

IPCC AR6 WGIII First Order Draft Government and Expert Review Comments Responses (Entire Report)								
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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
1919	0				A key topic to be assessed in this report is the realism of pathway RCP8.5 which exhibits high emissions and extremely high coal use which might contrast with recent trends. This is critical since this pathway is central to the description of climate in the working groups 1 and 2 draft reports, and it has been argued to be unrealistic by Hausfather and Peters https://www.nature.com/articles/d41586-020-00177-3 . Suggest that this topic be assessed in the context of recent trends in Ch2, near term and long term in Ch3-4 and energy in Ch6 perhaps through a cross chapter effort. The findings of assessment of this topic should inform the description of future climate change and potential impacts in the other volumes of the AR6 and it is therefore important that this be carried out soon so that their assessments will be informed by the status of RCP8.5. Furthermore, the consistency between, for example, current NDCs (2030) and the full range of scenarios including RCP8.5 should be assessed (e.g. do the current NDCs if implemented prevent a high emission scenario?).	Haroon Khesghi	United States of America	Noted. Thank you for your comment. There is now a detailed assessment of RCP8.5 in the Chapter Box 3.3 of the FGD draft of Chapter 3.
2689	0	0	0	0	At the same time, the readers of the report will suspect, as possibly do the authors, that there is little hope of reaching 1.5°C and even staying below 2°C. It would be useful to explore possible thresholds that mitigation will meet and should overcome when considering somewhat higher warming levels. I take it this will be for AR7.	Philippe Waldeufel	France	Noted. Thank you for your comment. The FGD version of Chapter 3 as well as the SPM addresses this topic to reflect what is assessed in the underlying literature.
16563	0	0	0	0	<p>Introducing a category of mitigation pathways that would limit global mean warming to "well below 2°C" is starkly policy prescriptive. Any use of this category has to be avoided throughout the entire AR6. Therefore this is also a comment on the entire chapter and the entire WGIII report!</p> <p>Rationale: For a majority of countries (106 Parties to the UNFCCC subscribed to the "Coalition of the ambitious" in the run-up to the Paris Agreement) "well below 2°C" means a limit of 1.5°C above pre-industrial levels. For all other countries it is unknown and not defined what "well below 2°C" means. That value may be understood by those Parties as falling in the range 1.5 .. 1.9, perhaps its upper end being even 1.99 (regardless whether this may sound cynical). Claiming in this report that we as scientists do know what that range is (e.g. Hof et al., 2017) becomes therefore normative ahead of what policy makers have discussed and therefore starkly policy prescriptive.</p> <p>A category "below 2°C" understood as covering limits above 1.5°C and below 2°C (>1.5 .. <2) includes logically "well below 2°C" and is fine to introduce by AR6. Either you treat this entire interval as "below 2°C" or perhaps you could split this interval somewhere arbitrarily – there is some value for policy making in distinguishing the lower limit part of that interval from the upper limit part. Say you split it in the middle, you could speculate somewhere that the first half of this interval could perhaps be used by policy makers as a rough proxy for "well below 2°C", but you would need to stress the arbitrary nature of such a choice and disclaiming any consistency with Paris Agreement goals and use a policy neutral terminology to describe such a category of scenarios. In general any claim by IPCC to know what "well below 2°C" means must not be made. It preempts and prejudices the outcome of a heavy and contentious policy making process. That process may well not start before the first Global Stock Take, i.e. 2023, when the entire AR6 is already published. And the outcome of that may even come later if at all. Given this situation, AR6 must remain fully policy neutral.</p> <p>Cited References: ----- Hof, A. F., M. G. J. den Elzen, A. Admiraal, M. Roelfsema, D. E. H. J. Gernaat, and D. P. van Vuuren, 2017: Global and regional abatement costs of Nationally Determined Contributions (NDCs) and of enhanced action to levels well below 2 °1 C and 1.5 °C. Environ. Sci. Policy, 2 https://doi.org/10.1016/j.envsci.2017.02.008</p>	Andreas Fischlin	Switzerland	Noted. Thank you for your comment. The labels of scenarios categories in the FGD version of the report have been fine-tuned, and the end of century warming likelihood under each category have been added to the labels as part of the approval process.

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16731	0				The current draft report is highly prescriptive in the classification of the emission pathway that would be in line with the Paris Agreement long term temperature target, particularly with regards to the probabilities that are assigned to 'below' or 'well below' 2°C. The 'well below' 2°C language represents a substantial strengthening of the "below 2°C" language of the Cancun agreement. The report at 3-11 line 19 states that there is ambiguity with regards to the Paris temperature target. There are however multiple lines of evidence that indicate that the "below 2°C" language is linked to a likely (66%) chance of staying below 2°C, and that thus "well below 2°C" must be classified as a higher than likely (66%) probability.	Dennis van Berkel	Netherlands	Noted. Thank you for your comment. The labels of scenarios categories in the FGD version of the report have been fine-tuned, and the end of century warming likelihood under each category have been added to the labels as part of the approval process.
16733	0				[continued] •First, all COP decision after Cancun, until the Paris Agreement, in the preamble referred to the 'likely' classification of the IPCC when referring to the "below 2C" target form the Cancun decision: "Noting with grave concern the significant gap between the aggregate effect of Parties' mitigation pledges in terms of global annual emissions of greenhouse gases by 2020 and aggregate emission pathways consistent with having a likely chance of holding the increase in global average temperature below 2 °C or 1.5 °C above pre-industrial levels" •Second, several decision of the meeting of the Parties to the Kyoto Protocol (1/CMP.6, preamble, 1/CMP.7, 1/CMP.8) refer to the finding of the IPCC AR4 report that in order to stay below 2C, Annex 1 countries should reduce their emissions by 25-40% before 2020 compared to 1990. This reduction level is connected to a concentration of 450ppm (WGIII, table 13.7), which according to AR5 gives a 'likely' 66% chance of staying below 2°C.	Dennis van Berkel	Netherlands	Noted. Thank you for your comment. The labels of scenarios categories in the FGD version of the report have been fine-tuned, and the end of century warming likelihood under each category have been added to the labels as part of the approval process.
16735	0				[continued] •Third, the AR5 report, including in the WG3 SPM and Synthesis report, linked the 'below 2°C' language of the Cancun Agreement to likely (66%) emission pathways. From the AR5 Synthesis report "There are multiple mitigation pathways that are likely to limit warming to below 2°C relative to pre-industrial levels." •Fourth, the Paris COP decision at para 17, notes that in order to stay "below 2°C" emissions by 2030 need to be reduced to 40Gt. This relates to a 'likely' change of staying below 2°C, as is evident from the UNEP 2014 Gap report, table 2.2 (p.16) and the UNCCCC secretariat NDC Synthesis report (FCCC/CP/2015/7), figure 2 (p. 11).	Dennis van Berkel	Netherlands	Noted. Thank you for your comment. The labels of scenarios categories in the FGD version of the report have been fine-tuned, and the end of century warming likelihood under each category have been added to the labels as part of the approval process.
16737	0				[continued] The above lines of evidence all point at the fact that both the parties to the UNFCCC and following form this the IPCC in AR5, interpreted "below 2°C" as a likely (66%) chance of staying below 2C. It is also evident that the Paris Agreement 'well-below 2°C' language represents a substantial strengthening of the 'below 2°C' language from the Cancun agreement. 'Well below 2°C' therefore has to represent a higher than likely (66%) change of staying below 2°C. A simple 'relabelling' of the previous 66% below pathway from below 2°C to 'well below 2°C' would go counter to the previous decision of the COP and would moreover be policy prescriptive.	Dennis van Berkel	Netherlands	Noted. Thank you for your comment. The labels of scenarios categories in the FGD version of the report have been fine-tuned, and the end of century warming likelihood under each category have been added to the labels as part of the approval process.
16739	0				[continued] At the very least the IPCC cannot rule out the possibility that 'well below 2°C' should represent a higher than likely (66%) change of staying below 2°C. The current report however rules out that possibility. The IPCC has established language to provide likelihood assessments. Throughout the report, the IPCC should thereby provide assessments for pathways that are likely to hold warming below 2°C and for pathways that are very likely to do so, where the former should be connected to the "below 2°C" target and the latter to the "well below 2°C" target.	Dennis van Berkel	Netherlands	Noted. Thank you for your comment. The labels of scenarios categories in the FGD version of the report have been fine-tuned, and the end of century warming likelihood under each category have been added to the labels as part of the approval process.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
37089	0				<p>The IPCC is meant to be policy relevant, but not policy prescriptive. However, I find the current draft to be highly prescriptive in its pathway classification towards the Paris Agreement temperature goal by classifying what 'below' or 'well below' 2°C is in terms of probabilities. Obviously, policy makers did not make explicit reference to a probability level or concept. However, this does not mean it is unknown. Here are some indications that could guide an assessment on this crucial policy relevant question:</p> <p>Some background on this:</p> <ul style="list-style-type: none"> • Pre-Paris, the 2010 Cancun Agreements language was 'below 2°C'. In response to that, the research community developed modeling protocols and IPCC AR5 presented the likely (66%) below 2°C category. This has in turn been taken up by the UNFCCC. Both the preambles of the Doha and Lima decisions (COP 19 and COP20) refer to pathways with 'a likely chance' and Paragraph 17 1/CP.21 explicitly mentions a 40 Gt limit in 2030 that is linked to 66% 2°C pathways. • The introduction of 'well below 2°C' in the Paris Agreement represents a clear strengthening of previous language (e.g. Schleussner et al. 2016) and is a reaction to the outcome of the 2013-2015 Review that established in its Structured Expert Dialogue that 2°C 'cannot be considered safe' (compare also decision 10/CP.21). 	Michiel Schaeffer	Netherlands	Noted. Thank you for your comment. The labels of scenarios categories in the FGD version of the report have been fine-tuned, and the end of century warming likelihood under each category have been added to the labels as part of the approval process.
37091	0				<p>(continued)</p> <p>This draft and in particular its chapter 3, is now shifting the goalpost on 2°C. A 50% 2°C pathway becomes 'below 2°C' (which is at odds with what is commonly understood by the word 'below') and a 66% 'well below' (compare table 3.3) suddenly becomes 'well below 2°C', without changing anything in model protocols for developing emissions mitigation scenarios that were previously used to inform the "below 2°C" goal of the Cancun Agreements. This is highly policy prescriptive and arguably in contradiction with the evidence available on how to interpret the PA goal. Rather than interpret the PA, the IPCC should label findings for different 2°C categories in purely factual ways, in particular by calling pathways that achieve a 66% probability to hold warming below 2°C just that ("66% probability below 2°C") and not anything that suggests a link to PA text, such as "well below 2°C", which is clearly wrong. The IPCC has calibrated likelihood language that can be deployed here.</p> <p>Schleussner, C.-F., Rogelj, J., Schaeffer, M., Lissner, T., Licker, R., Fischer, E. M., et al. (2016). Science and policy characteristics of the Paris Agreement temperature goal. <i>Nature Climate Change</i>, 6, 827–835. https://doi.org/10.1038/nclimate3096</p>	Michiel Schaeffer	Netherlands	Noted. Thank you for your comment. The labels of scenarios categories in the FGD version of the report have been fine-tuned, and the end of century warming likelihood under each category have been added to the labels as part of the approval process.
37093	0				<p>(continued)</p> <p>and the following fragment from Wachsmuth et al (2019) "The EU long-term strategy to reduce GHG emissions in light of the Paris Agreement and the IPCC Special Report on 1.5°C", Fraunhofer ISI Working Paper Sustainability and Innovation No. S 22/2018:</p> <p>"The core scientific basis for mitigation pathways that underpinned the Cancun Agreements and subsequent literature, and the work of the SED on the 2013-2015 Review of the adequacy of the long-term goal (all preceding the Paris Agreement) systematically characterized the Cancun "hold below 2°C" global goal using pathways that limited warming to below 2°C with a chance of at least 66%, or "likely" in IPCC terms [15]. The decision to strengthen the long-term goal therefore has to be seen with reference to this context, which frames the negotiations over the ambition elements of the Paris Agreement. The Paris Agreement LTTG strengthens the former Cancun temperature goal by referring to holding warming "well below 2°C" and, in this context, pursuing efforts to limit warming to 1.5°C. It therefore signals that warming needs to be held to a lower level than in the former (Cancun) goal, and hence increase both margin and likelihood by which warming is to be kept below 2°C compared to merely "hold below 2°C" [4]."</p>	Michiel Schaeffer	Netherlands	Noted. Thank you for your comment. The labels of scenarios categories in the FGD version of the report have been fine-tuned, and the end of century warming likelihood under each category have been added to the labels as part of the approval process.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
39053	0	0	0	0	<p>SPLIT OF CCUS (COMMENT 1/6): In the report, the term CCUS (Carbon Capture Utilisation and Storage) is broadly used but not clearly defined and in most cases, this term discusses only Carbon Capture and Storage (CCS) technologies and not the utilisation phase. CCS and Carbon Capture and Use (CCU) distinctly differ regarding their CO2 reduction potential, the underlying technical processes and outcomes, their effects on climate mitigation, and their environmental policy targets. Therefore, presenting commingling CCS and CCU does not do justice to the specific characteristics of the two concepts and could be counterproductive for the further development particularly of CCU. Therefore the term CCUS should be separated in CCS and CCU and both options should be clearly addressed independently (Cuéllar-Franca and Azapagic, 2015, Bruhn et al., 2016, Arning et al., 2019). Please find below the key differences between CCS and CCU: In the case of CCS, large quantities of CO2 are captured from flue gas or from ambient air, then transported to storage locations and buried in geological settings. The storage is meant to be permanent, i.e., for more than a thousand years (e.g. Metz et al., 2005, IEA, 2013). In the case of CCU, CO2 can be captured similarly, but it is subsequently converted into valuable products (e.g. building materials, chemicals, synthetic fuels) (Styring et al., 2011; von der Assen et al., 2013, Kästelhön et al., 2019). The duration of the CO2 storage into a product strongly varies from days to centuries according to the applications. While the environmental assessment of CCS projects may be relatively straight forward, it is not the case for CCU technologies. Indeed, CCU projects should not be assessed only with respect to the amounts of CO2 that can be used but rather it is essential to determine the life cycle of the CO2-based product generated (e.g. Bruhn et al., 2016, Nocito et al., 2020). If these products are assumed to be substitutes for fossil-based products and thus provide the same service (i.e. it would be used and disposed of according to the same patterns as conventional products), the focus of the life-cycle-analysis may lie in the cradle-to-gate phase (e.g. Kästelhön, et al., 2019). Two important points should however be highlighted (Arning et al., 2019, IEAGHG, 2019b, Zhu, 2019):</p> <ol style="list-style-type: none"> 1) If CO2-based products can be produced with less environmental impact (including GHG emissions) than fossil-based ones, an environmental benefit can be asserted, independent of the storage time of CO2 in the products. 2) If CO2-based products are recycled i.e. if their end of life CO2 emissions are captured to generate new products, the duration of CO2 storage in a product is not anymore crucial to consider in the life cycle analysis. The potential applications of CCU are diverse, ranging from using CO2 in greenhouses and farming to conversion of CO2 into fuels, chemicals, polymers and building materials. CO2 has already been used for decades with mature technologies in various industrial processes such as the food and beverage industry, urea production, water treatment and the production of fire retardants and coolants. There are also many new CO2-utilization technologies at various stages of development and commercialization. These technologies have the 	Célia Sapart	Belgium	Noted. Thank you for your comment. A detailed assessment of CCS and CCU is covered in Chapter 6 (Energy System).
39055	0	0	0	0	<p>SPLIT OF CCUS(COMMENT 2/6): CCS versus CCU in the energy system transition:</p> <p>CCS is a relatively old concept that has been proposed at first as a way to reduce the climate impact of continued fossil power generation at increased energy costs (Metz et al., 2005, IPCC-SR-1.5, 2018), but this strategy counteracts the deployment of renewables and shift the environmental costs of today's emissions onto future generations. Hence, large-scale CCS deployment does not represent a step towards a shift of the energy system away from fossil resources (e.g. ZERO, 2015, Bruhn et al., 2016).</p> <p>Current trends worldwide indicate that energy systems in this century will increasingly be based on electricity, mainly due to high technical efficiencies, comparably lower costs and the availability of prospective power-to-X technologies. These power-to-X technologies include sustainable or nonavoidable CCU (Farfan et al., 2019, Ram et al., 2019). Excess renewable energy, generated when the demands for energy are low, could potentially provide an inexpensive or even negatively priced energy supply for CO2 conversion to products. Energy storage technologies could harness excess generation that would otherwise be curtailed and make it available for use in CCU. Transport technologies are also expected to play an important role due to the likelihood that conversion technologies and sources of raw material will be in different locations (Jarvis and Samsatli, 2018).</p> <p>Also and in contrast with CCS, CCU technologies aim to replace fossil resources and thus they support a transformation towards renewables and extend it to industries outside the energy sector such as transport and materials (e.g. Klankermayer and Leitner, 2015). CCU as the power to stimulate the energy transition by enabling energy storage through power-to-X approaches and contribute to a circular economy by converting waste emissions into resources (IEAGHG, 2019b, Castillo-Castillo, 2019, Zhu, 2019, CCES, 2019).</p>	Célia Sapart	Belgium	Noted. Thank you for your comment. A detailed assessment of CCS and CCU is covered in Chapter 6 (Energy System).

