggested to streamline the relevant contents in order to provide the latest and most important assessment findings for easy understanding by policy makers.	Government of China, China Meteorological Administration
2162					We would like to thank the authors for good work on further processing of the SPM. In general the draft is already relatively easy to read and conveys its messages well. However, there are still some room for improvement. We hope that our additional comments will help the authors to further develop the SPM towards a smooth approval in the March session.	Government of Finland, Finnish Meteorological Institute (FMI)
2164					The SPM is quite long. We have identified figure panels that do seem of less importance to the SPM than other figures. Please, see detailed comments.	Government of Finland, Finnish Meteorological Institute (FMI)
2198					We would like to suggest that the differentiation between 1,5C and 2C paths would be further clarified and sharpened in the text. If 1,5C scenarios would always be first introduced, it would be more consistent order.	Government of Finland, Finnish Meteorological Institute (FMI)
3820					Overall this is a very well-written and well put together SPM. It is readable, a reasonable length, balanced and contains a lot of policy-relevant information. The figures are well-constructed and provide useful additional complementary details. The authors should be commended on an excellent FGD.	Government of Canada, Environment and Climate Change Canada
3822					SSP-based scenarios are not featured prominently in this SPM. Our understanding was that these scenarios were intended to be a dimension of integration across WGs. For example, the Executive Summary of Chapter 1 of IPCC AR6 WGI states "Scenarios have a long history in the IPCC as a method for systematically examining possible futures. A new set of scenarios, derived from the Shared Socio-economic Pathways (SSPs), is used to synthesize knowledge across the physical sciences, impact, and adaptation and mitigation research." The SSP scenarios are used in the WGI and WGII reports and SSP scenarios are assessed in Chapter 3 of this report, but mention of the SSPs is hard to find in the SPM. We strongly encourage authors to consider including key SSP scenarios assessed in other working groups (SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5) at least in figures SPM.5 and SPM.6, so that WGIII assessments can be more easily related to WGI and WGII assessments.	Government of Canada, Environment and Climate Change Canada
3824					The Figures in the SPM are in good shape and are generally straightforward to understand. We appreciate and support the inclusion of Figure messages, in line with the new approach taken in the AR6 by WGI. These are very helpful and for the most part, the messages were clearly articulated and support the main points of the Figures.	Government of Canada, Environment and Climate Change Canada

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
3826					An important concern that Canada raised at the SOD stage as well is the persistent inconsistency in the SPM about how to describe C3 category scenarios - as limiting GW to below 2C or to 2C. As one example, see footnote 8 on page 6. C3 and C4 are described as limiting warming to 2C, with stated probabilities. But Note 1 to Table SPM.1, where the emission pathway categories are defined, uses 'below 2C'. While to the authors, these differences in description may be perceived as only slight differences in terminology, we would argue they convey different messages to readers. Using 'below 2C' gives a better indication that there is a range of warming projections from scenarios in this category and that some scenarios in this category may limit global warming to levels substantially below 2C. Describing these scenarios as limiting global warming "TO 2C" could be interpreted to mean that all the scenarios in this category essentially project warming of exactly (or very close to) 2C. So our recommendation is to use the phrasing "below 2C" consistently in the SPM for this scenario category (and others, as appropriate).	Government of Canada, Environment and Climate Change Canada
3828					We strongly encourage the inclusion of a Figure in the SPM showing total GHG emissions in the set of emission pathways shown in Table SPM.1 out to the year 2100. It is very difficult to visualize some of the key results in Table SPM.1 without having a corresponding figure illustrating total GHG emissions (noting that Figure SPM.6 shows emission paths for individual GHGs). As one example, it is hard to understand why only 52% of C1 pathways (limiting GW to 1.5C with no or limited overshoot) reach net zero GHG emissions, whereas 87% of the C2 category pathways (high overshoot) do so. Presumably this has to do with compensating for the larger overshoot in C2 pathways, by achieving net zero and then net negative GHG emissions but without seeing a visualization of this, it is hard to be sure. Since C2 pathways are not currently shown in Figure SPM.6, this increases the challenges around understanding this result. Another challenge is the scale of the Y-axis which makes it hard to see details across the low emission scenarios. One option would be to split Figure SPM.6 into 2 Figures. One figure could be comprised of current panels a, b and c and then a new panel could be added to show the GHG emission paths. The second figure would have current panels d-e.	Government of Canada, Environment and Climate Change Canada
3830					Table SPM.1 is critical to the SPM of course. Given how much detail is packed into the table it is, however, challenging to read. While balance is important, we wonder whether all of the higher emission categories need to be included in the SPM version of this figure. If some space were saved by deleting a few scenario categories, there might be room to include a box that provided a narrative of how to interpret a sample row in the table across all columns. This would be very useful we think to help readers be confident they are interpreting this table appropriately.	Government of Canada, Environment and Climate Change Canada