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39657	0				There are a few scenarios in the SSP5 / C7 groups with very high coal use, which look like quite extreme outliers from the others. One scenario seems to have around 4 times the coal use in the IP1 scenario. It appears questionable if it is really necessary to have a scenario with 4 times the coal use of the baseline scenario. Removing these could potentially have a positive impact on some of the critique the IPCC scenario work is getting. If these are to remain, a detailed description of the potential for coal reserve growth over the coming century and a viable coal production trajectory up to, and beyond 2100, should be included somewhere. See eg: Bartlett, A.A., 2006. A Depletion Protocol for Non-Renewable Natural Resources: Australia as an Example. Nat Resour Res 15, 151–164. https://doi.org/10.1007/s11053-006-9018-1	Simon Davidsson Kurland	Sweden	Noted. Thank you for your comments. All scenarios included in the report have undergone a vetting process based on criteria set out in Annex III of the report, alongside the justifications for these criteria.
47509	0				The report would benefit from the use of a consistent terminology of inventory sectors. It currently mixes references to LULUCF with those to AFOLU (or just FOLU). This reviewer would consider LULUCF (+agriculture) preferable for clarity, as it would allow the transparent separation of CO2 vs non-CO2 fluxes as well as land-use change from other forest emissions and other land use related CO2 emissions. However, if the authors prefer the AFOLU notation (and "FOLU", as often used), then that should be applied consistently. Mixing the two systems is unhelpful and can be very confusing even for the expert reader, let alone non-specialists. In addition, references to "FOLU" often obscure differences between LUC emissions and other forest emissions and removals. This is particularly confusing when CO2 estimates that essentially represent land-use change (the "LUC" part of LULUCF) are labelled as "forestry and land use", strongly suggesting the non-LUC part of LULUCF. See, for example, the caption of Figure 2.3.	Zoltán Rakonczay	Belgium	Accepted. Thank you for your comment. This has now been detailed in Chapter 2.
47511	0				When discussing emissions and removals, a clear differentiation should be made between economic sectors and inventory sectors. This is particularly relevant to the treatment of bioenergy. Whilst the inventories do not include bioenergy CO2 emissions under the sectors where the combustion occurs (as they should be reflected in the LULUCF/AFOLU sector), in the discussion of the economic sectors (energy, transport, industry) they should not be ignored, as they are important for the analysis of drivers and sectoral policies.	Zoltán Rakonczay	Belgium	Accepted. Thank you for your comment. This has now been detailed in Chapter 2.
96	0				Discussion on CDR options are scattered in several chapters: 3,6,7,12, 14 and 16. It would be good to have a cross-chapter box that introduces these options. Or a coordinated approach is needed between the chapters. A link to chapter 5 of WG1 report would also help.	Govindasamy Bala	India	Accepted. A cross-chapter box has been added. This is cross-chapter box 8, which sits in Chapter 12
108	0				CDR is discussed in several chapters of this report. Are we fooling ourselves given that none of the CDR options has been proven to work on global scale and they could be costly? Also, there is a distinct possibility that some of the CDR options (e.g. BECCS and DAC) would have to be as big as our current global energy system. In that case, won't our environmental damage be doubled - once in emitting CO2 and second in removing the emitted CO2?	Govindasamy Bala	India	Thank you for your comment. CDR has been comprehensively assessed throughout the report, including in cross-chapter box 8 in chapter 12. Chapter 12 also includes a discussion on costs and potential of certain CDR methods.
2677	0	0	0	0	Some remarks made about specific chapters and paragraphs are found actually relevant for the whole document and included again in comments relative to the entire report.	Philippe Waldteufel	France	Noted.
2679	0	0	0	0	This is a very long document. Compared to AR5/WG3 it is 70% longer, with about 2165 pages plus annexes. Even allowing for the 646 pages allocated to references (against 317 in AR5, twice as many), this makes a reading for many winter evenings. Besides, there is a SPM to come. Keeping finally in mind that each of the 17 chapters begins with a summary, one may wonder: who is going to read this report?	Philippe Waldteufel	France	Noted. Chapter lengths have been reduced by removing overlapping content where applicable
2681	0	0	0	0	The most likely answer seems to be: while nobody is supposed to read all of it, people interested in a specific aspect will be happy to select the relevant chapter and keep to it. This may however not be so simple. For example, somebody interested in energy will extract chapter 6 (energy systems) in which the word "energy" appears 1922 times.	Philippe Waldteufel	France	Noted. Chapter lengths have been reduced by removing overlapping content where applicable
2683	0	0	0	0	The same word, however, appears 7239 times in the remaining of the FOD, leading one to speculate that meaningful discussions and information about energy are likely to be found throughout the whole report.	Philippe Waldteufel	France	Noted. Chapter lengths have been reduced by removing overlapping content where applicable
2685	0	0	0	0	There is no easy way to decide whether the report is "too long" as far as the subject is concerned. One can only remark, in general terms, that many if not every of the 17 chapters find often necessary to refer to other chapters and the angles they are covering, with a bit of duplication once in a while. In some cases it is found useful to comment along the lines: "while they are doing this, we are doing that, which is not quite the same thing". While I agree it may be necessary, it takes some room, and also increases to some extent the complexity of the report.	Philippe Waldteufel	France	Noted. Chapter lengths have been reduced by removing overlapping content where applicable

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
2687	0	0	0	0	Another issue which causes the document to spend a lot of lines is the will to refer to the warming limit and the warming objective 2°C and 1.5°C spelled out by the Paris Agreement. I of course do not discuss the fact that the report has to refer to the P.A! It turns out however that such references are invoked for the sake of <u>comparison with a variety of mitigation efforts, resulting in tedious repetitions.</u>	Philippe Waldeufel	France	Accepted. Language surrounding the Paris Agreement has been checked and harmonised
2691	0	0	0	0	There are many examples where one feels that the purpose of the document is to report on the literature, mainly the academic one, and to update its contribution to knowledge. What should we expect from the authors then? In cases where the papers they refer to do not contradict, possibly help to show how synthetic views emerge. In cases where divergences exist, my feeling is that the report should either take a stand, or point to the problem and store it for the "knowledge gaps" or "further research needed" sections.	Philippe Waldeufel	France	Thank you for your comment. IPCC reports assess the science related to climate change. Through its assessments, the reports identify the strenghts of scientific agreement in different areas and indicate where further research is needed. Authors have been reminded that the goal of the report is to produce a policy relevant assesement
2693	0	0	0	0	Finally I have noted in many places statements stressing the mandatory convergence and compatibility between mitigation and fighting inequalities, or more generally between mitigation and reaching the SDG. My understanding is that IPCC is concerned (in WG3) with assessing mitigation possibilities. Whenever efficient mitigation actions are seen for example to increase poverty rather than to eradicate it (this seems to me rather likely on the short term) then of course this is to be indicated frankly (which is not the case in this FOD) and then ways to achieve trade-offs might be analysed, bearing in mind that (in my opinion) the responsibility of pushing forward any trade off does not belong to IPCC.	Philippe Waldeufel	France	Noted. WG III focuses on the mitigation of climate change. In the approved outline for this report, several chapters were asked to assess climate change linkages to sustainable development and the sustainable development goals. This includes both co-benefits and trade-offs.
9655	0				<p>For Annex B page 12 lines 8-9. Section 3.6.2 in Chapter 3 of IPCC WG3 AR5 (i.e., the last IPCC AR) summarized the state of knowledge on discounting and the applicability of the simple Ramsey rule and extensions. Table 3.2 also consider long-term social discount rates between from the literature between 1.4 and 16 percent.</p> <p>Two new contributions to the literature I) find larger consensus on the value of the long-term social discount, and II) questions the applicability of the simple Ramsey rule. I think it is important to highlight these more recent contributions.</p> <p>The key normative/ prescriptive (relating directly to Table 3.2. in the previous IPCC AR) is: Drupp, Moritz A., Freeman, Mark C., Groom, Ben, and Frikk Nesje (2018), Discounting Disentangled. American Economic Journal: Economic Policy 10(4), 109-34. Webpage: http://www.aeaweb.org/articles?id=10.1257/pol.20160240</p> <p>Abstract: The economic values of investing in long-term public projects are highly sensitive to the social discount rate (SDR). We surveyed over 200 experts to disentangle disagreement on the risk-free SDR into its component parts, including pure time preference, the wealth effect and return to capital. We show that the majority of experts do not follow the simple Ramsey Rule, a widely-used theoretical discounting framework, when recommending SDRs. Despite disagreement on discounting procedures and point values, we obtain a surprising degree of consensus among experts, with more than three-quarters finding the median risk-free SDR of 2 percent acceptable.</p> <p>The key positive/ descriptive contribution is: Giglio, Stefano, Maggiori, Matteo , and Johannes StroebeI (2015), Very Long-Run Discount Rates. Quarterly Journal of Economics 130(1), 1–53. Webpage: https://doi.org/10.1093/qje/qju036</p> <p>Abstract: We estimate how households trade off immediate costs and uncertain future benefits that occur in the very long run, 100 or more years away. We exploit a unique feature of housing markets in the United Kingdom and Singapore, where residential property ownership takes the form of either leaseholds or freeholds. Leaseholds are temporary, prepaid, and tradable ownership contracts with maturities between 99 and 999 years, while freeholds are perpetual ownership contracts. The price difference between leaseholds and freeholds reflects the present value of perpetual rental income starting at leasehold expiration, and is thus informative about very long-run discount rates. We estimate the price discounts for varying leasehold maturities compared to freeholds and extremely long-run leaseholds via hedonic regressions using proprietary data sets of the universe of transactions in each country. Households discount very long-run cash flows at low rates, assigning high present value to cash flows hundreds of years in the future. For example, 100-year leaseholds are valued at more than 10% less than otherwise identical freeholds, implying discount rates below 2.6% for</p>	Frikk Nesje	Germany	Noted - thank you for your comment. The SDR section in Annex B was a placeholder for FOD. The new text for SOD will focus on the algebra of discounting. An extensive and critical discussion on discounting will take place in Ch3.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
10953	0				The extension of the scope to include embodied emissions, emissions caused by the supply chains of building materials and elements is appreciated.	Rolf Frischknecht	Switzerland	Noted. Thank you for the positive comment
10955	0				The chapter lacks a clear focus on life cycle based greenhouse gas emissions as well as on GHG emission benchmarks. It remains open how future buildings may contribute to the net zero carbon emission target by 2050 (at latest). The Chapter should be extended in particular regarding embodied GHG emissions and the solutions offered by the construction materials industries how to contribute to this goal.	Rolf Frischknecht	Switzerland	Accepted. The revised Second Order Draft includes a discussion on building elements. Please also refer to chapter 11 which includes the circular economy discussion
10973	0				I perceive an imbalance in the report: the chapters on non technical mitigation options (5.), economic considerations (6.), links to sustainable development (8.) are very extensive whereas the most central one on technology options (4.) is rather short and coarse. I recommend extending and deepening the contents of Chapter 4 substantially.	Rolf Frischknecht	Switzerland	Partially accepted. Technical options are explored in several chapters in the report - please see chapters 6-11 for options in energy, cities, buildings, transport and industry are covered in detail
10977	0				The Executive summary contains substantial repetitions (partly entire sections)	Rolf Frischknecht	Switzerland	Noted, repetition removed
12117	0				We encourage you to further develop the references to explicit section and chapters in the SOD review, especially in the executive summaries. This makes reviewing the draft much more easier for the reviewers. Also encourages the authors to develop more across chapter statements and bring them forward to the SPM level.	Maria Malene Kvalevåg	Norway	Accepted. Cross-chapter links added, and executive structures now include links to specific chapter sections
12907	0	0	0	0	This is for the Report as a whole: a uniform and precise definitions of near-term, medium-term and long-term should be adopted throughout the report.	Prashant Goswami	India	Noted. A glossary entry has been provided on these terms to ensure standardisation
12909	0	0	0	0	It's possible that AR6 is meant to discuss only climate (in fact emission) mitigation with the Paris 2015 as the goal. However, this is not clear, and the comment below is with the assumption that AR6 will discuss climate change in general, and not just emission mitigation. The chapter seems to put much less emphasis on adaptation (to change practices to changing climate than on mitigation (to offset climate change and to maintain essentially the same climate). If climate change can be adapted to with no more or less cost (cost understood in a comprehensive framework) than mitigation, then adaptation is also a climate-resilient development (again, development understood in an inclusive sense) pathway. However, there is no evidence presented, not even discussed, between these two climate responses. These two-mitigation and adaptation- are not always mutually consistent or compatible. While some adaptations, like transition to renewable energy, may be anyway desirable, others, like change of agronomical practices, will find conflicting recommendations from adaptation and mitigation. For example, if climate changes are adopted to in Agriculture, then successful mitigation would require reversing those adaptations!!	Prashant Goswami	India	Noted and partially accepted. Linkages between mitigation and adaptation have been highlighted and assessed in more detail in the SOD. Please also note that these linkages are given prominence in the WG II contribution to the AR6 as well.
12911	0	0	0	0	Some reference to the healthcare sector should be made; maybe as part of Industry.	Prashant Goswami	India	Noted thank you for your comment, this has been considered
13885	0	0			Indigenous Peoples have unparalleled knowledge on mitigation and adaptation to climate stressors. The COP has recognized the necessity of including Indigenous knowledge and practices when addressing and responding to Climate Change. The Local Communities and Indigenous Peoples platform was established in part to facilitate the meaningful and holistic integration of knowledge, technologies, practices and efforts of local communities and Indigenous Peoples into the UNFCCC process. Consequently, it is disappointing to see a significant lack of Indigenous knowledge and recognition of Indigenous Peoples in this report. The IPCC should be responding to the COP by ensuring that Indigenous knowledge is represented in all future reports.	Bridget Doyle	Canada	Noted. Chapter 7 includes case studies on more inclusive resource management approaches that integrate indigenous knowledge can deliver multiple benefits. The role of indigenous people in adaptation is adequately addressed in the WGII report (Impacts and Adaptation) of the IPCC.
16437	0				In the Entire Report, consider adding a chapter on the global military sector and its influence on climate change. The military sector is a driver of manufacturing, transport and food provisioning emissions and a key to their mitigation. Likewise, there exists a potential for eliminating warfare altogether as a means of addressing climate change. Global war diminishes the human potential for a sustainable and just future, such that increasing alliances globally for the purpose of climate mitigation may reduce the military sectors of all countries and lead to further benefits. But the ties of the financial industry to military operations makes transition difficult. The entire report would be strengthened with a clear description of these ties and opportunities. The absence of the military sector in the sectoral analysis of the report is a major gap that ought to be remedied for the sake of clarity and accuracy.	Daniel Helman	Micronesia, Federated States of	Rejected. The scope and outline of the WG III Contribution to the Sixth Assessment Cycle was approved by governments at the start of the cycle. At this stage it is not possible to add new chapters.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
16533	0	0	0	0	Annex A: Glossary. Low forest cover countries (LFCCs) which are country with less than 10% forest cover comparing with total land could be added, because of their potential for plantation and their role on mitigation.	Mostafa Jafari	Iran	Rejected. Thank you for your comment. Terms are added to the glossary if they are used in multiple chapters across the report.
17687	0				Especially re chapters 2, 4, 6, 16 and 17: A theme which could perhaps be more explicit would seem to be the gathering pace and depth of change, most obviously in the capacity and cost reductions in PV, wind and batteries / electric vehicles, and the potential scale of impacts within a decade or two if the pace of exponential growth is at all sustained or only slowly declines. Whilst currently still focused on particular regions, this trend appears to be spreading. We really need a dynamical systems / "S-curve" / network diffusion view on this. However I am not aware of this being applied adequately in the literature - is this my ignorance, or a research gap?	Michael Grubb	United Kingdom (of Great Britain and Northern Ireland)	Noted thank you. Chapter 2 includes information on cost reductions and adoption rates of dynamic energy technologies.
17729	0				The chapters vary enormously in the extent to which they are just reviews, or more focused assessments. Some are clearly assessments with a solution-oriented focus, such as Chapter 4 which opens by defining three policy-relevant questions which the chapter seeks to then answer. Most do not however clearly offer the government readers either assessment of future prospects, or of specific options and choices, but rather come over as broad reviews from which it is hard to draw clear policy-relevant conclusion	Michael Grubb	United Kingdom (of Great Britain and Northern Ireland)	Noted. Chapters have been significantly revised for the second order draft to provide assessments of the scientific literature . Authors have been reminded that the goal of the report is to produce a policy relevant assesment
17731	0				Across many of the chapters, it feels like the 'elephant in the room' is the renewable energy revolution - which I think is a reasonable term. Our problem is that we do not have sufficient timely knowledge, understanding or metrics of the processes of dynamic systems transformation involved. But we have a duty to try to understand the implications of four facts. (1) PV auctions last year broke the world record for cheapest energy multiple times (most recently, around 1.6c/kWh in Qatar) - across growing regions of the world, comprising well over half the world's population, solar is clearly becoming the cheapest widespread high-grade energy source in human history. (2) Beyond PV, wind especially is also frequently competitive in auctions (the UK auction saw offshore wind prices competitive with the wholesale market – the government has just committed to around 35-40% of UK electricity from offshore wind by 2030, whilst also restoring auctions for onshore renewables). (3) battery cost reductions enhance integration and mean that EVs will also soon be cheaper than conventional cars. (4) If the % growth rates of the past 5 years or so were to continue, these sources would dominate global electricity and small vehicle transport within 10-15 years [just try the numbers for yourselves], with growing periods of 'free' electricity from surplus hours eg. for H production. Several chapters seem grounded in literature from a previous age – again, review of old literature, or assessment of current knowledge and options? My specific suggestion is that WG3 should (A) set up a cross-chapter working group on the topic to assess data, trends, projections and how policy may either accelerate or retard these transitions, and (B) negotiate, with BNEF, IRENA, IEA or the trade magazines, access to the latest data on trends to help inform all chapters assessment over the coming year of possible implications.	Michael Grubb	United Kingdom (of Great Britain and Northern Ireland)	Noted. Chapters have been significantly revised for the second order draft to provide assessments of the scientific literature . Authors have been reminded that the goal of the report is to produce a policy relevant assesment
25503	0	0	0	0	Analysis should elaborate further on mitigation costs, providing quantitative findings. Based on AR5, WG III, SPM p. 18. "There is a wide range of possible adverse side-effects as well as co-benefits and spillovers from climate policy that have not been well-quantified (high confidence). Whether or not side-effects materialize, and to what extent side-effects materialize, will be case- and site-specific, as they will depend on local circumstances and the scale, scope, and pace of implementation. Mitigation policy could devalue fossil fuel assets and reduce revenues for fossil fuel exporters, but differences between regions and fuels exist (high confidence). Most mitigation scenarios are associated with reduced revenues from coal and oil trade for major exporters (high confidence). The effect of mitigation on natural gas export revenues is more uncertain, with some studies showing possible benefits for export revenues in the medium term until about 2050 (medium confidence). The availability of CCS would reduce the adverse effect of mitigation on the value of fossil fuel assets (medium confidence)."	Eleni Kaditi	Austria	Accepted .Quantification added where possible based on the underlying literature
28197	0				The coverage of transport sector is not consistent across the report. Emphasis in Transport Chapter is on technology (Improve option) while other chapters rightfully give more emphasis to Avoid and Shift options. Having an almost exclusive Technology focus in the Transport chapter creates the impression that decarbonization of the transport sector can be achieved through technological measures.	Cornie Huizenga	Germany	Accepted. The second order draft is revised to provide a more comprehensive overview of response options in the transport sector