3832					Readers would benefit greatly from some background information about the scenarios featured in the WGIII SPM. This includes information about categories (C1-C8) from Table SPM.1, the Illustrative Mitigation Pathways (IMPs) and the 'current policies and current NDC scenarios' featured in Figure SPM. 5. An explanation of how the scenario categories C1-C8 relate to SSPs, in order to draw linkages/connections across IPCC WGs, is also necessary, we think. There are options for doing this: by introducing a Box on scenarios (our preference), by writing explanatory text in the Introduction, or by adding a chapeau to Section C (and to other sections as well, for consistency). While there are annotations in Table SPM.1 about how these various scenarios/pathways relate to each other, it is easy to miss in the detail of this table and such important contextual information would be better placed earlier in the SPM. We think it is important for policy-makers to understand that "most of the scenarios in the AR6 database are SSP-based" (TS-41). If the focus in the SPM on categories C1 and C3 is because these align with SSP1-1.9 and SSP2-2.6 featured in the WGI report, this would also be useful information to include in the WGIII SPM.	Government of Canada, Environment and Climate Change Canada
3834					There seems to be some inconsistency within the WGIII SPM in terms of the value used for current (year 2019) GHG emissions and/or CO2 emissions. Please see specific comments on this topic for Figures SPM.5 and Figure SPM. 6 and B.6.1. Here, we summarize our main request that any variation in 2019 GHG values used in the SPM should be carefully explained. Our concern is that reported emissions in Figure SPM.1 are higher than those used elsewhere in the SPM, which in turn affects estimates of needed emission reductions relative to current levels as well as what emissions are projected to be with an extension of current policies.	Government of Canada, Environment and Climate Change Canada

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
6018					As repeatedly mentioned in plenaries and submissions, Belgium would like SPMs to be very short in view of facilitating the approval session and reach a wider audience, including policymakers which would not have the time to read a long text, journalists, laypersons, and citizens at large. The current draft SPM is far too long, with many complex figures and a language which is often difficult to understand without a dictionary. Initially (during IPCC 46-Montréal) it was foreseen to have a Technical Summary of about 40 pages. This SPM is about the length foreseen for the TS. The length of the SPM was not defined in Montréal because it was not really discussed among the WGs. Belgium called for limiting the length of the SPM to no more than 10 pages, to ensure a clear and concise message. A balance has to be found between the provision of information that is sufficiently specific and reducing the length.	Government of Belgium, Belgian Science Policy Office - Belspo
6020					We have the impression that the word "barrier" is often used in a reductive manner in this SPM. The many uses of the word "barrier" appear to lack clarity on what is actually at stake, as well as consideration for the governance dimension. References to barriers would likely benefit from being made more concrete or precise, as some barriers can be removed while others cannot, some are of ethical nature, etc.	Government of Belgium, Belgian Science Policy Office - Belspo
6024					References to "per year" units should be expressed in a uniform way throughout the report as either /y or "per year". Examples of mixed use of these units are visible on page SPM-6, lines 13 and 18, and in figures (such as SPM.11, upper title).	Government of Belgium, Belgian Science Policy Office - Belspo
6026					We are surprised that the words "socioeconomic", or "socioeconomic pathways" are not used at all in the report. Likewise, the "Shared Socioeconomic Pathways" (SSPs) are not used and not explained. This may give the impression that, contrary to what the SSPs intend to clarify, the mitigation potential is independent of the socioeconomic context. Given that chapter 3 refers to these scenarios as a notable development since AR5 (e.g. page 3-15), and noting that these scenarios can also be important for the link with vulnerability and adaptation, we would like to ask for the inclusion of a presentation of these SSPs and their links with future emissions in the SPM.	Government of Belgium, Belgian Science Policy Office - Belspo
6028					Please provide a definition of the expression "energy carrier", which is used several times in the SPM, at least in a footnote.	Government of Belgium, Belgian Science Policy Office - Belspo
6030					Paragraphs in bold should preferably synthesise the information provided below them. In the current draft, some of these do have this role, while others appear to add information on their own.	Government of Belgium, Belgian Science Policy Office - Belspo
6032					The SPM refers to key factors contributing to increase GHG emissions, such as increasing population and material or services consumption per capita. However, these appear as "external factors", despite the fact that they are influenced by a range of actions and decisions, and contribute to environmental pressures outside climate change, including biodiversity loss. Could you provide more information on how "socioeconomic" drivers may evolve in the framework of more sustainable pathways?	Government of Belgium, Belgian Science Policy Office - Belspo
6034					The term "median" is used for at least two purposes in this SPM: for the median emission level within a range of scenarios, and for the median warming associated to the uncertainty in climate sensitivity. We believe that this may be hard to understand for policymakers or other readers that are not modelling experts. To clarify, we would like to suggest explaining that there are two main ensembles of results for which a median and other statistics can be defined: the emissions across scenarios within a given category, and the uncertainties in climate sensitivity. Numerous statements in the SPM refer to a combination of these two types of "ranges". For example, within a given scenario category, it is possible to define a median scenario (e.g. based on cumulative emissions), and for this median scenario, there is a median global warming estimate (and a range of very likely values).	Government of Belgium, Belgian Science Policy Office - Belspo