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
30355	0				Hydrogen is correctly recognized in the report as an unavoidable low carbon and/or renewable energy carrier that is needed to achieve the climate ambition (typically, below 2° or 1.5° trajectory). This is in line with several recent studies (Energy Transition Commission "Mission Possible" ; H2 council "Scaling Up" ..) highlighting the role of hydrogen especially for hard-to-abate sectors (such as some segments in transport: intensively used LDV fleets, heavy-duty, part of the bus lines, maritime, aviation, etc.). Anyhow given the dynamics of the sectors (new developments, cost decreases...), risk is high to rely on out-dated/too conservative visions. ETC study : http://www.energy-transitions.org/sites/default/files/ETC_MissionPossible_FullReport.pdf H2Council Scaling Up: https://hydrogencouncil.com/wp-content/uploads/2017/11/Hydrogen-scaling-up-Hydrogen-Council.pdf	Guillaume DE SMEDT	France	thank you for your comment.
30547	0	0	0	0	There needs to be more consistency across chapters in terminology of language referring to dietary shifts. Some chapters (e.g., Chapter 5 discusses "low/high meat diets" throughout while other chapters use different terms (e.g., "(less) GHG-intensive diets", "(less) carbon-intensive diets"). Given that the GHG intensity of different meats vary significantly as highlighted in Table 12.8 - and that there are other foods with similarly high (or higher) GHG intensities as some meats per unit of protein or serving (e.g., farmed crustaceans, dairy) -- it is worth replacing text around "low meat" and "limiting meat consumption" to more specific language (e.g., "less GHG intensive diets" or "limiting consumption of ruminant meat, farmed crustaceans, dairy, and other GHG-intensive foods" throughout the report. This can also help reduce potential concerns about rebound effects if "meat" consumption is replaced by other GHG-intensive foods like dairy.	Raychel Santo	United States of America	Thank you for your comment. Terminology has been checked to ensure consistency in how to treat these concepts throughout the report.
30579	0	0	0	0	Throughout the report, it is assumed that vegetarian and vegan diets are the most climate-friendly options, and they are often used as examples or within models as the least GHG-intensive diet scenario. While it is true that, in most cases, vegan diets have lower GHG footprints than other diets, there are other plant-forward diets (e.g., "low food chain," 2/3 vegan, Mediterranean, New Nordic) that could substantially reduce GHG emissions without necessarily replacing all animal products. In many cases, low food chain and 2/3 vegan dietary scenarios have better GHG implications even than lacto-ovo vegetarian diets. Whenever possible, it would be worth adding more dietary variety into descriptions, as climate-friendly diets do not require an all-or-nothing approach. See: Kim et al. (2019). Country-specific dietary shifts to mitigate climate and water crises. Global environmental change, 101926. https://doi.org/10.1016/j.gloenvcha.2019.05.010	Raychel Santo	United States of America	Thank you for your comment. Terminology has been checked to ensure consistency in how to treat these concepts throughout the report.
33157	0	1	55	70	Over the last decade I observed that many regional experts found that IPCC report are wordy and not easy to understand. It would be highly appreciated if final version can reduce jargons and apparently present different concepts and implications. There are limited direction how end users such as individuals and households who may be significant stakeholders in one way or other, get involve and be part of climate change mitigation and adaptation. Primary level school curriculum should include basic and fundamental concept of climate change, mitigation and adaption particularly individual behaviour and awareness in relation to agriculture, forestry and other land uses (AFOLU), demand, services and behaviour aspects of mitigation, urban system and settlement, building construction, transport, industry, emission and mitigation pathways.	Edris Alam	United Arab Emirates	Noted, thank you for this important comment. Jargon has been reduced in the second order draft and IPCC authors are always encourage to use clear language. The objective of the IPCC is to provide governments with scientific information that they can use to develop climate policies. The IPCC produces outreach material for a range of different audiences which can be found on the IPCC website.
34991	0				What message goes to the Health sector is not adequately addressed in its real context particularly in developing countries where the infrastructure and development endeavors require intersectoral collaboration to ensure co-benefits	Adujna Gameda	Ethiopia	Since the focus of this report is on Mitigation of climate change, as the comment correctly points out, health is seen as a co-benefit. There is a discussion of how such co-benefits can be leveraged in chapters 8 and 17. IPCCs WGII on impacts and adaptation addresses this in more detail

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
35789	0				Please recommend all chapters to read the introductory section of Chapter 5 which has done a particularly good job of framing mitigation in the light of wellbeing and decent living standard – see p17 L16-17 for the heart of the matter. This should be integrated throughout all chapters: the marriage between reducing emissions where it is too high, and low-carbon development (avoiding lock-in, leapfrogging, 'smart development'), where decent living standards are not yet met.	Debra Roberts	South Africa	Thank you for your comment. The framing and messages in Chapter 5 were discussed within the entire chapter team during breakout groups in the virtual LAM3 to ensure concepts are properly applied throughout the report
35791	0				Please consult comments from ZOD, many of which have not been addressed yet. They represent a significant investment of time by non-authors.	Debra Roberts	South Africa	Noted.
35793	0				Keep in mind that at the end of the cycle, the report will be mined for information that is specifically relevant for different regions. Currently the Special Reports are being mined for specific mentions of Africa and African countries. This is a new trend, as countries are turning increasingly to action, they need the numbers and evidence, lists and tables, the details, to guide their respective climate action. ALL chapters need to be mindful of this, and aim by all means to present regional data, and not continue to merely cite easy examples from developed countries (where most of the literature is found), but specifically call out solutions and options for all the major regions, by name, with examples, and with the various regional realities in mind. This is where the diverse author teams can really add value. As such, all chapters should also be constantly and acutely wary of regional bias.	Debra Roberts	South Africa	Accepted - thank you for this important comment. The chapter team is continually striving for regional balance in the reports, based on the available underlying literature. Chapters also include case studies from different regions to ensure lessons are captured from a wide range of experiences
37095	0				Throughout the report, statements are made referring to multiple Paris Agreement "goals" - this is misleading and incorrect and needs to be addressed and harmonized throughout WG3's text. - There is a single "goal" in the PA related to pursuing a global limitation to 1.5C temperature increase, as laid out in Article 2.1. See Mace (2016) Mitigation Commitments under the Paris Agreement and the Way Forward (Climate Law) . - The PA further lays out in Article 4.1 certain operational qualities desirable in reaching the goal provided in Article 2.1, notably lack of overshoot, reduction of need of CDR, etc. - Article 2 and 4 need to be interpreted in conjunction and are thus more than just a temperature goal (see e.g. Schlusser et al. 2019, Table 1)	Michiel Schaeffer	Netherlands	Accepted. Language surrounding the Paris Agreement has been checked and harmonised
39647	0				While the term "energy production" is accepted within some fields, many would point out that energy cannot be produced, but only converted between different forms. To avoid unnecessary confusion or critique on scientific soundness, the wording "energy production" should be avoided throughout the report.	Simon Davidsson Kurland	Sweden	Noted. The term 'energy production' is used in areas of the report, reflecting the terms use in the underlying literature
41321	0				Scenarios are used across all WGs (and SRs). To enhance consistency in presentation and use of scenarios it could be useful to have complementary Boxes in all WG reports explaining how scenarios and concepts are used in the report. These boxes should be strongly coordinated and complementary, and the xWG team on scenarios and help producing these. WGI SPM, TS and Ch1 have boxes on scenarios and we have involved WGII and WGIII authors. This could be followed up by Boxes in WGII and WGIII, and together these boxes will form a solid and useful basis for use of scenarios in SyR. This should be discussed further in the xWG team on scenarios.	Jan Fuglestedt	Norway	Noted - thank you. xWGs discussions on Scenarios and Illustrative Pathways are undergoing.
41323	0				The ES of Ch2 is written in a format that works very well. Hope this can be used across chapters.	Jan Fuglestedt	Norway	Thank you for your positive comment. The structure of the Executive Summaries is harmonised across the report for the SOD.
41325	0				Check consistency with WGI for definitions of global temperature metrics (GSAT vs GMST) and clarify usage in WGIII	Jan Fuglestedt	Norway	Noted - thank you. Coordination with WG1 is undergoing to ensure consistency
41329	0				A core set of scenarios were suggested by the xWG team on scenarios (SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0, SSP5-8.5). Please consider using these also in WGIII.	Jan Fuglestedt	Norway	Noted - thank you. xWGs discussions on Scenarios and Illustrative Pathways are undergoing.
41331	0				Plausibility of the scenarios are not addressed in WGI. This is needed from WGIII, and will help the integration, presentation and use of scenarios in SyR.	Jan Fuglestedt	Norway	Noted - thank you. xWGs discussions on Scenarios and Illustrative Pathways are undergoing.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
41333	0				WGI will do an assessment of emission metrics. It would be good for the consistency in AR6 if WGIII authors can read and comment on this in WGI SOD in order to secure relevance and consistency across reports.	Jan Fuglestedt	Norway	Noted - thank you. xWGs discussions on GHG emission metrics are undergoing. WGIII authors are in the process of revising Box 2.2 and producing a more extensive discussion for Annex B. Both outputs will be available for SOD.
41335	0				Re the concepts net zero, carbon neutrality, climate neutrality, GHG balance: these related concepts are often used without clear definitions. This needs clarification and consistent use across WGIII chapters. Consistency and coordination with WGI is also needed. A better presentation and application of these concepts is needed since these concepts are used in the Paris Agreement Art.4, IPCC SR15 and extensively in various developments of climate policies. Thus, I suggest a cross chapter box on this, and I think Chapter 1 would be the best place for this. (Here is an incomplete and preliminary overview of the use of the concepts 'net zero' and 'balance' across the chapters: Ch1: Introduces and uses net zero and GHG balance in chapter text, and has a "FAQ 1.3 What is carbon neutrality?". Ch2: Discussion of balance and net zero in Box 2.2. Ch3: Several related concepts used; net zero CO2, GHG balance, carbon neutrality etc. Section 3.2.1. "What are the long-term goals?" refers to Art. 4 and says that net zero is used as a more direct formulation of the article. Section 3.3.3.3 "The timing of net-zero emissions (balance of sources and sinks)" gives timing for bot net zero CO2 and for GHGs. Ch4: Mainly net zero, but also carbon or GHG neutrality. Cross chapter Box 1 refers to "...achieve balance". Ch5: Some use of net zero. Ch6: Mainly use of net zero but section "6.6.4.2 The timing of carbon-neutral energy systems" also discusses timing of GHG balance. Ch7: mainly carbon neutrality (and a couple of cases GHG neutrality). Ch8-Ch10: Mainly use of net zero. Ch11: net zero GHG. Ch12: net zero and GHG balance. Ch13 and Ch14: Mainly use of net zero. Ch15 and Ch16: Not mentioned. Ch17: uses net zero.)	Jan Fuglestedt	Norway	Accepted. A cross-Working Group effort is underway to harmonise the use of these terms across the AR6. These concepts have also been clarified within the WG III report, and a cross-chapter box has been added.
41337	0				WGI Ch7 assess the knowledge on ECS from multiple lines of evidence, while Ch4 use CMIP models, with their ECSs. The use of emulators / simple climate models is a critical link across WGI - WGIII. This needs clear explanation in WGIII.	Jan Fuglestedt	Norway	Noted thank you
41339	0				WGI Ch1 has presented "Dimensions of integration"; i.e., cumulative CO2 emissions, warming levels and scenarios. These were introduced to help integration across chapters in WGI and can also support integration across WGs. We hope these can be useful and that we can apply these in a consistent manner across WG reports.	Jan Fuglestedt	Norway	Noted - thank you. This will be flagged to the teams working on carbon budgets, scenarios and GHG metrics.
42331	0				<p>W.r.t. Annex A. Like any glossary, the one compiled in this Annex does carry a world view. It seems to me that it lacks balance between various economic theories. (See for instance my previous comments on consistency, discount rates, & market failure.)</p> <p>While concepts of little use, (& sometimes debatables), are mentioned, several others are severely missing. Of course this is an unavoidable consequence of the contents found (or missing) in the main economic reviews, (The ones that WG 3 members may be reading, contributing, or even peer reviewing).</p> <p>In accordance with the rule: Policy relevant, not policy prescriptive, only these contents are reported in the outstanding & respectful work of WG 3 members.</p> <p>There is however a difference with the working conditions of WG 1: when scientific findings are worsening the threat of climate change, (greater climate sensitivity than previously thought, for instance), scientists do not consider the possibility to change the physical properties or laws governing fluid mechanics, water vapor, or radiative exchange.</p> <p>When WG 3 members report findings increasing the difficulties for attenuation, they do not consider either the possibility to change the (human made...) rules & (financial) regulations which are non physical obstacles (or rather... anthropogenic obstacles) to meet the objectives of the UNFCCC.</p> <p>It seems to me that there is a gap between the academic knowledge reported here, and the urgent need of good governance & consistency. Who should fill this gap remain to be decided...</p> <p>Let me sum up this (sad) situation by quoting the french writer & economist Erik Orsenna:</p> <p>This climate issue is the mirror of our contradictions and of our lack of courage. (Cette question de climat est le miroir de nos incohérences et de notre manque de courage. in Climat le temps d'agir, p.288. Sept.2015. Ed. "Le</p>	Raymond Zaharia	France	Noted, thank you for your comment. Annex A includes terms that are used by multiple chapters in the WG III report.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
42333	0	0	0	0	The extensive use of acronyms in several, (if not all), chapters may be painful, unless a list & meaning of those acronyms is provided in each & every chapter including them.	Raymond Zaharia	France	Noted. List of acronyms will be provided for the report as a whole before publication
42335	0	0	0	0	The authors & the WG3-TSU should be commended for the impressive work accomplished to deliver this FOD. Nevertheless, there are concerns about the compliance with the overarching requirement: "Policy relevant, not policy prescriptive". Btw, as a result of the pregnancy of the standard theory in peer reviewed papers dealing with economics, (or, conversely, the absence of heterodox points of view in the main publications), it appears that several chapters include statements that may not be compliant with the "Not policy prescriptive" requirement. I have been striving to document some of these findings in comments of the Annex A: like any glossary, the one compiled here does carry a world view which seems to me as lacking balance between various economic theories. (See for [] instance comments on discount rates, market failure, or [missing entry on...] consistency between policies.)	Raymond Zaharia	France	Thank you for your comment, and your positive response to the draft. IPCC reports aim to be policy relevant but not policy prescriptive. This means that the scientific literature is assessed, and reports identify the strength of scientific agreement in different areas (indicating where further research is needed). The IPCC aims to evaluate a broad range on perspectives drawing on the diversity and expertise of the author team and recommendations of reviewers.
42337	0	0	0	0	The above concern about neutrality of point of view is even more apparent when considering what is missing: for instance, I could not find any reference to the Modern Monetary Theory < https://en.wikipedia.org/wiki/Modern_Monetary_Theory >.(MMT) which is discussed in many places & occasions (including the campaign of senator Bernie Sanders and aids like Ms A.O. Cortez.) Given the criticism of issues like the GCF (Green Climate Fund), it seems rather detrimental not to consider the power of MMT to ease a successful completion of the GCF pledge, (at least for countries whose central bank is backed by a large & robust economy.) The same goes for innovative methods of funding devoted to... "too small" projects (such as improved energy efficiency or renewables): when the size of the projects is too small for funding agencies (as quoted in chapter 15, page 15, lines 10 to 12), ordinary citizens may bundle their savings to support these endeavours. (See for instance: Energie partagée < https://fr.wikipedia.org/wiki/%C3%89nergie_Partag%C3%A9e >)	Raymond Zaharia	France	Thank you for your comment.
42339	0	0	0	0	Of course, most of this impressive work of WG 3 was accomplished before the outbreak of the world wide coronavirus crisis. We have now a robust proof, if needed... of the close & robust link between economic activity & GHG émissions. See for instance: https://www.carbonbrief.org/analysis-coronavirus-has-temporarily-reduced-chinas-co2-emissions-by-a-quarter This observed fact may bring to the WG 3 an opportunity to discuss & question « non essential activities » as worded by governments before shutting down lots of activities, (meetings, theaters, schools & universities...), considered as hazardous w.r.t. to the risk of speeding the spread of the disease. Indeed, there are several « hazardous & non essential activities », from the point of view of the GHG threat on many living species, (including human beings), that their GHG emissions constitute. A systematic quantitative assessment of the benefits of shutting down some parasitic activities could be very « policy relevant » (& not policy prescriptive.) What about HF trading ? What about replacing tenths of « Fixings » per second by one per day ? What is the need to have thousands of fixings for one single day ? Do bookkeepers need to perform reporting several times per minit ? Another issue is substitution of a GHG intensive activity by a less intensive one. What about tourists flying all over the world ? What about of the GHG emissions reductions when replacing tourists aircrafts by tourists sea going ships ? If & when relevant quantitative info is available, governments may perform some fine tuning... not possible with	Raymond Zaharia	France	Partially accepted. The revised Second order draft includes a box on COVID 19 which points to sections in different chapters