9384					The concept of "Nature-based Solutions" (NbS) and "Ecosystem-based Approach" (EbA) has been included in the Summary of the Working Group II, but not that of the Working Group III. Since a number of climate-change mitigation approaches are utilizing ecosystems (e.g., plantation), the summary of WG III should also clearly show which mitigation approaches are NbS and/or EbA and to which degrees NbS and/EbA can support the mitigation efforts. For instance, Griscom et al. (2017: PNAS 114(44), 11645-11650) focused on the contributions of "Natural climate solutions", and the IPCC could examine and/or develop such previous studies.	Government of Japan, Climate Change Division - Ministry of Foreign Affairs
9876					suggestion to add a Table of Contents consistent with SPMs of AR6 WG I and II	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12462					The scenarios used should be labelled as illustrative modelled scenarios. In results about the future and in terms of projections and pathways it must be made clear in the text once in every sub-section that these are illustrative. Further, it must be explicitly stated that they carry no implication of parallel or similar behaviour at the regional or national level. Currently, the statement appears clearly only once in the legend of Figure SPM 2.	Government of India, Ministry of Environment, Forests and Climate Change

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
12464					The term 'developed countries' are not defined in the SPM and also in several chapters. The glossary explicitly refuses to provide an appropriate definition even for the purpose of this report. However, in view of quantifying results in relation to developed countries, a proper definition is essential. We generally support the quasi-regional classification used in some places in the SPM, where developed countries are treated as one region and the other geographical regions are described without the inclusion of developed countries. This treatment should be made uniform across the SPM.	Government of India, Ministry of Environment, Forests and Climate Change
12466					As in the case of scenarios in general, the specific scenarios selected as illustrative mitigation pathways must also be referred to consistently as illustrative. Quantitative features of these scenarios/pathways must explicitly refer to this illustrative aspect.	Government of India, Ministry of Environment, Forests and Climate Change
12468					It must be clarified explicitly that the quantitative results associated with scenarios are obtained using models that carry no considerations of equity but only cost-benefit or least cost considerations. The part of section 1.5 of Chapter 1 titled "What the IMPs do and don't do" must be reproduced in the initial part of the SPM. It must be made clear that neither the scenarios nor the models explicitly even reflect the drivers and constraints discussed in the context of climate mitigation.	Government of India, Ministry of Environment, Forests and Climate Change
13026					Thank to the authors for the SPM which presents a lot of relevant information and we hope that the authors can make it clearer and even shorter than now.	Government of Gambia, Department of Water Resources
13028					Sections B and E should include more detail on finance and investment in fossil fuels as compared to low-carbon technologies and their attendant advantages. This will further help inform policymakers about choices that could be made.	Government of Gambia, Department of Water Resources
13030					We believe that Paris Agreement's LTTG is one goal, however the current formulation of mitigation pathways give an impression as if Paris agreement has a "below 1.5°C" and a "well below 2°C" goal. It would be helpful and will add a lot more clarity if the authors could also include "very likely below 2°C" pathways in C1. If this would be added, then C1 would read more compatible with PA LTTG. Furthermore, a significant number of pathways in C1 do not reach net-zero GHG levels in the 21st century, which makes them incompatible with Article 4 of the PA. We request authors to treat this matter carefully to avoid any misinterpretation.	Government of Gambia, Department of Water Resources
13032					We request the authors to give examples from the regions in the SPM as we find that those provided are very few. LDCs like Senegal and SIDs are already adversely impacted by climate change and these examples help to reinforce the evidence and have already been provided in the underlying chapters as well as in the Technical summary. Additionally country groupings should be consistent across the SPM (please check Figures SPM.2, SPM.3, SPM.11 where this is not the case).	Government of Gambia, Department of Water Resources
13034					In continuation to the previous comment, the C2 pathway category "below 1.5°C with high overshoot" is misleading as it may be interpreted in away that these pathways would keep warming below 1.5°C. Whereas, for this category, the warming is "likely" to exceed 1.5°C. Therefore, we request authors to use an alternative naming for this category to avoid confusion and mis-interpretation.	Government of Gambia, Department of Water Resources
13036					For LDCs carbon dioxide removal premised on availability of future technology (or even current) remains a challenge to access so it is imperative that challenges of CDR are clearly outlined including uncertainty on impacts of technology driven CDR.	Government of Gambia, Department of Water Resources
13100					The SPM uses the concepts of "sustainable development", "sustainability" and "development" throughout the document. It is unclear what the reasons are to use either of these concepts? If "development" is meant to refer to the economic development of a country, then it represents one out of the three dimensions of sustainable development. We judge the concept of sustainable development to be overarching and prefer to use it as the umbrella when referring to development. Sustainable development also is equally important for both developing and developed countries. ---> Please omit the term "development" entirely. In case you want to speak to one of the three dimensions of sustainable development (economic, social, environmental), name specifically and label them openly in the text. For the overarching idea of a sustainable pathway, use "sustainable development" as the overarching term.	Government of Switzerland, Federal Office for the Environment FOEN
13118					A lead paragraph in bold must take up the most important findings/take aways from the subparagraphs that follow the lead text. At the same time each paragraph should have one (1) idea/common threat. If there are four paragraphs following the lead paragraph, this lead should take up the four ideas mentioned.	Government of Switzerland, Federal Office for the Environment FOEN