IPCC AR6 WGIII First Order Draft Government and Expert Review Comments Responses (Entire Report)								
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: https://www.ipcc.ch/report/ar6/wg3/downloads/drafts-and-reviews								
Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
42875	0	0	0	0	W.r.t. Annex A. Hello Gents & Ladies of IPCC/TSU ! This is « editorial » (and/or « substantive ») : after downloading several FOD files (including Annex A), and spending more than 2 weeks parsing & working on them, I am rather concerned to see that Annex A is not included as an option in the drop down list of cell « C15 ». I do hope that the comments below will nevertheless be considered !	Raymond Zaharia	France	Thank you for your interest in Annex A: Glossary. Please note that the Glossary is provided as a resource to highlight how key terms are used across the report and is not open for expert review. However, your comments have been taken into consideration for the second order draft.
42877	0	0	0	0	W.r.t. Annex A. This definition of "Blue carbon" is not the same than the one appearing page 5 (or 543) in Annex 1 of https://www.ipcc.ch/sr15 . It may be worth to briefly explain the reasons for this difference. N.B. In some of my comments below, the same situation may occur. Indeed, it is preferable to have the same wording in both reports & annexes ! However, when an improvement of the compliance of this report with the requirement « Not policy Prescriptive » is at stake, it should be considered to deviate from a wording already approved in another report. This is the case for several other definitions in this FOD. (See for instance « Anthropogenic removals » Page 3 line 11 to 21 of this Annex.)	Raymond Zaharia	France	Partially accepted. A cross-WG effort is ongoing to ensure terms are defined consistently across the reports. Where applicable, definitions are consistent with previous IPCC reports. However, definitions are updated as the underlying literature evolves. The definition of blue carbon was updated for the Special Report on Oceans and the Cryosphere, as it was a key term for that Special Report. The current AR6 definition is consistent with the SROCC (and SRCL) definition.
42955	0				In my opinion the IPCC AR6 Climate Change 2021: Mitigation of Climate Change (WGIII) FOD is excellent, clear and date driven. Even if, according to President Lagarde words "we regard the current shock as severe, but still temporary, if the right set of policy measures are decided by all players" [Christine Lagarde, President of the ECB, Press Conference, Frankfurt am Main, 12 March 2020 < https://www.ecb.europa.eu/press/pressconf/2020/html/ecb.is200312~f857a21b6c.en.html >], I think that SOD must also contain considerations regarding the possible consequences of the coronavirus	MARIO VALENTINO ROMERI	Italy	Thank you for your positive comment
42957	0				In the WGIII FOD I had particularly appreciate the properly consideration give to hydrogen energy carrier and fuel cell technologies a 'game changer' in fighting climate change, according to what I wrote my paper: "The history could repeat itself: hydrogen-oxygen fuel cell is the 'game changer'" [published January 2020 in "4th AIEE Energy Symposium Conference Proceedings" Rome, available at < http://www.aieeconference2019rome.eu/documents/AIEE_Symposium_Proceedings_4.pdf >] and according to what IRENA wrote in his article: "Green hydrogen – The Potential Energy Transition Gamechanger" [available at < https://www.irena.org/newsroom/articles/2020/Jan/Green-hydrogen-the-potential-energy-transition-gamechanger >]	MARIO VALENTINO ROMERI	Italy	Thank you for your positive comment. The reference has been passed to the appropriate chapter
44093	0				I have one fundamental comment, which may apply to different chapters of the report, but in particular to chapter 5. This comment refers to role of health care sectors and health services in the context of both climate change mitigation and access to a basic need (i.e. health care). Although health and also - but less often - health care/health services are mentioned in many sections, I could not find any references to carbon footprint analyses of health care sectors (i.e. "health carbon footprints" HCF) or any suggestions from the literature, which addresses HCF reduction strategies and reduction of wasteful practices in rich countries (literature: see next comment) or references to the importance of access to health services in terms of a "good life" and well-being (in poor countries). Thus, in the following, I mainly provide some examples focussing on the first sections of chapter 5 only, where these issues could be stressed more explicitly.	Ulli Weisz	Austria	Partially accepted. Chapter 5 and other chapters include considerations of the importance of health care for wellbeing and climate change mitigation.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
44095	0				<p>Since AR5 a number of national health carbon footprint studies and in 2019 the first international comparison of health carbon footprints have been published. These studies also address climate mitigation options for the health care sector. Recently published: Eckelman and Sherman 2016 (https://doi.org/10.1371/journal.pone.0157014); Malik et al. 2018 (10.1016/S2542-5196(17)30180-8), Eckelman et al. 2018 (10.1371/journal.pmed.1002623), Wu et al. 2019 (10.1016/S2542-5196(19)30192-5), Nansai et al. 2020 (10.1016/j.resconrec.2019.104525), Pichler et a. 2019 (10.1088/1748-9326/ab19e1); forthcoming: Weisz et al. (in RC&R);</p> <p>Literature on "low carbon health services" see for example the World Bank Group 2017: http://documents.worldbank.org/curated/en/322251495434571418/pdf/113572-WP-PUBLIC-FINAL-WBG-Climate-smart-Healthcare-002.pdf</p> <p>Wasteful practices in health sectors: OECD 2017 (ISBN: 978-92-64-26627-8 978-92-64-26659-9 978-92-64-26644-4)</p>	Ulli Weisz	Austria	Thank you for these references. They have been considered by the authors in chapter 5 when revising the SOD
45357	0	0	0	0	Figures and data should be doubly checked and must be updated with the latest ones.	Jaimin Parikh	India	Accepted and updated
46697	0				<p>In general, the co-benefits associated with climate mitigation policy and climate mitigating measures are far from sufficiently well described and underlined in the report. These co-benefits may often exceed mitigation costs and offer a way of coping with the wicked problem nature of climate change, as well as with opposition from climate science deniers. Moreover, the monetized value of co-benefits is often high despite the fact it is commonplace to study only a subset of the co-benefits at hand. In addition, despite their significance, co-benefits re seldom considered in policy-aking, which should be underlined. Finally, it would be of value if IPCC could help in offering guidance on suitable standards for studying and expressing co-benefits, perhaps in the future in a special IPCC report on the topic. This comment is made more precise in a number of comments below, for specific chapters on the report, and the reasoning is further develop in the following recent review on the topic: Mikael Karlsson, Eva Alfredsson & Nils Westling (2020) Climate policy co-benefits: a review, Climate Policy, DOI: 10.1080/14693062.2020.1724070.</p>	Mikael Karlsson	Sweden	Thank you for your comment. Assessment of co-benefits, synergies and trade-offs have been strengthened. This applies particularly to Ch17, where interlinkages between mitigation options and the SDGs are assessed. The report also includes a costs and potentials exercise in Ch12, and a feasibility assessment in Ch6-Ch12 which goes beyond just economic aspects.
15563	1	1			<p>The absence of any significant discussion (with the possible partial exception of a few short passages in chapter 3) of the impacts of population growth on GHG emissions is major problem with the report and risks undermining its overall accuracy and credibility. I understand that the document is written from a policy perspective, and that population growth is quite difficult - maybe almost impossible - to address effectively and ethically through policy measures, so that it might seem like a moot point to the framers and authors. This report will, however, be read far beyond the policy community, and when an IPCC report comes out with chapter titles like "Emissions Trends and Drivers," for example, the leading role of population growth needs to be expressly acknowledged. It was (for instance) demonstrated in a widely discussed 2009 article by Murtaugh and Schlax in Global Environmental Change ("Reproduction and the carbon legacies of individuals") that the greatest impact a person has on the amount of greenhouse gases they are responsible for producing is through their reproductive choices; the impacts absolutely swamp everything else. This result has been confirmed by others, for example in 2017 by Wynes and Nicholas in Environmental Research Letters ("The climate mitigation gap: education and government recommendations miss the most effective individual actions"). There have of course been some alternative opinions, offering some criticism of the methodology used and the exact numbers obtained; these critiques seem to be based on the philosophical assertion that a person's responsibility for carbon emissions end with their own personal carbon generation, not the growing number of additional carbon generators they choose to create, and on the rather optimistic assumption that a low-carbon economy will appear due to unspecified reasons in some future generation. Even if we were to accept those critiques, though, the bottom line is that there has been a huge volume of work demonstrating in one way or another the primacy of population growth as a driver of climate change and/or its impacts (as another recent example, Fleming demonstrated in 2016 in the Hydrological Sciences Journal ("Demand modulation of water scarcity sensitivities to secular climatic variation") that the sensitivity of water scarcity to climate change is a nonlinear function of population growth). Overall, no one seriously contends the primary conclusion that reproducing in excess of the replacement rate is, in terms of GHG emissions and perhaps ecological impacts more broadly, the single worst environmental choice a person can make. There have been some discussions about how to address this in terms of taxation policy, for example, and it has had a profound impact on environmental philosophy, such as the work by Travis Rieder at Johns Hopkins, which has been prominently discussed in public venues (NPR, etc.). The question may not warrant large tracts of the report, but it can't simply be ignored, as it is in this first order draft.</p>	Sean Fleming	United States of America	Thank you for your comment. Chapter 2 on emission trends and drivers include discussions on relevant drivers of emission growth or emission slowing. Chapter 3 on long term mitigation pathways include a discussion on the role of population growth in RCP8.5 (Chapter Box 3.3 in Chapter 3).

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
27643	1	1	300	70	THESE GENERAL COMMENTS APPLY TO CHAPTERS 3, 4, AND 17 The underlying models, which represent the bulk of current research, are mostly very aggregated. They cannot address, among others, non-linear phenomena or interpersonal distributional problems, i.e. arguably some of the most relevant issues for climate transition. This point is sparingly noted among others in Chapter 4. More granular, disaggregated and/or systemic models that try to remedy these weaknesses do exist but are most sparingly mentioned in the chapters. Wouldn't it be scientifically justified to attract the attention on the shortcomings of existing studies and on possible remedies? In my comments to Chapter 17, I further develop the argument and suggest adding a methodological box on the shortcomings of aggregated approaches and on existing non-aggregated studies. In the same vein, I regret that Input-output approaches are ignored, although these are arguably the best tool to understand the material and financial requirements of specific transition efforts.	Christophe Deissenberg	Luxembourg	Noted. Thank you for your comment. Detailed and disaggregated models are assessed in the sectoral chapters of the report Chapter 6-11. Both Chapter 3 and the sectoral chapters assess the differences between top-down models and bottom-up models.
42389	1	1			Overall lack of precision, lack of cutting edge references and lack of updated discussions. Especially in Chapter 4, 6 and 11 the report seems oriented in parts and is not in line with the efforts of the IPCC, which should be a neutral entity covering the peer-reviewed literature as exhaustively as possible. Concerning CCU (but also on other subjects including CCS, electrification,...), it seems that the authors have missed the key advancements published in the literature over the last 5 years and the discussion is not well structured and in parts even misleading. The over-representation of hydrogen as the key solutions across chapters (without even discussing the timescale of deployment, the infrastructure needs nor all the drawbacks) does not reflect the peer-reviewed literature. Also the report contains key statements supported by reference(s) associated to report(s) written by interest groups. This type of literature should not be cited in such reports. In general IAMs with their often outdated model environment are not great at predicting or modeling individual CDRTs/NETs or CCU in view of a portfolio approach. This is a major methodological issue. For example the combination of fossil jet fuel and then BECCS to get zero emissions – might be a result of inherent biases of the models. Better results could be taken from ESMs. The four ESMs which do that at least partly (either Fisher-Tropsch, or Power-to-Methane, or even Power-to-Methanol, and DACCU) are: o Teske/DLR: https://www.springer.com/gp/book/9783030058425 o Breyer et al.: (all sectors) http://energywatchgroup.org/wp-content/uploads/EWG_LUT_100RE_All_Sectors_Global_Report_2019.pdf ; (power) https://www.nature.com/articles/s41467-019-08855-1 o DIW: https://www.mdpi.com/1996-1073/10/10/1468 o Pursiheimo et al.: https://www.sciencedirect.com/science/article/pii/S096014811831156X	Christoph Beuttler	Switzerland	Thank you for your comment. Assessment of these technologies is covered in the relevant chapters including Ch6 on energy and Ch12 on cross-sectoral topics. The role of IAMs and their underlying assumptions are detailed in Ch3 and Annex III of the report.
43711	1	1			While all chapters make valid contributions, major and dominant dynamics for climate change mitigations are insufficiently treated. This involves sector-coupling, i.e. the possibility of decarbonizing transport and heating by coupling them to RE. It is a major dynamic, underpinned by large-scale investments, but the report remains ignorant about it. Similarly, the price decline of solar PV, outcompeting coal in many locations by now, and the concurrent decline in battery storage costs, are dealbreakers (even as obviously not sufficient on their own). Accurate numbers of recent dynamics are missing in Chapter 3, 4, 6, and 12 and hence the AR6 appears blind to major developments. It also appears that the scenario database underlying this report is outdated in many assumptions (e.g. CCS is overestimated in scenarios compared to real-world developments, whereas PV is underestimated, see Ch. 2). On the energy side, and more for the short-term dynamics, where NETs are less relevant, it would be good if several authors from the ESM community are invited to help surveying modelling results in energy systems, including also sector coupling. Sector coupling would deserve a major section of one chapter.	Felix Creutzig	Germany	Thank you for your comment. Assessment of these technologies is covered in the relevant chapters including Ch6 on energy, Ch10 on transport and Ch12 on cross-sectoral topics. The role of IAMs and their underlying assumptions are detailed in Ch3 and Annex III of the report.
43713	1	1			Representative scenarios could be displayed in a matrix. One axis is coal/BECCS in one direction, RE in the other. The other axis is low-demand vs high demand. The demand story could be narrated along the different possible impact of digitalization.	Felix Creutzig	Germany	Thank you for your comment. Assessment of these technologies is covered in the relevant chapters including Ch6 on energy, Ch10 on transport and Ch12 on cross-sectoral topics. The role of IAMs and their underlying assumptions are detailed in Ch3 and Annex III of the report. Finally, one of the main Illustrative Mitigation Pathways addresses the issue of demand (IMP-LD)

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
15565	1	1			The overall tone, and to some degree the content, of some parts of the report, especially the introduction, would benefit from some additional refinement. There is almost an "echo chamber" feel to parts of the report. To solve climate change, we also need to have some willingness to look beyond the issue itself and understand how it integrates with other questions, concerns, and goals. In some respects, the FOD is good at this, but there seem to be several missing elements. Some obvious examples are: (1) the wider environmental impacts of climate change solutions like nuclear power, electric vehicles and their batteries, and so forth, acknowledging that climate change can't be credibly tackled at the expense of other major aspects of human and ecological health, (2) a wider understanding of the economic justice aspects of some climate change solutions, like regressive carbon taxes, which seem to be undermining the democratic credibility/viability of climate change policy more generally, and (3) the central role of population growth in greenhouse gas emissions as noted in the preceding comment. There is no doubt that a general readership will be thinking about these sorts of issues, so I'm worried that neglecting such topics in this report could raise eyebrows and have potential to undermine the report's impact.	Sean Fleming	United States of America	Thank you for your comment. Interlinkages between mitigation and other objectives have been revised and strengthened throughout the report. This includes interlinkages with sustainable development and adaptation.
18823	1				<u>All hands must be on deck for a global conquer of climate change</u>	Michael Ugom	Nigeria	Noted, thank you for your comment.
27639	1	1	300	70	THESE GENERAL COMMENTS APPLY TO CHAPTERS 3, 4, AND 17. The coordination between the chapters 3, 4, and 17 is weak. There is a fair amount of overlap as well as some discrepancies. This is most evident e.g. with respect to the presentation of the different types of pathways and scenarios. Possibly, many introductory remarks could be done in Chapter 3 only, with the other chapters referring to the presentation there. In any case the presentation could be more homogenous, and it might be appropriate to use the mature formulations found elsewhere in the literature, also in previous IPCC documents— there is no need to reinvent the wheel every time. Similar comments apply to equity. There is some overlap in more substantive sections also. A case could be made for integrating Ch. 17 in the other two.	Christophe Deissenberg	Luxembourg	Accepted. The revised Second Order Draft has harmonised the presentation of pathways and scenarios and their co-benefits and trade-offs between chapters 3,4 and 17
27641	1	1	300	70	THESE GENERAL COMMENTS APPLY TO CHAPTERS 3, 4, AND 17 As noted in the chapters, mitigation, sustainable development, SDGs, etc., are intrinsically related. However, the chapters tend to add the latter aspects as (a) afterthoughts to mitigation rather than (b) make mitigation a special subset (admittedly, until now by far the largest one) of the issues of interest. Wouldn't it be more straightforward and informative to organize the chapters along (b)? This would not require excessive editorial efforts.	Christophe Deissenberg	Luxembourg	Accepted. A cross-chapter box is added to address linkages of mitigation and sustainable development. Sections in chapters 1, 3,4 and 17 are made to better express these linkages
30533	1		100		In all things, policy makers will hear when you write of people. Who will suffer with insufficient action, who will benefit and live with sufficient action. Be courageous and compassionate in your work, for your voice is important to us all. Thank you for your dedication.	Lindsey Cook	Germany	Thank you for your positive comment
32165	1	1	50	1	There is no provision to comment on Annex A. Is this Annex not part of the draft?	LOKESH CHANDRA DUBE	India	Thank you for your interest in Annex A: Glossary. Please note that the Glossary is provided as a resource to highlight how key terms are used across the report and is not open for expert review. However, your comments have been taken into consideration for the second order draft.
32167	1	1	50	1	Annex A: Glossary; Afforestation may be defined as "Conversion to forest of the land that has not contained forests in known or recorded history."	LOKESH CHANDRA DUBE	India	Noted. The definition of afforestation is currently consistent with the definition used in the IPCC Special Report on Climate Change and Land.
32169	1	1	50	1	Annex A: Glossary; Reference Period: Is it only anomalies, or any property or parameter such as emission?	LOKESH CHANDRA DUBE	India	Noted. An anomaly is defined as: "the deviation of a variable from its value averaged over a reference period". This can include emissions.
32171	1	1	50	1	Annex A: Glossary; Technology Transfer: Use word "handing over" instead of "exchange"	LOKESH CHANDRA	India	Rejected. The current phrasing is a more formal phrasing.
32173	1	1	50	1	Annex A: Glossary; Developed / developing countries (Industrialised / developed / developing countries): Delete "Special" in line 3 of the paragraph	LOKESH CHANDRA	India	Accepted, thank you

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response	
33121	1	1	55	70	Over the last decade I observed that many regional experts found that IPCC report are wordy and not easy to understand. It would be highly appreciated if final version can reduce jargons and apparently present different concepts and implications. There are limited direction how end users such as individuals and households who may be significant stakeholders in one way or other, get involve and be part of climate change mitigation and adaptation. Primary level school curriculum should include basic and fundamental concept of climate change, mitigation and adaption particularly individual behaviour and awareness in relation to agriculture, forestry and other land uses (AFOLU), demand, services and behaviour aspects of mitigation, urban system and settlement, building construction, transport, industry, emission and mitigation pathways.	Edris Alam	United Arab Emirates	Noted, thank you for your helpful comments. The use of jargon has been reduced for the next draft to enhance readability. The role of actors at variety of scales, including at the household and individual level, is highlighted in several chapters and in Chapter 5 in particular. Please also note that there are several helpful non-IPCC led efforts ungoing to 'translate' the reports for a wider audience.	
11505	3	1	5	46	Regarding exective summary, some chapters use thick letters to highlight some bullet points, and others don't. If all chapters can take this point into acctont and make them consistent, that would be better.	Muneki Adachi	Japan	Accepted. Harmonised throughout the report so that the main statements in each Executive Summary will be bolded.	
45169	3	2	59	36	The end page listed is the last page for Chapter 17. There needs to be more coherence in the report. Currently it seems even some of the numbers (GtCO2 and their uncertainties in different scenarios, e.g.) are not consistent among some of the chapters.	Cheah Singfoong	United States of America	Accepted. Units harmonised throughout the report.	
45173	3	2	59	36	The end page listed is the last page for Chapter 17. There should be an abstract for the entire document.	Cheah Singfoong	United States of America	Editorial - please note that end pages will be fixed during the next drafting stage	
2251	7	4	7	4	In Annex A: Glossary, page A - 7, after carbon stock definition, please add a new definition: "Carbonation Hydrated cement used in concrete or mortars naturally absorbs carbon dioxide during its lifetime, a physicochemical process known as carbonation, thus removing carbon from the atmosphere. This permanently locks carbon dioxide, providing a stable long-term carbon dioxide storage solution. The process can even boost concrete strength by increasing the density of its pore structure. (CEMBUREAU 2020; Sanjuán et al 2020; Andrade and Sanjuán 2018) See also Recarbonation". CEMBUREAU 2020. https://lowcarboneyconomy.cembureau.eu/5-years-on/the-5c-approach/recarbonation/ Sanjuán, M.Á.; Andrade, C.; Mora, P.; Zaragoza, A. Carbon Dioxide Uptake by Cement-Based Materials: A Spanish Case Study. Appl. Sci. 2020, 10, 339. https://doi.org/10.3390/app10010339 Andrade C, Sanjuán MA. Updating Carbon Storage Capacity of Spanish Cements. Sustainability 2018;10:4806. https://doi.org/10.3390/su10124806	Miguel Angel Sanjuán	Spain	Rejected. The glossary includes terms that are applied by more than one chapter in the WG III AR6 report.	
12559	7	4	7	4	In Annex A: Glossary, page A - 7, after carbon stock definition, please add a new definition: "Carbonation Hydrated cement used in concrete or mortars naturally absorbs carbon dioxide during its lifetime, a physicochemical process known as carbonation, thus removing carbon from the atmosphere. This permanently locks carbon dioxide, providing a stable long-term carbon dioxide storage solution. The process can even boost concrete strength by increasing the density of its pore structure. (CEMBUREAU 2020; Sanjuán et al 2020; Andrade and Sanjuán 2018) See also Recarbonation". CEMBUREAU 2020. https://lowcarboneyconomy.cembureau.eu/5-years-on/the-5c-approach/recarbonation/ Sanjuán, M.Á.; Andrade, C.; Mora, P.; Zaragoza, A. Carbon Dioxide Uptake by Cement-Based Materials: A Spanish Case Study. Appl. Sci. 2020, 10, 339. https://doi.org/10.3390/app10010339 Andrade C, Sanjuán MA. Updating Carbon Storage Capacity of Spanish Cements. Sustainability 2018;10:4806. https://doi.org/10.3390/su10124806	MORA PERIS PEDRO	Spain	Rejected. The glossary includes terms that are applied by more than one chapter in the WG III AR6 report.	
42291	9	3	9	3	W.r.t. Annex A. Before the entry Climate projection, there is the indication "See also Policies (for climate change mitigation and adaptation)", I was unable to find the corresponding entries.	Raymond Zaharia	France	Noted, and corrected	
45707	9	16			It is necessary to determine from the start what "trasportation" refers to. Whether transpot of energy or of people. At page 6 line 9 transportation referes to "transportation of energy" while at page 9 line 18 is intended as transport of people. I would suggest to use i.e. mobility for the latter.	anna maria sempreviva	Denmark	Noted. Terms clarified where appropriate	

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response	
42293	10	37	10	37	<p>W.r.t. Annex A. Proposed new entry: Consistency between policies. (Placeholder for SOD)</p> <p>In the definition of "Emission scenario", one can read: "A plausible representation of the future development of emissions [...] based on a coherent and internally consistent set of assumptions about driving forces (such as demographic and socio-economic development, [...])"</p> <p>Overall, the word "consistency" appears 2 times in this Annex A, (while "consistent" appears also 6 times.) Considering the severe lack of consistency between policies of national governments and of international bodies, it seems to me policy relevant to add in this Annex an entry devoted to the statement: "Consistency between policies is a necessary condition of their efficiencies."</p> <p>Identifying and reporting the various inconsistencies between rules & regulations issued by different int'l bodies which may be sources of conflicting requirements slowing or precluding mitigation policies, should be considered as a priority task.</p> <p>* For instance, at the end of the 20th century, the IASB issued a new financial rule prescribing to Mark to market. (« MTM rule. » This unfortunate move disregarded the fact that, long before, MTM worsened the Great Depression.)</p> <p>Even with the slight revision of April 2009, (applying only to times of financial crisis), the drawbacks of this MTM rule do include increased attention to the "quarterlies", less good will for long term investment in non fossil sources of energy, and parasitic activities such as HF trading. (Often with a high fossil carbon content.)</p> <p>* Inconsistencies are also blatant between UNFCCC & WTO objectives, the latter contributing to increase the int'l traffic of goods, while the former wishes to decrease CO2 emissions resulting from shipping & displacement of products.</p>	Raymond Zaharia	France	Rejected. Thank you for your comment. While an important concept, this would be better explored in depth in the chapters rather than added as a glossary entry.	
42295	11	17	11	21	<p>W.r.t. Annex A. About decarbonisation: when the CO2 emissions from fossil fuels will be stopped, we do hope that the Earth crust will still include a lot of fossil carbon ! Therefore, it seems to me that the word "existence" should be replaced by "use" (or "utilization". English is not my "mother language" !)</p>	Raymond Zaharia	France	Noted. The existence here refers to the entities	
42297	11	17	11	21	<p>W.r.t. Annex A. It seems to me that decarbonisation is a... false friend ! Even when the anthropogenic perturbation of the climate system by our use of fossil fuels will be under control, we will still use a lot of (non fossil...) carbon: in our food, in our heat engines powered by biogas, in our building processes, in our fire places, Etc.</p> <p>When official reports or the press forget "fossil" when quoting "carbon", "decarbonisation" may appear as an inconsistent policy to the general public: by the way, decarbonisation may increase the uses of non fossil carbon !</p> <p>Rather, it is a policy aimed at a complete defossilization of our sources of energy.</p>	Raymond Zaharia	France	Noted. Decarbonisation is a well-established term used in the underlying literature. The second sentence in the definition clarifies that decarbonisation typically refers to a reduction of the carbon emissions associated with electricity, industry and transport, which addresses the reviewers comment	
42299	11	17	11	21	<p>W.r.t. Annex A. Statements supporting the 3 previous comments on decarbonisation:</p> <p>The Earth's climate system has an abundance of non fossil carbon.</p> <p>It is found principally in the form of carbonate (in combination with calcium) in many rocks and sediments as well as in the form of carbon dioxide (highly stable in combination with oxygen), which is found in the atmosphere and dissolved in the ocean.</p> <p>Non fossil carbon is likewise found totally or partially stripped of oxygen in wood, soil humus, living organisms, food, and in biogas or methane resulting from Power to gas techniques.</p> <p>Before the industrial era, oceanic and terrestrial carbon sinks worked as a balanced regime with the result that the concentration of atmospheric CO2 barely changed from the end of the last glacial period right up to 1850, rising only slightly from 265 to 280 parts per million (ppm).</p>	Raymond Zaharia	France	Noted. Decarbonisation is a well-established term used in the underlying literature. The second sentence in the definition clarifies that decarbonisation typically refers to a reduction of the carbon emissions associated with electricity, industry and transport, which addresses the reviewers comment	
42879	11	17	11	21	<p>W.r.t. Annex A. Furthermore, there are non fossil carbon emissions associated with electricity production (e.g. heat engines fired with wood or biogas). Since the emission factors of various sources of non fossil carbon are much lower than those of fossil fuels (4, 10, or 50 times lower [#], according to the use of gas, oil, or coal), the word "fossil" [carbon emissions] should be repeated in the 2nd sentence.</p> <p>[#] Cf. pages 17 to 20 of the following handbook (in french): Guide Ademe <http://www.23dd.fr/images/stories/Documents/PV/Ademe_Metro_Chapitre_2_Energie.pdf></p>	Raymond Zaharia	France	Noted. Decarbonisation is a well-established term used in the underlying literature. The second sentence in the definition clarifies that decarbonisation typically refers to a reduction of the carbon emissions associated with electricity, industry and transport, which addresses the reviewers comment	

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
42301	12	1	12	5	In Annex A, W.r.t. "Supply-side measures", the first sentence ("Policies and programmes for influencing how a certain demand for goods and/or services is met."), appears extremely weak. On a matter related to a threat on human beings future fate, the objective of public governance should not be of "influencing". A consistent public governance should preclude the huge losses and wastes of ressources, (in particular in OECD & BRICS countries), that result from aggressive marketing & advertising campaigns. The rest of this definition has a rather limited scope. (Only related to the energy sector.) See also the proposed new entry: "Reasonable human needs"	Raymond Zaharia	France	Rejected. Thank you for your comment. The glossary definition is not intending to be a judgment of the effectiveness of these policies, but a description of what they typically encompass
42881	12	6	12	9	In Annex A, W.r.t. "Demand-side management", the first sentence ("Policies and programmes for influencing the demand for goods and/or services."), appears again to be weak, while the rest of the definition has a limited scope. (Related to "reducing the demand for electricity and other forms of energy".) This wording completely miss the topic of marketing and advertising campaigns. (Cf. mottos like: "No limit !", or "Everything right now !") The resulting unreasonable consumer behaviours are sources of huge losses and wastes of ressources, (in particular in OECD & BRICS countries) See also the proposed new entry: "Reasonable human needs"	Raymond Zaharia	France	Rejected. Thank you for your comment. The glossary definition is not intending to be a judgment of the effectiveness of these policies, but a description of what they typically encompass
42303	13	13	13	18	W.r.t. Annex A. It seems to me policy relevant to complement the statement: "The choice of discount rate(s) is debated as it is a judgement based on hidden and/or explicit values.", by clearly indicating that the high discount rates currently in use may be detrimental to mitigation, since they are biasing cost comparisons between fossil [as well as fissile] sources of energy, on the one hand, and renewables ones on the other.	Raymond Zaharia	France	Rejected. The glossary is intended to reflect the definitions of terms used by authors in multiple chapters of the report. Further discussions on the implications of using different discount rates is better suited for an in-chapter discussion.
42305	13	19	13	22	W.r.t. Annex A. It may be worth to signal the large difference in this definition of Displacement w.r.t. to the one appearing page 9 (or 547), in Annex 1 of https://www.ipcc.ch/sr15 .	Raymond Zaharia	France	Noted. The definition of 'displacement' as included in the WG III glossary refers to its specific application in land system science. It is a different term than 'internal displacement' which was included in the Special Report on Global Warming of 1.5C
42307	16	36	16	42	W.r.t. Annex A. This definition of "Exergy" is of course physically correct. However the academic sentence "Exergy efficiency describes how much useful work can be performed by a particular energy flow in relation to the thermodynamic maximum possible." completely miss the important point of heat & work co-generation. The historic separation between 2 industrial sectors, (heat production and distribution on the one hand, & electricity production and distribution on this other), is a tragedy: in winter of northern or southern countries, it precludes ~6 months per year, to perform with 1 m3 of gas or 1 t of biomass almost the same output of heat & electric power, than with... 2 ! Overcoming the "thermodynamic maximum possible" would be achievable by avoiding (or forbidding ?), to produce heat without producing electric power at the same time. (See also my comment on "Mitigation measures" and the entry "Resource cascade")	Raymond Zaharia	France	Noted.
42309	18	1	18	1	W.r.t. Annex A. In the sentence "[...]food security explicitly includes nutrition within it dietary needs … for an active and healthy lifef...]" the words "dietary needs …for an active..." should be corrected.	Raymond Zaharia	France	Accepted.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
42311	21	39	21	39	<p>W.r.t. Annex A. Proposed new entry: Improper use of limited resources. (Placeholder for SOD) [This new entry is linked with the entry Remaining carbon budget.] Waste & losses of limited resources may result, inter alia, from insufficient or misleading information provided by suppliers. For instance, in 2018 a new smart phone featuring a 40 Mpixels camera was introduced in the consumer market. However most people cannot distinguish the difference in quality between a 300 dpi and a 150 dpi picture when printed in 6x4 inches format, & viewed at normal viewing distances. (Even printing a high quality poster of A1 size do not need more than 5 to 8 Mpixels !) The first smile of baby taken with a 40 Mpixels HD camera is nonsense & a huge waste of ressources. When shared on the internet, such improper use of devices contributes to the exponential growth in terms of Internet bandwidth & cloud storage capacity. In the absence of government & WTO regulations prescribing suppliers to document possible improper uses of their Products (and how to preclude them), the waste and losses of ressources & energy are unavoidable. (See also my comments on Demand- and supply-side measures and the proposed new entry Reasonable human needs, or Juste besoin in french.)</p>	Raymond Zaharia	France	Rejected. Thank you for your comment. While an important concept, this would be better explored in depth in the chapters rather than added as a glossary entry.
42313	24	28	24	32	<p>W.r.t. Annex A. It may be worth to document the size of the differences with LULUCF estimates, in National GHG Inventories that derive from these carbon dioxide (CO2) removals not considered as anthropogenic [...] (Or where such assessment can be found.)</p>	Raymond Zaharia	France	Rejected. Thank you for your comment. The glossary includes definitions to terms and aims to be as succinct as possible. These differences in estimations are explored in more detail in the underlying chapters, in particular in Chapter 7
42315	27	1	27	10	<p>W.r.t. Annex A. In the definition of Market failure, the following statement: Examples of factors causing market prices to deviate from real economic scarcity are environmental externalities, public goods, monopoly power, information asymmetry, transaction costs, and non-rational behaviour. carry a lot of prejudices: It implies, inter alia, that when economic agents are perfectly informed & have a rational behaviour, market prices do comply with economic scarcity. Whether this necessary condition is also sufficient... is an academic question of little interest, since such economic agents are rather scarce. This description of some causes of market failures carry a world vision which is problematic, since it misses: - the huge wastes deriving from a too pregnant supply side policy & associated practices of intrusive marketing & advertising (such wastes being a large fraction of our primary energy consumption.) - non rational behaviour of finance markets are not occasional failures, but usual consequences of collective thinking of traders.</p>	Raymond Zaharia	France	Noted thank you. This term reflects the definition of market failure as used in the underlying report, but does not encompass all factors
42317	28	15	28	19	<p>W.r.t. Annex A. The expression waste minimization processes does appears in this definition of Mitigation measures. However, it is 1 of the 2 occurrences of the word waste not related to food. [#] While it is important to consider the (huge & unfortunate) waste of food, the waste of primary energy (during the cascade from production steps yielding to final energy, and even more, during consumer actual use yielding to useful energy), is not quoted nor documented in this glossary. The entry Resource cascade does exist, but is not very fit to introduce the option of heat and power co-generation, which may allow to avoid most of the losses between primary & final energy. (See also my previous comment on "Exergy".) [#] 3 occurrences of waste are related to food. (Disregarding the list of references pages 42 to 50, which include 4 other occurrences of "waste".)</p>	Raymond Zaharia	France	Thank you for this suggestion. This is better explored within the chapters than in the glossary
42319	28	23	28	28	<p>W.r.t. Annex A. Mitigation measures is a very useful entry. I believe it should also mention such a high efficiency measure as heat and power co-generation. (Cf. my previous comment on Exergy.)</p>	Raymond Zaharia	France	Noted and considered. Please note that the definition is not intended to provide an exhaustive list of measures