13120					In the lead paragraph: Use simple language, and decide on which one or two key numbers to place in the lead para for the decision maker reading this document.	Government of Switzerland, Federal Office for the Environment FOEN

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
13122					In the lead paragraph: Try to avoid highlighting findings that correspond to low to medium confidence levels. Of course that is not always possible as the lead needs to take up the single one results from all the subparagraphs that follow the lead. However, when possible do so.	Government of Switzerland, Federal Office for the Environment FOEN
13136					It would be helpful for the reader of the SPM to have the explanation around the 1.5 and 2 degrees reference. It could be introduced and explained in section A, that is framing the document. For the first time it appears only in section B, page 4, lines 16-17.	Government of Switzerland, Federal Office for the Environment FOEN
13360					We take this opportunity to thank the authors for this SPM which we find to be informative and well structured for enhanced understanding and use by policymakers. We urge for further shortening and clarity in both text and figures to enhance readability of the SPM across board.	Government of Kenya, Kenya Meteorological Service
13362					More regional examples across the SPM would help to ground/situate main issues. This is especially important for developing countries, SIDs and LDCs faced with existential threats even at 1.5oC warming.	Government of Kenya, Kenya Meteorological Service
13364					CDR use across the entire document needs to be expounded on to provide more understanding especially as regards tech for CDR whose risks/impacts may remain unknown and some based on technology availability only in future. Important to note also that this has a bearing on access and deployment by developing countries	Government of Kenya, Kenya Meteorological Service
13366					We would like to ask the authors to provide details and add clarity on pathways compatible with the Paris Agreement long-term Temperature Goal (LTTG) because this appears to be an overarching issue in the SPM with no clear reference regarding compatibility with the PA. For instance is it the case that C1 is PA compatible? The approved outline for Chapter 3 of the WG contains, "Modelled emission pathways compatible with the Paris Agreement, including the long-term temperature goal[1], and higher warming levels, .... [1] As set out in article 2 of the Paris Agreement" so it is important that this is well clarified to better inform policymakers.	Government of Kenya, Kenya Meteorological Service
13368					There is need to clarify what 'limiting warming to 2°C' exactly means. We suggest phrasing as 'well below 2°C to align with the PA LTTG and for consistency and clarity throughout the SPM.	Government of Kenya, Kenya Meteorological Service
14256					Overall, reviewers appreciated the revisions of the SPM from the first-order draft and find the text and figures of the SPM much improved. The SPM is still, at times, overly technical, and it too often extracts statements from underlying chapters rather than providing a summary that is accessible for policymakers. Reviewers highlighted several specific instances where the SPM text is inconsistent with the underlying material, including multiple instances where confidence levels are not appropriately reflected in the SPM based on the underlying assessment. There were also concerns raised about the how the SPM presents findings about system transitions where critical questions about the behavioral, cultural, psychological, political, and additional aspects of human choices that explain the gap between what may be technically feasible and what has been, or may be, practically achievable seem to be glossed over in the final text.	Government of United States of America, U.S. Department of State
14258					Reviewers raised several concerns about the SPM draft's description of near-term emissions projections. Wherever the text presents future estimates of emissions, ambiguous terms such as "current policies" or "current nationally determined contributions (NDCs)" should be avoided.	Government of United States of America, U.S. Department of State
14260					Concern over clarity in emission estimates extends to the treatment of non-CO2 gases and short-lived aerosols, net vs. gross emissions, and sectors within emission estimates. In each of these cases, a careful review of the text should be performed to ensure that there is no ambiguity over the presented results.	Government of United States of America, U.S. Department of State
14262					Reviewers had significant concerns about how the SPM categorizes country groupings according to "developed" or "developing". At the WGIII webinar, the authors indicated that they use the UN M49 statistical groupings for country classifications in their analysis, and thus use three development levels: least developed, developing, and developed countries. This scheme was not consistently applied throughout the text, with developing countries and least developed countries often grouped together.	Government of United States of America, U.S. Department of State
14264					The M49 groupings never represented an agreed definition of "developed" or "developing" within the UN system, and in many respects these groupings represented outdated characterizations of countries informed by political considerations. Indeed, the M49 standard was recently updated to remove the "developed regions" and "developing regions" country classifications in recognition that "[t]here is no accepted definition of developing and developed countries (or areas) within the UN system," and on the basis that over time those categorizations "became more and more outdated and not reflecting reality as many countries (or areas) situated in 'Developing regions' had undergone a dynamic development." In this context, it is inappropriate to use these classifications for this IPCC assessment particularly given the direct policy relevance of the industrialization of a few countries within the developing regions classification to the assessment of climate mitigation.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14266					If the authors wish to distinguish countries by development levels, they should employ classification schemes based on objective indicators, such as those used by the World Bank and IMF that are based on income levels that are able to distinguish and highlight the role of emerging economies in climate mitigation. Otherwise, data and information should be presented in the UN regional aggregations: a high level with 6 categories, an intermediate level with 10 categories, and a low level with 21 categories. Taking such an approach would improve upon the presentation of the scientific assessment in the SPM and increase the policy relevance of its findings.	Government of United States of America, U.S. Department of State
14268					The typology chosen for representing the development spectrum in two or three categories is not fully sufficient to relay the information critical for policymakers. This decision reduces the focus on rapidly industrializing developing countries throughout the SPM. Understanding the unique role that these economies play in the attainment of climate goals is a central mitigation policy question, and this information should be highlighted within the SPM discussions of historical and projected emissions trends as well as in discussions of systems transitions, financial needs, and potential policy and technology responses.	Government of United States of America, U.S. Department of State
14270					Overall there is lack of clarity about the role of food systems in the SPM. Farming, ranching, aquaculture, and forestry land use is one piece of the agriculture sector. Global, regional, and local food systems integrate agricultural production, industrial processing, refrigeration and storage, transport, and food waste. Highlighting the integrated nature of food systems, and thus need for integrated policymaking, will provide policymakers in the agriculture sector a clearer view of the necessary pathways for climate adaptation and mitigation.	Government of United States of America, U.S. Department of State
14272					The increase in F-gas emissions is not sufficiently addressed in the SPM. F-gases have high warming potentials and long lifespans. Refrigeration from the global food systems may be an important contributor of F-gas emissions.	Government of United States of America, U.S. Department of State
14274					Throughout the document, "behavioral programs", "behavioral changes", or "demand-side strategies" are referenced; however, there are very few examples offered as strategies, with the exception of changes to the built environment and architecture (C.10.1 and C.10.2). Given the importance that the SPM gives to behavioral changes for both mitigation and adaptation, particularly for the AFOLU sector, the reader would likely benefit from specific examples of how to enact, encourage, or aspire to behavioral changes.	Government of United States of America, U.S. Department of State
14276					Throughout the document, a great deal of emphasis is placed on shifting pathways in developing countries and linking mitigation and adaptation efforts to development; however, developing countries are also identified as the least significant contributors to GHG emissions. Is there a way to communicate this idea -- shifting pathways, tying mitigation and adaptation to changes in infrastructure -- outside of the framing of developed vs. developing countries? If these ideas could be applicable to developed countries, that would likely be of interest to policymakers.	Government of United States of America, U.S. Department of State
14278					The document could benefit from situating agriculture (beyond farming) within the larger food system, which also includes processing, packaging, transport, and storage of food. What are the emissions related to this broader agricultural system? How does the agricultural system draw off of other systems? What are the inter-dependencies?	Government of United States of America, U.S. Department of State
14280					Reduce the jargon peppering the document, and include a brief description of the pathways.	Government of United States of America, U.S. Department of State
14282					Figure SPM.9 includes "Urban Systems" as a category. This is an important category for mitigation pathways, socio-cultural changes, and mitigation options in general, but is not included in Figures 6, 7, and 8. Serious consideration should be given to expanding the previous figures to include Urban Systems in each of these figures.	Government of United States of America, U.S. Department of State
14284					The summary lacks a specific analysis of the most effective policy or legislative provision(s) that have led to current (or over the last decade) adoption or the greatest impacts. Readers are shown the economic factors leading to adoption, etc., but at the end there is no follow through. Something that identifies the most effective policies at the regional, national, and local levels would seem to be most helpful for policymakers. Specifically show the policies that have demonstrated the greatest effectiveness.	Government of United States of America, U.S. Department of State
14286					Much of the SPM deals with strategies to reduce carbon in the atmosphere. Authors should also look at the impact of these mitigation strategies on water. Address the trade-offs.	Government of United States of America, U.S. Department of State
14288					While avoided deforestation is addressed briefly as a mitigation strategy, there seems to be no mention of the important role that forest degradation and avoided forest degradation can play in increasing or decreasing emissions from the AFOLU sector. Spaceborne and airborne lidars can play a role in assessing degradation.	Government of United States of America, U.S. Department of State
14290					The SPM would benefit from more robust discussion of the role of indigenous peoples and local communities (especially poor and marginalized communities), including the role of institutional frameworks, land tenure and property rights, community forest management, and the contribution of indigenous and local knowledge in informing decisions and optimizing co-benefits or trade-offs, in the selection of mitigation options and strategies.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
14292					The authors of Chapter 7 are commended for adding Box 7.8, Management of native forests by the Menominee people in North America and lessons from forest owner associations. The statistics and other information provided in this new material coupled with the box on Brazilian forests (Box 7.12) highlight the significance of carbon stored in lands managed by indigenous peoples around the globe. The unique history and role of indigenous people in land carbon management should be added to the SPM.	Government of United States of America, U.S. Department of State