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response	
42321	28	25	28	25	W.r.t. Annex A. The term primary energy in use here, (as well as in table 12.2 of chapter 12, together with final energy), should be defined in this annex, more explicitly than it is now in Resource cascade. The same applies to the third term of the cascade : useful energy. (=Final energy less waste & losses at end user level.)	Raymond Zaharia	France	Accepted. The definition of primary energy has been added to the glossary.	
42323	29	30	29	34	W.r.t. Annex A. For Net zero emissions, the words between brackets should not be removed (the brackets should be removed !) Otherwise, this definition may be wrong, since there is not any chance that overall emissions of GHG (natural or not) could be balanced by anthropogenic removals. There is no reason to maintain the contemplated differences with the definition appearing page 17 (or 555) in Annex 1 of https://www.ipcc.ch/sr15 If & when possible, two identical definitions are much better than 2 diverse.	Raymond Zaharia	France	Noted, the definition has been revised	
2253	32	40	32	40	In Annex A: Glossary, page A - 32, after Rebound effect definition, please add a new definition: "Recarbonation Concrete or mortars naturally absorbs carbon dioxide during its lifetime, removing carbon from the atmosphere and permanently locking carbon dioxide. This process provides a stable long-term carbon dioxide storage solution. During the life of a built structure, up to 25% of the process emissions related to the production of the cement can be absorbed (CEMBUREAU 2020; Sanjuán et al 2020; Andrade and Sanjuán 2018) See also Recarbonation". CEMBUREAU 2020. https://lowcarboneyconomy.cembureau.eu/5-years-on/the-5c-approach/recarbonation/ Sanjuán, M.Á.; Andrade, C.; Mora, P.; Zaragoza, A. Carbon Dioxide Uptake by Cement-Based Materials: A Spanish Case Study. Appl. Sci. 2020, 10, 339. https://doi.org/10.3390/app10010339 Andrade C, Sanjuán MA. Updating Carbon Storage Capacity of Spanish Cements. Sustainability 2018;10:4806. https://doi.org/10.3390/su10124806	Miguel Angel Sanjuán	Spain	Rejected. The glossary includes terms that are applied by more than one chapter in the WG III AR6 report.	
12561	32	40	32	40	In Annex A: Glossary, page A - 32, after Rebound effect definition, please add a new definition: "Recarbonation Concrete or mortars naturally absorbs carbon dioxide during its lifetime, removing carbon from the atmosphere and permanently locking carbon dioxide. This process provides a stable long-term carbon dioxide storage solution. During the life of a built structure, up to 25% of the process emissions related to the production of the cement can be absorbed (CEMBUREAU 2020; Sanjuán et al 2020; Andrade and Sanjuán 2018) See also Recarbonation". CEMBUREAU 2020. https://lowcarboneyconomy.cembureau.eu/5-years-on/the-5c-approach/recarbonation/ Sanjuán, M.Á.; Andrade, C.; Mora, P.; Zaragoza, A. Carbon Dioxide Uptake by Cement-Based Materials: A Spanish Case Study. Appl. Sci. 2020, 10, 339. https://doi.org/10.3390/app10010339 Andrade C, Sanjuán MA. Updating Carbon Storage Capacity of Spanish Cements. Sustainability 2018;10:4806. https://doi.org/10.3390/su10124806	MORA PERIS PEDRO	Spain	Rejected. The glossary includes terms that are applied by more than one chapter in the WG III AR6 report.	
42325	32	38	32	38	W.r.t. Annex A. Proposed new entry: Reasonable human needs [Juste besoin, in French.] (Placeholder for SOD) While this Annex A include 2 occurrences of human needs, there is not any reference to reasonable human needs. Even if this expression may be difficult to agree (The perception of reasonable human needs may differ according to various factors like age, location, and affluence), this should not result in missing the statement: Unreasonable human behaviours may result from unreasonable assessments of human needs. This discussion is not directly related to soberness (a term, by the way, not quoted either in this annex), since unreasonable behaviours induced by the huge domination of supply side policy and advertising, may result in improper use of limited resources (Cf. entry Remaining carbon budget & proposed new entry: "Improper use of limited resources".)	Raymond Zaharia	France	Rejected. The glossary includes terms that are applied by more than one chapter in the WG III AR6 report.	
42327	33	30	33	34	W.r.t. Annex A. This definition of Resource cascade is useful but not very fit to introduce the important option of heat and power co-generation. (See also my previous comment on Exergv.)	Raymond Zaharia	France	Noted	
42329	35	15	35	15	W.r.t. Annex A. The 4 characters > (i.e. greater than) should be replaced by > .	Raymond Zaharia	France	Accepted, corrected	

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
26131	98	1	127	20	Add reference Berger, A. et al., 2017a: Nuclear energy and bio energy carbon capture and storage, keys for obtaining 1.5°C mean surface temperature limit. International Journal of Global Energy Issues, 40(3/4), 240, doi:10.1504/IJGEI.2017.086622.	Herve Nifenecker	France	Thank you for your comment and suggested literature. Unfortunately it was not possible to identify in which chapter the comment was referring to.
12645	160	45	160	45	Reference not fulfilling: "Peters, S., 2016: The cold economy"	Marie Münster	Denmark	Noted. Unfortunately it is not clear which chapter this comment is referring to
1253					<p>results cited throughout Chapter 3 should be discarded, and not relied on in this WGIII report, is that most of the models relied on still have not been peer reviewed, they have not been adequately documented in material available to the public and to readers of this report, and the numerous key input assumptions have not even been made available in this first draft report in the form of tables of key input assumptions for each model. This report does not even reveal what the numerical assumptions are which define the various SSP scenarios for each model. Even "Annex C - Scenarios and Modeling Methods" does not include any numerical assumptions used in IAM runs. Not providing these materials to the readers of this critical report for the future of humanity is disgraceful and is not consistent with doing good science. Good science requires proving all key equations, databases and numerical input assumptions for all models relied on. How can you expect climate change policy makers to trust the results cited in Chapter 3 from dozens of IAMs if they don't even know what was assumed in each model? A large number of model runs like 900 does not make for a more robust set of findings, quite the contrary. Reporting on so many runs (e.g. 900) just confuses the reader of this draft, as it has confused IPCC reports in the past. So many runs even confuse the authors of this draft report. A few runs, carefully and thoroughly explained, using integrated assessment models with available public documentation where the input assumptions important for mitigating climate change are clearly presented, MIGHT be useful in helping policy makers to better understand the technical and economic issues which impact effective mitigation policy for climate change. Or they might not be useful, that is yet to be determined.</p> <p>Another reason why few if any IAM models will likely be useful for mitigation policy makers is because most do not have sufficient disaggregation of the key carbon emitting technologies in each key end-use sector of the economy so that robust technology-specific policies can be created for each relevant time period until when total carbon emissions must equal zero. An example of the need for greater disaggregation than most IAMs have is the necessity for useful models to disaggregate building space heating, cooling, hot water, and cooking demand from all present and future electrical appliances. This demand data must also be disaggregated by the type of energy source current supplying that demand such as natural gas, oil, wood, or electricity. In addition, the models must know how many buildings and which building types have useful space on roofs, or wherever on their property, to install solar cells for the site-specific production of electricity.</p> <p>3.It is not clear, however, that cost benefit analyses done at a very aggregate level for each sector of the economy as in most IAMs are really needed or able to educate policy makers about the relevant issues that arise when attempting to mitigate climate change. This implies that Integrated Assessment Models that attempt to perform cost effectiveness analyses of the type described in draft Chapter 3 may not be needed or useful at</p>	Richard Rosen	United States of America	Noted. Thank you for your comment. The FGD of Chapter 3 alongside Annex III undertook a detailed assessment and documentation of the IAMs used in the report with the underlying assumption. All data for each scenario assessed by the IPCC are publicly available on the AR6 scenarios data. Chapter 3 and Annex III make a clear distinction between the cost-benefit IAMs and cost-effectiveness IAMs and which findings are based on these types of models. Cross Working Group Box 3 contained in Chapter 3 undertakes a detailed assessment of the cost-benefit IAMs. Detailed and disaggregated models are assessed in the sectoral chapters of the report Chapter 6-11. Both Chapter 3 and the sectoral chapters assessment the differences between top-down models and bottom-up models. The relevant chapters also include a detailed assessment of the CDR methods, their role, side-effects, and feasibility. The most detailed assessment of CDR methods is included in Chapter 12.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
1255					<p>5.Unfortunately, since at least major parts of this draft of the next WGIII report are not structured in this useful way as described above, in particular Chapter 3 needs to be completely revised with most of its current contents eliminated. If the existing "literature" referred to in the draft Chapter 3 is weak on cost/benefit studies of mitigation scenarios assuming 1-2% discount rates, so be it. A lack of the relevant kinds of literature in this field does not justify basing this report on irrelevant literature and irrelevant model runs from the IIASA database. As described above, since so little time is available for the world to meet the Paris Accord temperature targets, not to speak of the UN's SDGs, one does not need to run long-term complex economic models with insufficient disaggregation in order to produce the kind of mitigation pathways that policy makers need to study and understand, before making relevant policies to achieve their mitigation goals. In a basic sense the general outline of a mitigation scenario as described above in #4 would lay out the basic outline of a "one-size fits all" plan, where many key details to flesh out such a plan would be regionally dependent. To repeat, climate change mitigation researchers do not need to use complex IAMs to develop regional mitigation plans when society only has about 20-30 years to implement such a plan in order to reach zero carbon emissions from fossil fuel uses.</p> <p>6.With regard to the usefulness and legitimacy of most if not all IAM results cited in chapter 3, their cost effectiveness methodology merely assumes that any decrease in GDP relative to a base case or some other case is a "cost" of the scenario with the lower GDP. Page 3-67 of Chapter 3 states that "If GDP and consumption in mitigation pathways fall below the baseline levels, they are reported as losses or macro-economic costs." However, this definition of cost makes no sense at all and further invalidates the 900 IAM results for cost-effectiveness calculations of mitigation pathways. A decrease or change in GDP may be due to many reasons, not just a change due to a different mitigation plan. For example, a decrease in GDP might be due to a different economic development plan such as achieving certain SDGs that has nothing to do with mitigating climate change. Secondly, an added cost of a mitigation plan would, in common sense language, usually show up as an increase in the GDP, not a decrease. Namely from a micro-economic perspective, in this situation, society would have to spend more money than the benefits or cost reductions to get the desired mitigation outcome if a mitigation measure were not cost effective. Namely, there would be a net cost for this mitigation outcome. Thirdly, a lower GDP as a result of mitigating climate change might just reflect a more efficient outcome, for example, a more efficient energy system. Thus, if one could better insulate buildings at little or no cost (free insulation), then less of the GDP would be spent on energy to heat the buildings, thus the GDP would decrease even though society and the individuals paying for heat would be much better off, at no or little cost. Since this underlying methodology for measuring "cost" in the methodology assumed for determining the cost effectiveness of mitigation policies and measures in IAMs is fatally flawed, this alone provides a sufficient reason why the IAM results using this flawed methodology must not appear or be relied on in this report.</p>	Richard Rosen	United States of America	Noted. Thank you for your comment. The FGD of Chapter 3 alongside Annex III undertook a detailed assessment and documentation of the IAMs used in the report with the underlying assumption. All data for each scenario assessed by the IPCC are publicly available on the AR6 scenarios data. Chapter 3 and Annex III make a clear distinction between the cost-benefit IAMs and cost-effectiveness IAMs and which findings are based on these types of models. Cross Working Group Box 3 contained in Chapter 3 undertakes a detailed assessment of the cost-benefit IAMs. Detailed and disaggregated models are assessed in the sectoral chapters of the report Chapter 6-11. Both Chapter 3 and the sectoral chapters assessment the differences between top-down models and bottom-up models. The relevant chapters also include a detailed assessment of the CDR methods, their role, side-effects, and feasibility. The most detailed assessment of CDR methods is included in Chapter 12. Finally, the FGD chapters have been edited and reduced in size where appropriate.
18345					Make sure that WG3 provides information for all scenarios, including 3.0C and 4.0C, together with net-zero emissions, 1.5C and 2.0C. Make sure this concept applies to all chapters. Current text on sectoral chapters put too much emphasis on net zero emissions scenario.	Kazuhiko Hombu	Japan	Noted. Thank you for your comment. The full set of scenarios categories cover these warming levels in the FGD of the report.
18457					<p>Renewable Energy.</p> <p>The major element supporting belief in the capacity of technical advance to help solve the climate problem is the potential of transition to renewable energy. In my critique of a previous IPCC Mitigation report (Trainer 2014) I tried to caution regarding the expectation that renewables could and would work miracles. Suffice it to say here that there is now a substantial literature questioning the capacity of renewable energy sources to substitute for fossil fuels reliably and at an acceptable cost. At least the coming report should represent this opinion, as a counter to the dominant tendency to assume that renewables are going to make a major contribution to dealing with the climate problem at a comfortable cost. This view is usually misled by the fact that the cost of producing one kWh by renewables might soon be lower than by use of fossil fuels. That is not crucial here; what matters is the cost per kWh delivered by renewable systems capable of meeting demand with high reliability despite the intermittency of solar and wind sources. Such systems would need very large expenditures on storage capacities and grid strengthening. (Palmer and Floyd, 2020.) One exploratory study of the cost of a fully renewable supply system for Australia based on hydrogen found that it would be a quite unaffordable proportion of GDP. (Trainer, 2017.)</p>	Ted Trainer	Australia	Noted. Thank you for your comment. Role of renewable energy is covered in the Chapter 3 with the discussion related to the Illustrative Mitigation Pathway IMP-Ren, as well as other parts of the chapter. It has also been covered in Ch6 in detail.

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18459					<p>Previous IPCC over-optimism.</p> <p>The IPCC has rightly been criticised in the past for giving a too optimistic impression of the scope of the climate problem and the possible solutions. It has at least implicitly indicated that the problem can be solved, and at an acceptable cost. A considerable literature disagrees with both these theses. They have encouraged complacency, especially by focusing attention on potential technical solutions and therefore not stressing the need to consider radical solutions involving lifestyle change and radical social restructuring, including the scrapping of the economic system.</p> <p>One element in this impression-giving issue is proceeding as if a 66% chance of achieving a target is acceptable. Many would insist that options which involve a one in three chance of bringing on catastrophic collapse in global ecosystems, social systems and population is a very long way from acceptable. We believe that the IPCC's previous presentations have encouraged undue complacency on this point.</p> <p>The position these comments derive from holds that technical fixes cannot solve the climate problem or the other major problems confronting us, such as resource depletion, general ecological destruction, the poverty and deprivation of billions in the Third World, resource wars and declining cohesion in rich societies. These problems are being generated by the commitment to ever-increasing affluence and GDP, which are essential elements in both the economic system and in Western culture. It follows that no solution is conceivable unless it involves major De growth to very radically different forms of settlement and economy, and value frameworks.</p> <p>Thus there are now several strands in an emerging movement arguing that global problems cannot be solved unless there is transition from industrialised, centralized, globalized, high-tech, resource intensive ways to social forms characterized by de growth to steady state economies, localism, municipalism, self-sufficiency, frugality and simpler lifestyles and systems. (See The Simplicity Institute 2020, and The Simpler Way, 2020.) It is argued that these alternative ways, evident in the Eco-village and Transition Towns movements, can achieve dramatic reductions in per capita resource demand while providing a high quality of life and without jeopardizing sophisticated science, R and D, medical standards etc. It is important that the coming Mitigation Report should at least make sure policy makers are aware of this option and thus are not left with the impression that they have no choice but to pursue supply side tech-fixes to climate and other global problems.</p>	Ted Trainer	Australia	Thank you for your comment. Many of these issues have been address in various chapters of the report such as: technology costs and feasibility (Chapters 2, 3, 6 and 12), sectoral chapters (Chapter 6-11), and demand chapter (Chapter 5).
20457					<p>there is a category one failure in the entire document, while chapters 4 & 6 are most affected: solar PV cost are simply wrong. In Krey et al. (https://www.sciencedirect.com/science/article/pii/S0360544218325039) the PV cost assumptions are displayed for all relevant IAMs with about 1150 USD/kW in 2050, while in 2020 the real utility-scale cost are half of that, but cost decline in the next 3 decades will come on top - see Vartiainen et al. (https://onlinelibrary.wiley.com/doi/full/10.1002/ptp.3189). This leads to the consequence that several major conclusions of IAMs, and thus of the entire report, are strongly distored, at best, if not wrong: First, high shares of renewables would be not affordable in time (this is in strong contradiction to Ram et al. (http://energywatchgroup.org/wp-content/uploads/EWG_LUT_100RE_All_Sectors_Global_Report_2019.pdf) and Bogdanov et al. (https://www.nature.com/articles/s41467-019-08855-1), see also Haegel et al. (https://science.sciencemag.org/content/364/6443/836); Second, nuclear energy and fossil CCS would be needed (which is not the case in the cost optimised scenarios in Bogdanov et al. and Ram et al.); Third, Power-to-X/CCU is not found by models since IAMs do not have low-cost electricity or even PtX routes are not available in IAMs (while this is a major element for a least cost energy system solution in Ram et al.); Fourth, BECCS is favoured while DACCS would be too costly (which is in contradiction to Breyer et al. (https://www.cell.com/joule/fulltext/S2542-4351(19)30413-1)). Major ESMs with highly renewables are in contradiction with these conclusions. Major ESMs are also able to show zero GHG emissions in 2050, while this state-of-the-art insights are hartly, or not at all, available in the entire report.</p>	Christian Breyer	Finland	Noted. Thank you for your comment. Role of renewable energy is covered in the Chapter 3 with the discussion related to the Illustrative Mitigation Pathway IMP-Ren, as well as other parts of the chapter. It has also been covered in Ch6 in detail.