14294					The report doesn't seem to address issues such as reliability and resilience of the grid and supply chains for electricity and materials (cement and steel) that will require CCS. The SPM does not address the lack of available energy storage at scale and the current need for on-demand electricity for which CCS will be a critical technology component. CCS may provide a higher value service than other approaches, especially when there is peak demand and other source capacity factors are low.	Government of United States of America, U.S. Department of State
14296					Some methods of producing hydrogen can result in increased GHG emissions compared to baseline. Recommend using a modifier (such as "clean hydrogen") where appropriate and emphasis is needed to specify low-carbon methods of producing hydrogen to reduce GHGs.	Government of United States of America, U.S. Department of State
14298					The term "limited overshoot" is used 26 times in the document, but is not clearly defined. Since this document is to be used by policymakers, additional clarity would be beneficial.	Government of United States of America, U.S. Department of State
14300					Strike "with no or limited overshoot" when not referring to a particular scenario category or pathway; if 1.5°C is out of reach, it is implied that further reductions are also out of reach. This general comment applies to the entire SPM (e.g., page 13, line 2; Figure SPM.5 title; page 16, line 11). At minimum, clearly define the term "limited overshoot".	Government of United States of America, U.S. Department of State
14302					Recommend the addition of "and other clean sources of energy" wherever "renewable energy" is mentioned in isolation (e.g., page 6, line 20; page 39, line 25). Not all renewables added to the grid during this time mitigated carbon. And nuclear power, while not typically considered renewable, contributed to carbon mitigation worldwide through both capacity and capacity factor increases. Recommend against using the term "low-carbon energy" as some readers may interpret this to include natural gas.	Government of United States of America, U.S. Department of State
14304					While the SPM is in relatively good shape, there remain findings that lean toward policy advice rather than objective and refined analysis. This is reflected, for example, in crude bifurcation of countries into "developed" and "developing" which places many middle income countries and some with high capital resources into the developing category along with very low income countries. A useful assessment would have taken a more fact-based and refined approach in this regard. Other examples include uses of "needs to" when modest rewriting can easily avoid the appearance of policy recommendations. Authors cross the line into advocacy in the financial flows section in E.5, which appears to promote particular policy outcomes without adequately conveying the lack of consistency within the analysis upon which it relies. Overall, while there is much useful information, the WGIII SPM needs to continue to be wary of appearing politically motivated and biased, which would obviously undermine its credibility.	Government of United States of America, U.S. Department of State
14306					The scenarios section, and references to the scenarios, is complicated, confusing, and overly confident in stating results relative to the precision of the modeling and, at the same time, does not address the likelihoods of feasibility of the extreme scenarios. It also uses cumbersome language to describe the scenarios, which leads to certain policy views. Many of the analytical issues cannot be changed at this stage, but the language can be more objective and acknowledge that results derive from input assumptions and methods.	Government of United States of America, U.S. Department of State
14308					In comparison with AR5, AR6 WGIII Chapter 5 (Demand, services and social aspects of mitigation) reflects a major advance in the use of the social sciences to inform plans for climate change mitigation.	Government of United States of America, U.S. Department of State
14310					Notably absent from the SPM is the ongoing sequestration happening in intact forests (about 25% of existing forests). Many robust studies have quantified this contribution (e.g., Pan et al. 2011, Phillips et al. 2017, Qie et al. 2017, Sullivan et al 2017, Xu et al. 2021). Leaving out these fluxes means that the treatment of the land sector as a whole in the SPM is a bit misleading. This omission needs to be addressed in an underlying chapter as well, probably Chapter 7. Protecting these forests takes real effort and cannot really be considered a non-anthropogenic effect.	Government of United States of America, U.S. Department of State
3836					Section A is very long for a section that aims to provide background context for the WGIII SPM (vs findings of the assessment). While it does provide helpful context, the length of this material makes it more suitable for the technical summary or Ch. 1. (Indeed much of the content does seem to be included in the Introduction to the TS.) If there is a need to shorten the SPM text, our recommendation would be to cut the length of this section.	Government of Canada, Environment and Climate Change Canada
2166					There seem to be variability in the nomenclature of regions between the figures. Please consider harmonizing.	Government of Finland, Finnish Meteorological Institute (FMI)



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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2200					Changes in effectiveness and costs of green technology (sun, wind etc) have been disruptive and there has been major development since the last report. We consider relevant to highlight these developments also outside of the figures. we wish that some sentences from the technical report would be added in this respect.	Government of Finland, Finnish Meteorological Institute (FMI)
14770					Section B outlines a new and alarming pattern among F-gas emissions: These GHGs are reported as having the highest rate of growth since 1990. Yet the document does not report on the origin, system, or means of mitigating these gases. In fact, F-gases are likely closely tied to food storage and would (presumably) fall under "industry" or "AFOLU".	Government of United States of America, U.S. Department of State
14772					The sequence of sections in the SPM is neither aligned with the priority of the information, nor with what readers will be most interested in seeing. The material in Section B.6 should come first. It is the "bottom line". All the information before that -- about rates of emissions from different sectors -- is supporting information. The reader should not have to wade through it or skim past it to get to the heart of the matter -- the synthesis that is policy-relevant.	Government of United States of America, U.S. Department of State
2948					We suggest to give more details on the question of rare metals, summarazing key informations of Box 10.6	Government of France, Ministère de la Transition écologique et solidaire
2972					The expression "sustainable intensification of agriculture and forestry" can generate a contradiction and is quite a controversial concept. The intensification of agriculture is carried out by large companies or large owners. In general, it is accompanied by deforestation as is the case with soybeans, palm oil, corn, etc. It would therefore be necessary to clarify what "sustainable intensification" means.	Government of France, Ministère de la Transition écologique et solidaire
3838					Shifting to renewable energy sources, in particular shifting to wind energy and solar energy, are the two mitigation options with the biggest potential to mitigate (Figure SPM.8). But they are not dealt with in any detail in any of the bullets in Section C, and are only mentioned incidentally. Perhaps they were omitted because this is considered too obvious to focus on, but given their impact, including a section on mitigation options in energy generation would seem worthwhile.	Government of Canada, Environment and Climate Change Canada
6104					We have the impression that the whole section C lacks clear global messages and recommendations regarding mitigation solutions priorities (especially given the length of this section). Could you consider extracting and clarifying the most important messages?	Government of Belgium, Belgian Science Policy Office - Belspo
6106					While section B makes a distinction between developed and developing countries, we have the impression that section C (system transformations) does not distinguish pathways between these groups of countries, although system changes can be very different. Could this be improved?	Government of Belgium, Belgian Science Policy Office - Belspo
15322					The words "net zero" appear 42 times in Section C, but without context as to why net zero carbon dioxide emissions are necessary for stabilizing carbon dioxide concentrations. Some background is needed on how carbon dioxide accumulates in the atmosphere, especially for policymakers.	Government of United States of America, U.S. Department of State
15324					This section uses the term "net zero" as if readers understand the difference between net zero carbon dioxide emissions and net zero emissions of all greenhouse gases. A clear defintion of both types of targets is needed. Policymakers might not understand the difference, or that net zero emissions of all greenhouse gases is the more stringent target.	Government of United States of America, U.S. Department of State
15326					Section C is titled "System Transformations to Limit Global Warming"; however, "system" goes undefined and instead the topics covered are energy, industry, urban areas, and transportation. For example, the section discusses electric vehicles and biofuel as discrete variables, rather than outlining their role in interconnected systems of transport-agriculture-energy. Another element of the agriculture system that is not touched on in this document is water/hydrological systems. Could this section be modified to address the benefits of a systems-based approach?	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
15328					Comments on Chapter 9 provided during the Government and Expert Review of the second-order draft were not addressed -- most notably the use of the IPCC AR6 database for scenarios. The authors are picking and choosing specific policy scenarios rather than surveying the database and the broader literature. This is not consistent with the rest of the report and does not seem appropriate for robust, harmonized results with a consistent understanding of uncertainty. It would be acceptable to use the AR6 database as the core results, then to show some additional results from specific studies, but ignoring or not focusing on the AR6 database significantly reduced the ability to consistently assess trends, uncertainties, and other issues using a wide range of model results. The text discussing the figures also should be updated to include discussion of the AR6 database results. Specifically: 9-24, lines 1-10 rely on scenarios that are not in the IPCC AR6 database. It is important to show the range of estimates for the buildings sector that emerge from the AR6 database to show results in a consistent way and to express the uncertainty with outcomes. 9-25, line 18-21 ditto 9-26, lines 1-8 ditto 9-28, lines 1-3 ditto 9-29, lines 1-5 ditto	Government of United States of America, U.S. Department of State
15330					The Chapter 9 focus on "sufficiency" was noted in multiple comments submitted as part of the Government and Expert Review of the second-order draft. While the section has reduced the focus on reducing floorspace as a key indicator, it is still present. This is not part of the mainstream buildings literature, and there is limited attention on the implications for limiting floorspace on equity, affordable housing, homelessness, and the like.	Government of United States of America, U.S. Department of State
15332					The Technical Summary does not reflect previously submitted comments on the buildings sector. Specifically: TS-73, lines 1-3. The chart shows only a limited number of scenarios, not the full suite of scenarios from the AR6 database. Authors may want to emphasize lifestyle/alternative scenarios, but it is still important to utilize the database scenarios as they provide a consistent means of assessing each sector. Strongly recommend that authors focus primarily on the core IPCC scenario results. It would also be appropriate to mention alternative scenarios, but not as the core results. Same comment for TS-74, lines 1-4 Same comment for TS-75, lines 1-11 Same comment for TS-75, lines 27-36	Government of United States of America, U.S. Department of State