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20459					scenarios with very high shares of renewables are missing in the entire report in particular in chapters 4 & 6. Knowledge about highly renewable energy systems is very weak in the entire report, despite the fact that about 400 journal articles exist on the topic - a perspective on the topic is available from Hansen et al. (https://www.sciencedirect.com/science/article/pii/S0360544219304967) referring to 180 articles on highly renewable energy system analyses and Breyer et al. (https://www.iaee.org/eeep/article/305). Both chapters 4 & 6 lack major literature and focus on IAMs while major insights and conclusions of highly renewables ESMs are practically ignored, however, some of them are in contradiction to IAM findings, which is not discussed in the entire report.	Christian Breyer	Finland	Noted. Thank you for your comment. Role of renewable energy is covered in the Chapter 3 with the discussion related to the Illustrative Mitigation Pathway IMP-Ren, as well as other parts of the chapter. It has also been covered in Ch6 in detail.
20461					Power-to-X, sector coupling, CCU, flexibility is of highest importance of low-cost renewable energy based energy systems, see for instance Hansen et al. (https://www.sciencedirect.com/science/article/pii/S0360544219304967); the problem is that IAMs are methodologically highly limited to represent this major trend, AND ESMs are practically ignored in the entire report, while the best developed ESMs are nowadays able to show that. Articles are available, but the respective chapters have major gaps in such literature. Just as an example, from the three internationally leading ESM teams on highly renewable energy system one can find only three references of the team with the most citations (Henrik Lund, Aalborg University; second most articles in the field), three articles of the team with the historical second most citations but in a negative context (Mark Jacobson, Stanford University, fourth most articles in the field) and two references (but not the most important in Nature Comms) for the team with the third most references (Christian Breyer, LUT University; most articles in the field - about 60). However, one can find many dozens of references of the IAM leaders. This means the primary aim of covering the existing literature on the topic - energy systems and transition options - is simply not reached. Why not inviting the scientific leaders in the ESM field to contribute a 10 page perspective on energy system transitions?	Christian Breyer	Finland	Noted. Thank you for your comment. The topics of Power-to-X, sector coupling, CCU, flexibility among others have been fully assessed in Chapter 6 on energy systems.
20531					Fig. 3.16 shows a structural imbalance of the IPx which requires a major revision. The entire class of global 100% RE scenarios is FULLY ignored, which is not acceptable. They are published in peer-reviewed journals, and are for at least one candidate submitted to the AR6 scenarios database, but no IP reflects this. Breyer et al. (https://www.iaee.org/eeep/article/305) shows an overview to all known global 100% renewable scenarios, while Ram et al. (http://energywatchgroup.org/wp-content/uploads/EWG_LUT_100RE_All_Sectors_Global_Report_2019.pdf) is uploaded and it covers the energy system in high detail. In Hansen et al. (https://www.sciencedirect.com/science/article/pii/S0360544219304967) one can find references to 180 articles on highly renewable energy system analyses. To emphasises this HUGE misery, the ESMs achieve 100% RE in 2050, the highest renewable scenarios does even not show something comparable in year 2100. Ram et al. can even show that the 100% RE 2050 system has the same specific energy cost as the present energy system. The central aim of AR6 to reflect the status of existing scientific literature is failed.	Christian Breyer	Finland	Noted. Thank you for your comment. Role of renewable energy is covered in the Chapter 3 with the discussion related to the Illustrative Mitigation Pathway IMP-Ren, as well as other parts of the chapter. It has also been covered in Ch6 in detail.
22399					This report stresses from time to time the options of CCS, BECCS, nuclear and hydrogen for zero or low carbon scenarios, however, stops short of assessing their technological maturity or viability for large-scale and commercial deployments for the foreseeable future. In fact, if put simply, there are still some uncertainties for practical implementation of CCS/BECCS projects in addition to cost burdens. Nuclear could be relatively more feasible if considering current progress in 3rd G and 4th G technologies with some demo projects having been put into operation. Hydrogen is also relatively promising with more and more FC-powered vehicles being commissioned into service.	Xiusheng Zhao	China	Noted. Thank you for your comment. The feasibility and scalability of technologies assessed in the report, based on the underlying literature, have been discussed in various chapters including Chapter3, 6 and 12.
26113					If the cost estimates for mitigation scenarios are based on such outdated market data as I pointed out above, it should be clearly noted that the cost estimates are based on already outdated market data (though it is still useful as a guideline).	Keiichiro Sakurai	Japan	Noted. Thank you for your comments. Details about these estimates can be found in Annex III of the report, alongside Chapters 3 and 6.
27077					The cost estimate for PV used in the IAMs are outdated. Capital expenditure(CAPEX) estimate around 1000USD/kWp @2050 is used in the referenced IAMs, as shown in the referenced Krey 2019 paper (https://www.sciencedirect.com/science/article/pii/S0360544218325039), in Figure 3. However, recent estimates are several times lower. For example, Vartiainen et al. expects CAPEX to be around 100-200EUR/kWp @2050 (https://onlinelibrary.wiley.com/doi/epdf/10.1002/pip.3189) for Europe. It should be clearly noted that the mitigation scenarios are based on such outdated estimates.	Keiichiro Sakurai	Japan	Noted. Thank you for your comments. Details about these estimates can be found in Annex III of the report, alongside Chapters 3 and 6.

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39057					<p>SPLIT of CCUS (COMMENT 3/6) : CCS versus CCU as climate mitigation options:</p> <p>CCS is seen worldwide as a technology in the global portfolio of mitigation options that can contribute to mitigation and is taken into account in many climate scenarios based on the Integrated Assessment Models (IAM's). However, significant drawbacks exist about CCS options amongst which the risks associated to geological storage, the possibility of leakages, long-term liability issues, problems with public acceptance of onshore storage locations and limited cost-effective storage capacity in some essential regions (Styring et al., 2011, Bruhn et al., 2016, Arning et al., 2019).</p> <p>To date, the IAM's have failed in simulating the complexity of the different CCU options to realize net zero or negative CO2 emissions (e.g. Detz and Zwaan, 2019). Consequently, CCU technologies are unfairly considered to have limited and predominantly indirect abatement potential and are not discussed as mitigation options in the different IPCC reports. As stated in the Annex C of this first order draft, IAM's are missing important dynamics, e.g. with regard to carbon dioxide removal (Smith et al. 2016), rapid technological progress in the renewable energy sector (Creutzig et al. 2017), actor heterogeneity, and distributional impacts of climate change and climate policy. This has given rise to criticism that IAM's lack credibility in set of crucial assumptions, among which stands out the availability of carbon dioxide removal technologies (Bednar et al. 2019; Anderson and Peters 2016). This recognized failure of the IAM's to represent specific technologies should not prevent the integration of updated scientific discussions on all existing important technologies to mitigate climate change. It should also be noted that Energy System Models (EMS) are able to simulate the major CCU routes and other specific technologies and therefore a discussion on EMS and on their key results should be added in the report (e.g. Ram et al., 2019, Krey et al., 2019).</p> <p>The capture and conversion of CO2 into valuable products require the use of important renewable energy sources, an aspect that is often considered as a drawback to use these technologies. However, the prices of the different renewable energy options as well as an adequate evaluation of the future evolution of these prices (especially the cost of the solar energy) is crucial to assess the viability and climate mitigation potential of CCU technologies (Creutzig et al., 2017, Breyer et al., 2019, Haegel et al., 2019, Vartiainen et al., 2019, Krey et al., 2019). Even if no exhaustive quantification exists today on the mitigation potential of CCU technologies, the key role of this concept should be considered as one building block in a portfolio of mitigation measures (e.g. GCI, 2016, Grüber et al., 2018, IEAGHG, 2019b, Detz and Zwaan, 2019). CO2 utilization will contribute to curbing CO2 emissions with an estimated potential impact of gigatons equivalent CO2 emissions, similar or even</p>	Célia Sapart	Belgium	Noted. Thank you for your comment. A detailed assessment of CCS and CCU is covered in Chapter 6 (Energy System).
39059					<p>SPLIT OF CCUS (COMMENT 4/6): Incentives and Policies</p> <p>Framing CO2 as a problem often translates into policies that hamper the implementation of technologies to decrease the amount of CO2 emitted into the atmosphere. Levänen and Hukkinen (2019) suggest that plurality in framing CO2 could lead to innovative ways and strategies to combat climate change.</p> <p>There are currently very few economic incentives for the deployment of CCS. In the future, however, regulation such as emission performance standards could make CO2 removal mandatory. Noteworthy, CCS is functional to a linear economy, whereas utilization of carbon dioxide is at the hearth of a circular economy and its strategic role will grow in the future (Zhu et al., 2019). For CCU, individual business cases are already providing incentives for different actors today. A higher price for emission allowances could further strengthen the incentives for both CCU and CCS (Bruhn et al., 2016, Castillo-Castillo 2019). CCU likely represents a promising perspective for contributing to climate mitigation efforts but considerations of CCU in climate scenarios and in politics need to account for the largely varying and technology specific features of each type of technology and sector. Moreover, the key role of CCU as a vector to move away from fossil fuel resources should be the first point highlighted.</p> <p>Hepburn et al, 2019 shows that broad policy and regulatory changes that may support the appropriate scale-up of CO2 utilization include creating carbon prices of around \$40 to \$80 per ton of CO2—increasing over time—to penalize CO2 emissions and to incentivize verifiable CO2 emissions reductions and removals from the atmosphere.</p> <p>The European SCO2T project concluded that CCU can make important contributions in Europe, by becoming a significant component in the future low-carbon circular economy and facilitating the energy transition (Wilson et</p>	Célia Sapart	Belgium	Noted. Thank you for your comment. A detailed assessment of CCS and CCU is covered in Chapter 6 (Energy System).

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39061					<p>SPLIT OF CCUS (COMMENT 5/6): Public acceptance:</p> <p>CCS projects have attracted considerable local opposition over the last decade (e.g. Brunsting et al., 2011; L'Orange Seigo et al., 2014). Therefore, using the term CCUS, especially considering the low public knowledge about CO2-based technologies (L'Orange Seigo et al., 2014; Perdan et al., 2017a), may transferred the negative vision of CCS to CCU and affect its perceptions and acceptance. A general public survey in Germany has demonstrated that CCU was perceived significantly more positively when it was properly considered (Arning et al., 2019).</p>	Célia Sapart	Belgium	Noted. Thank you for your comment. A detailed assessment of CCS and CCU is covered in Chapter 6 (Energy System).
39063					<p>SPLIT OF CCUS (COMMENT 6/6): Added value:</p> <p>In the case of CCS, the added value is negative due to the costs of capture and storage and the increased primary energy demand. In the case of CCU, added value can be positive as a result of the cost savings from fossil raw material reduction. If the capture costs can be minimized, CO2 can be given a value and transformed from a liability into an asset (Bruhn et al., 2016, Krey et al., 2019). The existing literature shows that the current benefits of CCU are numerous (VITO, 2018). CCU can:</p> <ul style="list-style-type: none"> • Decrease CO2 emissions at relatively short-term • Replace fossil or biobased feedstock • Defossilize the process industry and transportation sector • Store energy • Contribute to a circular economy • Create a revenue stream for CO2 abatement from fossil fuel use based on consumer demand for CO2-containing products. • Be an alternative for CCS • Improve Energy security • Make use of specific attributes of CO2 in commercially competitive applications • Remediate inorganic wastes from industrial processes • Sequester significant quantities of CO2 in building materials • Provide revenues to fund (partially) CCS projects • Reduce the complexity of chemical reaction pathways • Control the cost for the supply of fuels • Relocalize the energy supply 	Célia Sapart	Belgium	Noted. Thank you for your comment. A detailed assessment of CCS and CCU is covered in Chapter 6 (Energy System).

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
39065					<p>THE CONCEPT OF POWER TO X :In the first order draft of the AR6 WGIII, the discussion about alternative fuel largely focuses on hydrogen and very little on the other alternative fuels, e.g. power-to-fuel. Only the term “power to gas” is shortly cited once, but without further explanation or discussion while it is a broad and generic term that has various types of applications and implications (Mathiessen et al. 2015, Ram et al., 2019, Fasihi et al, 2019). According to its importance in the energy transition, an exhaustive definition of Power to fuel should be given in this chapter with a discussion on the availability of each type of alternative fuels in taking into account the timeline and sectors in which they could be used for.</p> <p>To reach the goal of net zero emissions, fossil fuel-based energy demand could be mainly replaced by renewable electricity (RE) (e.g. DENA, 2017, Ram et al., 2019). However, there are sectors such as aviation, shipping, heavy transportation, energy intensive industries for which hydrocarbons cannot be replaced by electricity easily, or physically not at all (e.g. Fasihi et al., 2017, Hepburn et al., 2019, SDSN & FEEM, 2019). Biofuel production is faced with resource limitations and conflicts with food production and, therefore, offers no sustainable substitute (Koizumi et al., 2015, Tomei et al., 2016). Net zero emissions could be achieved by a defossilization of the energy system, whereby carbon from fossil sources is replaced by that which is created synthetically and sustainably from CO2 with the aid of RE. These CO2-based fuels can be emission neutral and be used in the current fossil fuel-based infrastructure (DENA, 2017, Fasihi et al., 2017, Artz et al., 2019, CONCAWE, 2019).</p> <p>Power to fuel is the concept enabling the production of hydrocarbon fuels (e-fuels) using RE. Two types of fuels can be generated: 1) Synthetic gas (e.g. e-methane) so-called Power-to-Gas and 2) Liquid fuels (e.g. methanol, ethanol), so-called Power-to-Liquid. In both cases, CO2 and green H2 (i.e. hydrogen generated by the electrolysis of water with RE) produce e-fuel (e.g. Breyer et al., 2015, Sternberg and Bardow, 2015, Dimitrou et al., 2015, Fasihi et al., 2017, Anwar et al., 2020). These e-fuels can be stored, transported and use as such or to produce electricity again. Liquid e-fuels are easier (and relatively inexpensive) to store and transport compared to electricity. They can be kept in large-scale stationary storage over extended periods, and mobile storage in vehicle tanks, which can compensate for seasonal supply fluctuations and contribute to enhancing energy security (CONCAWE, 2019).</p> <p>Artz et al., 2019 has shown that the largest reduction in the absolute amount of greenhouse gas emissions could be achieved by coupling of highly concentrated CO2 sources from CO2-emitting sectors with carbon-free hydrogen or electrons from renewable power in so called “Power-to-fuel” scenarios.</p>	Célia Sapart	Belgium	Noted. Thank you for your comment. A detailed assessment of Power-to-x and renewables is covered in Chapter 6 (Energy System).
43575					<p>I am outstanding shocked that it seems that not a single IAM is able to model CCU and synthetic fuels/chemicals. Please double-check that! These topics are discussed since at least 10 years, and not a single IAM is adjusted to this major trend in sustainable energy systems!?! Three ESMS are able to do that, and also successfully. Ram et al. (http://energywatchgroup.org/wp-content/uploads/EWG_LUT_100RE_All_Sectors_Global_Report_2019.pdf) show that a zero GHG emission system is strongly based on Power-to-X (fuels, methane, etc.) and CO2 as raw material from DACCU. It is uploaded as LUT-ESTM to the AR6 scenario database, but obviously not used anywhere in the entire report, despite the fact that it is a zero GHG emission scenario in 2050, AND total energy system cost stay fully stable. Why such a scenario is ignored, while the used IAMs are even not able to model simple modern energy system routes? Other ESMS using CCU/PtX(fuels, methane) are Teske (https://www.springer.com/gp/book/9783030058425) and Pursiheimo et al. (https://www.sciencedirect.com/science/article/pii/S096014811831156X). A MASSIVE disclaimer at various positions in the entire report, in particular in chapters 2, 3, 4, 6, 10, 11 is needed that the IAMs have obviously methodological shortcomings so that they are not able to model attractive electricity-based routes which are needed for sustainable solutions in the energy system, in particular for transport.</p>	Christian Breyer	Finland	Thank you for your comment. The role of IAMs and their underlying assumptions and limitations are detailed in Ch3 and Annex III of the report.
43877					<p>In this report the treatment of climate futures is very schematic withough considering risk of impacts and associated 8global mean temperature thresholds for the transition to high risk (e.g. in burning ember diagrams). A key question by WGII also is how much mitigation is needed for adaptation to be successful. Both questions (avoidance of transitions to high risk and enabling successful adaptation) could be guiding principles in discussions of various mitigation futures.</p>	Hans Poertner and Elvira Poloczanska	Germany	Noted. Thank you for your comment. Linkages between adaptation and mitigation has addressed in the report.