15334					Section C is titled "system transformations" but nowhere in the document does the text clarify what "system" is being considered or what a transformation would mean. It appears that the section is simply talking about projected emissions pathways and the likelihood of achieving 1.5 or 2°C targets. There is no discussion of how different sectors would need to work together (energy, land management, transportation) and the associated opportunities and challenges. Using the phrase "system transformations" to describe the material here is confusing at best and misleading at worst.	Government of United States of America, U.S. Department of State
15336					Section C lacks information about technology adoption in food production, a substantial oversight given advances in vertical agriculture, alternative proteins, etc.	Government of United States of America, U.S. Department of State
6182					Paragraphs in bold should synthesise the information provided below them. In the current draft, they sometimes appear to provide information on their own, with general statements that are not explained in the following paragraphs.	Government of Belgium, Belgian Science Policy Office - Belspo
9878					suggest to provide references to the relevant findings of the AR6 WG II assessment about the the relations between adaptation and mitigation for consistency and comprehensiveness	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
9922					Section D is relatively long (6 full pages in the SPM, compared to just 1 page for mitigation cost), not warranted by the often speculative, generic and less concrete findings. Suggest to cut back drastically by limiting to more salient points backed by sound analysis.	Government of Netherlands, Ministry of Economic Affairs and Climate Policy
12750					The entire discourse of section D by constant use of the term development pathways indicates mitigation as a necessity only for regions and countries with substantial development deficits. This completely misses the point about rapid emission reductions and corresponding emission pathways in regions and countries with high levels of development and very low level of development deficits and where the onus is on them to rapidly shift to a low carbon and low resource use setting. A set of statements to correct this imbalance should be inserted in Section D.	Government of India, Ministry of Environment, Forests and Climate Change
15422					In Section D, consider not using the phrase "avoiding trade-offs" because trade-offs can't be avoided in situations where one decision doesn't dominate another across all dimensions. Suggest revising to "addressing trade-offs" or "managing trade-offs" to be more accurate. This comment would be applicable throughout the SPM.	Government of United States of America, U.S. Department of State

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer
2204					There is great difference between previous SOD and this FGD in respect to how the role of citizens and civil society has been formulated. In SOD there was E3 dedicated to the topic but in FGD there are only few references (E.2.1. and E.3.3.). Messages about the amount of active citizens needed for transformative change would be valuable for the public and public discussion.	Government of Finland, Finnish Meteorological Institute (FMI)
15606					There was insufficient discussion in Chapter 15 concerning the need to support first-of-a-kind technology demonstration projects. These projects cannot attract debt and equity costs are often too high. These demonstration projects are critical to the commercialization of new low-carbon technologies and have the potential to transform economies.	Government of United States of America, U.S. Department of State
15608					There was insufficient discussion in Chapter 15 concerning the need to support commercialization efforts such as loan guarantees and flexible, customized financing products. When debt providers are unwilling to take the technology risk for the first-of-a-kind, or high-risk, high-impact projects, these policies and guarantees can provide access to debt capital.	Government of United States of America, U.S. Department of State
15610					The need for political risk insurance and similar insurance products was not mentioned. This insurance protects conversion and transfer of earnings, returns of capital, principal and interest payments, technical assistance fees, and similar remittances. This product insures against potential host country government acts.	Government of United States of America, U.S. Department of State
15612					Chapter 15 did not make the differences between debt and equity clear, and how the requirements and risk tolerance between these sources of capital are important to the energy transition. Access to capital markets are not sufficient to meet goals and this access will not occur without targeted government support or will not occur at the speed needed to meet climate goals.	Government of United States of America, U.S. Department of State
15614					The balance of the discussion on climate finance in Chapter 15 remains a concern. While the SPM text is relatively balanced, the underlying chapter overrepresents a single view of climate finance in a way that is not consistent with the IPCC's mandate to perform a balanced, objective, and comprehensive policy-neutral assessment of the scientific literature. Reviewers highlighted that the chapter includes imbalanced rhetoric about how climate justice demands large transfers of bilateral and multilateral development assistance and unobjective political statements such as the "exceptional privilege of global reserve currencies in developed economies". The chapter has imbalanced coverage of interventions for Africa over other developing regions, and it overemphasizes public sector solutions and expresses favorable views on state-owned enterprises and banks while underemphasizing the critical role of private sector financing. Request that you consider revising the chapter in light of these significant concerns.	Government of United States of America, U.S. Department of State
					For reported ranges, could it be explained what is the corresponding range (very likely, 90% interval? Other?). Sometimes ranges are reported with a plus minus approach, sometimes with start and end numbers, why, is this due to an asymmetry of uncertainty?)	WGI Bureau