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44503					Throughout the report, the use of CDR and (net) negative emissions is quite inconsistent. It would be preferable to make very clear that these are not the same, by distinguishing gross and net removals, showing early on that significant amounts of CDR are needed to reach net zero CO2/GHG. This should probably be supported by one or two figures early on, not only in form of a global pathway but also by a more conceptual figure similar to figure 2.10 in SR1.5. Furthermore, it would be good to highlight the volumes for both gross CDR and net negative emissions, so that it becomes clear that considerable amounts of CDR are needed just to reach and maintain net zero (making clear that 'CDR for net zero' is not a negligible quantity)	Oliver Geden	Germany	Accepted. The treatment of CDR has been harmonised throughout the report.
46161					This part of the AR6 is even more about complex systems dynamics and should explore a wider array of possible future scenarii, including those about unintended declines of material and energy fluxes or even systemic collapses (Meadows et al. 1972, Turner 2012, IEA 2018, 2020).	Jean-Marie FLOWER	France	Rejected. Thank you for your comments. This topics is not included in the approved outlines of the report.
46293					The IPCC does not correctly understand Article 2 Paris Agreement (and the human rights behind it). There is a legally binding obligation to achieve zero emissions faster than under the IPCC scenarios. This is because the probabilities that the IPCC considers acceptable are illegal. The same applies to the assumptions on climate sensitivity and overshoot (which is illegal). The IPCC also does not properly understand the relationship between ethics and universal law. Climate protection is about legal issues; all relevant ethical questions can be answered by interpreting existing legal norms on climate change. Thus, even the most promising basis for climate litigation is not properly understood. See https://www.mdpi.com/2071-1050/10/8/2812/htm and http://www.sustainability-justice-climate.eu/files/texts/Sustainability-Springer.pdf (Chapter 3) and Ekardt et al. 2020, submitted to Global Sustainability (see attachment)	Felix Ekardt	Germany	Thank you for your comment. A detailed discussion of legal aspects relevant to the report is covered in Chapter 14 on International Cooperation.
46307					Various passages in WG III seem to be based on naive neoclassical optimism regarding economic growth. The criticism of this is largely absent. Here as well as in general, the influence of economists in IPCC reports would have to be reduced. See http://www.sustainability-justice-climate.eu/files/texts/Sustainability-Springer.pdf (Chapter 1.4).	Felix Ekardt	Germany	Thank you for your comment. The role of IAMs and their underlying assumptions, limitations and framework are detailed in Ch3 and Annex III of the report.

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47271					<p>Power to heat, power to fuel and sector coupling seem to be largely missing from the IAMs, while electric vehicles and their integration into the grid seem to be severely limited.</p> <p>I might be wrong but if this is indeed the case this is extremely serious. It means that the IPCC uses outdated models that simply cannot deal in a meaningful way with the most promising and fast evolving low carbon technologies on the table.</p> <p>I'm more than happy to explain this opinion in more detail but I think my core expertise is in electric mobility in chapter 10. Others that I know who are far more knowledgeable than me on this topic are Christian Breyer, Mark Jacobson and Tom Brown. Especially Christian Breyer and his group might be valuable contributors to the AR6 WG3 and especially to chapter 6 and 4 (in that order). He often complains about the lack of attention for 100% RE models (e.g. https://doi.org/10.1016/j.energy.2019.03.092 and he's now working on a review article with 400 papers doing 100% RE scenarios) so now you can make him prove he can make a valuable contribution.</p> <p>I met Tom Brown because I contacted him on an article that I think is still relevant in this context: https://doi.org/10.1016/j.rser.2018.04.113</p> <p>Some resources that I consider important:</p> <p>Teske et al, Achieving the Paris Climate Agreement Goals, https://doi.org/10.1007/978-3-030-05843-2</p> <p>Jacobson et al, Matching demand with supply at low cost in 139 countries among 20 world regions with 100% intermittent wind, water, and sunlight (WWS) for all purposes, https://doi.org/10.1016/j.renene.2018.02.009</p> <p>Manish Ram et al, GLOBAL ENERGY SYSTEM BASED ON 100% RENEWABLE ENERGY - Power, Heat, Transport and Desalination Sectors http://energywatchgroup.org/wp-content/uploads/EWG_LUT_100RE_All_Sectors_Global_Report_2019.pdf</p> <p>I'm not saying these authors are right and the IAM scenarios currently dominant in the report are wrong but I am saying that modern and realistic modelling of energy systems with a high amount of wind and solar seem to be missing and it might be a good idea to cover that blind spot.</p> <p>My personal thought of what the perfect energy model system looks like is different still but if you are interested: Hoekstra et al, Creating Agent-Based Energy Transition Management Models That Can Uncover Profitable Pathways to Climate Change Mitigation, https://doi.org/10.1155/2017/1967645</p> <p>But it will take me a couple of years and a dozen PhDs before I will have turned that into a reality using the NEON project so that's not in time for AR6 unfortunately.</p>	Auke Hoekstra	Netherlands	Thank you for your comment. Assessment of these technologies is covered in the relevant chapters including Ch6 on energy and Ch12 on cross-sectoral topics. The role of IAMs and their underlying assumptions are detailed in Ch3 and Annex III of the report.
47927					There is a need for clarity on the methods used to calculate per capita emissions : national emissions only? Footprint accounting for trade and international transportation?	Valérie Masson-Delmotte	France	Accepted. Thank you for your comment. This has now been detailed in Chapter 2.
252					I have comments to the Annex A, see comments below.	Terje Aven	Norway	Noted, thanks
256					<p>To Annex A: Confidence</p> <p>The robustness of a finding based on the type, amount, quality and consistency of evidence (e.g., mechanistic understanding, theory, data, models, expert judgment) and on the degree of agreement across multiple lines of evidence. In this Special Report, confidence is expressed qualitatively (Mastrandrea et al., 2010).</p> <p>Comment:</p> <p>This is unclear and not accurate: "the robustness of a finding".</p> <p>Suggestion for alternative definition: A judgment of the strength of the knowledge supporting a statement (for example a probability statement), reflecting the type, amount, quality and consistency of evidence (e.g., data, information, models, expert judgment) and on the degree of agreement across multiple lines of evidence.</p>	Terje Aven	Norway	Rejected. Thank you for your comment. The definition of confidence is consistent with the way the IPCC reports use the term. It is used consistently in the Special Reports as well as all three Working Group contributions to the AR6

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
258					<p>To Annex A: Evidence Data and information used in the scientific process to establish findings. In this report, the degree of evidence reflects the amount, quality and consistency of scientific/technical information on which the Lead Authors are basing their findings.</p> <p>Suggestion: Data, information and justified beliefs used in the scientific process to establish findings. In this report, the degree of evidence reflects the amount, quality and consistency of scientific/technical data, information and justified beliefs on which the Lead Authors are basing their findings. Comment: 'justified beliefs' should be added. Results from a risk assessment can be viewed as evidence, and is better characterized as justified beliefs than data and information.</p>	Terje Aven	Norway	Rejected. Thank you for your comment. The definition of evidence is consistent with the way the IPCC reports use the term. It is used consistently in the Special Reports as well as all three Working Group contributions to the AR6
260					<p>To annex A: Knowledge</p> <p>Comment: The glossary should define knowledge as it is a key concept in climate change research and analysis. Suggestion: Two types of knowledge: Know-how (skill) and know-that of propositional knowledge (justified beliefs). (SRA 2015) The justified beliefs are based on data, information, models, testing, argumentation, etc. SRA (2015) Glossary Society for Risk Analysis - www.sra.org/resources</p>	Terje Aven	Norway	Rejected. Thank you for your comment. The glossary includes terms related to knowledge, including different types of knowledge such as Local knowledge and Indigenous knowledge
262					<p>To annex A: Likelihood The chance of a specific outcome occurring, where this might be estimated probabilistically. Likelihood is expressed in this Special Report using a standard terminology (Mastrandrea et al., 2010).</p> <p>Comment: this is not a proper definition as it refers to a chance which is not defined, and the meaning of "estimated probabilistically" is not clear. A probability is not defined in the glossary. The definition is based on an unfortunate mixture of concept and its measurement. See critique and suggestions for solutions in Aven and Renn (2015) and Aven (2019). Suggestion for alternative definition: Likelihood/probability A measure for representing or expressing uncertainty, variation or beliefs, following the rules of probability calculus (SRA 2015). It is differentiated between classical, frequentist and subjective probabilities/likelihoods, precise and imprecise (see SRA 2015, Aven and Renn 2015, Aven 2019) Aven, Terje (2019). Climate change risk – what is it and how should it be expressed?. Journal of Risk Research. ISSN 1366-9877. s. 1-18. Aven, T. and Renn, O. (2015) An evaluation of the treatment of risk and uncertainties in the IPCC reports on</p>	Terje Aven	Norway	Rejected. Thank you for your comment. The definition of likelihood is consistent with the way the IPCC reports use the term. It is used consistently in the Special Reports as well as all three Working Group contributions to the AR6

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
264					<p>To annex A: Risk</p> <p>The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Relevant adverse consequences include those on lives, livelihoods, health and wellbeing, economic, social and cultural assets and investments, infrastructure, services (including ecosystem services), ecosystems and species.</p> <p>In the context of climate change impacts, risks result from dynamic interactions between climate related hazards with the exposure and vulnerability of the affected human or ecological system to the hazards. Hazards, exposure and vulnerability may each be subject to uncertainty in terms of magnitude and likelihood of occurrence, and each may change over time and space due to socioeconomic changes and human decision-making.</p> <p>Comments: this sentence is not accurate as for example the vulnerability concept reflects also uncertainty: Hazards, exposure and vulnerability may each be subject to uncertainty in terms of magnitude and likelihood of occurrence, and each may change over time and space due to socioeconomic changes and human decision-making.</p> <p>Suggestion for alternative text: Hazards, exposure and impacts are each subject to uncertainty, and the related risk characterizations may change over time and space due to socioeconomic changes and human decision-making.</p> <p>It should be added that a risk characterization includes</p> <ul style="list-style-type: none"> -Specified events and their impacts (consequences) -Likelihoods/probability (precise or imprecise) 	Terje Aven	Norway	Rejected. Thank you for your comment. There has been a comprehensive coordination effort across the AR6 to ensure the definitions related to risk are consistent across the three Working Groups. The current definitions accurately reflect how the term is used in the reports.
266					<p>To annex A: Risk assessment</p> <p>The qualitative and/or quantitative scientific estimation of risks.</p> <p>Comment: estimation is a too narrow concept</p> <p>Suggestion for alternative definition: The qualitative and/or quantitative scientific process of understanding and characterizing risk. Or Systematic process to comprehend the nature of risk, express and evaluate risk, with the available knowledge (SPA 2015)</p>	Terje Aven	Norway	Rejected. Thank you for your comment. There has been a comprehensive coordination effort across the AR6 to ensure the definitions related to risk are consistent across the three Working Groups. The current definitions accurately reflect how the term is used in the reports.
268					<p>To annex A: Risk management</p> <p>Plans, actions, strategies or policies to reduce the likelihood and/or magnitude of adverse potential consequences, based on assessed or perceived risks.</p> <p>Comment: risk management should not be restricted to "reducing" - for that purpose we just refer to risk reduction</p> <p>Suggestion for alternative definition: Plans, actions, strategies or policies to handle risk such as prevention, mitigation, adaptation or sharing Or Activities to handle risk such as prevention, mitigation, adaptation or sharing (SPA 2015)</p>	Terje Aven	Norway	Rejected. Thank you for your comment. There has been a comprehensive coordination effort across the AR6 to ensure the definitions related to risk are consistent across the three Working Groups. The current definitions accurately reflect how the term is used in the reports.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
270					to annex a: Risk perception The subjective judgment that people make about the characteristics and severity of a risk. Suggestion: The subjective judgment that people make about a risk. Comment: Why restrict the judgment to the "characteristics and severity of a risk"?	Terje Aven	Norway	Rejected. Thank you for your comment. There has been a comprehensive coordination effort across the AR6 to ensure the definitions related to risk are consistent across the three Working Groups. The current definitions accurately reflect how the term is used in the reports.
272					to annex A: Risk trade-off The change in portfolio of risks that occurs when a countervailing risk is generated (knowingly or inadvertently) by an intervention to reduce the target risk (Wiener and Graham, 2009). Suggestion to clarify: The phenomenon that intervention aimed at reducing one risk can increase other risks or shift risk to another population or target (SRA 2015)	Terje Aven	Norway	Rejected. Thank you for your comment. There has been a comprehensive coordination effort across the AR6 to ensure the definitions related to risk are consistent across the three Working Groups. The current definitions accurately reflect how the term is used in the reports.
274					to annex A: Uncertainty A state of incomplete knowledge that can result from a lack of information or from disagreement about what is known or even knowable. It may have many types of sources, from imprecision in the data to ambiguously defined concepts or terminology, incomplete understanding of critical processes, or uncertain projections of human behaviour. Uncertainty can therefore be represented by quantitative measures (e.g., a probability density function) or by qualitative statements (e.g., reflecting the judgment of a team of experts) (see Moss and Schneider, 2000; IPCC, 2004; Mastrandrea et al., 2010). Comments: the reasons for the incomplete knowledge indicated are just examples Suggestion for an adjustment: A state of incomplete knowledge. It may have many types of sources, from limited or imprecision in the data to ambiguously defined concepts or terminology, incomplete understanding of critical processes, or uncertain projections of human behaviour. Uncertainty can for example be described by a probability distribution, with related confidence judgments	Terje Aven	Norway	Rejected. Thank you for your comment. The definition of uncertainty is consistent with the way the IPCC reports use the term. It is used consistently in the Special Reports as well as all three Working Group contributions to the AR6
276					to annex A: Vulnerability The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. Comments: need to highlight stronger that this is conditional an event (hazard) This is a qualitative definition, something should be said also about how to measure vulnerability Suggestion: The propensity or predisposition to be adversely affected by the occurrence of a hazard. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. Vulnerability can for example be described by a conditional probability distribution given the occurrence of a hazard, with associated confidence judgments	Terje Aven	Norway	Rejected. Thank you for your comment. The definition of vulnerability is consistent with the way the IPCC reports use the term. It is used consistently in the Special Reports as well as all three Working Group contributions to the AR6
777					I review all of the chapters. I think all of the chapters presented a good actions for future but it is better we have volume for public due to all of content may be understood by people and may be by some of scientists.	Manuchehr Farajzadeh Asl	Iran	Noted, thanks for your positive comment

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
1251					<p>INITIAL COMMENTS ON THE FIRST DRAFT OF THE AR6 WGIII REPORT By Dr. Richard A. Rosen, Tellus Institute (retired) – approved as an official expert reviewer February 15, 2020</p> <p>For now, I will focus my comments on the first drafts of Chapters 1,3,9 and 17 of the WGIII Report, but they are relevant to most of the other chapters. One important aspect of these comments is what they imply for how to write the first draft of the Executive Summary for the entire AR6 WGIII report over the next few months. As you can see from these comments, I believe that very major changes are needed to the first draft when preparing the second draft. The need for change in the WGIII report goes back to the major problems made in prior WGIII reports, especially the AR5 report:</p> <p>1..Chapter 1 – “Introduction and Framing” – omits at least one critical topic which needs to be discussed very early in this chapter. That topic is the issue of what is an appropriate discount rate and what significance do discount rates have IF one intends to perform and report cost/benefit or cost effectiveness type analyses to produce potential climate change mitigation pathways. Surprisingly, the term “discount rate” currently does not appear at all in Chapter 1, and only appears in the titles of two of the references at the end of this chapter. The term only appears once in Chapter 3 but in a trivial context. This is rather shocking since the choice of an appropriate numerical value for a discount rate for use when making cost effectiveness calculations is the single most important input assumption for the entire modeling analysis. Thus the assumptions for discount rates and the relevance of discount rates must be made explicit to the policy makers and the general public to whom the WGIII report is addressed. At least a half to one page of chapter 1 needs to be devoted to discussion of the discount rate issue in relation to the model runs reported in chapter 3.</p> <p>Yet, in the October 2018 Special Report on 1.5 degree C Scenarios, the discount rate issue became a big issue partly at my insistence as it has been before in the history of performing economic analyses of mitigating climate change and other economic analyses of environmental issues. In fact, one of the references for Chapter 3 (and to Chapter 9), the Emmerling, et al, paper, is very useful in describing some of the issues and impacts of different discount rates for such economic analyses. Since the issues surrounding the discount rate concept, such as the moral issues raised, are critical in public policy reports such as IPCC reports, there must be an extensive discussion of the moral and economic issues involved early in Chapter 1 in the Second Draft of the <u>WGIII Report</u> because it is one of the most important “framing” issues. Remember the famous Stern/Nordhaus</p>	Richard Rosen	United States of America	Noted
1961					No comment	Ronaldo Seroa da Motta	Brazil	Thank you.
3057					In order to make the report more understandable, please define all acronyms at first mention. E.g: the acronym AFOLU is first introduced on page 7 line 28 but its meaning is given on page 8 line 6; the meaning of the acronym CCS first inserted on page 13 line 23 is given in the FAQ, page 53... and so forth.	Manuela Milli	Italy	Accepted.
3065					When the word “trade-off” is used in a non-technical meaning do you think it could be replaced by a synonym? This might make the text more fluent.	Manuela Milli	Italy	Taken into account and implemented where possible
3073					I find the chapters reviewed well-written and informative. I regret that time is too short for me to provide further comments, and I hope that my input proves to be useful.	Manuela Milli	Italy	Noted, thank you for your comments

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5049					<p>I think there are some misunderstandings in whole chapters around the several concepts such as "transition", or "public". As for the transition, the concept which Geels and his colleagues discussed (2002,2005,2016,2018, etc), was exactly and nicely written in Chapter 1: that reads: Explicit frameworks of transition analysis identify interacting processes at three broad levels, which also align with different levels of economic behavior and associated theories: a common component is that major transitions usually need to overcome political resistance in the middle ("meso") level of economic rules and regulations (the socio-technical regimes governing specific sectoral markets), as well as macro-level infrastructure and innovation systems. These in turn interact with social transformations, so as to ensure 'just transitions'. (Chap1-p5-L7).</p> <p>None of the authors in other chapters followed this definition. They wrote their own definition or impression. Every author has to review in this regard. If some specific fields have their own definition of "transition", authors have to write clearly the differences between the two. The same can be pointed out about the concept of the "public", which means "the collective body of individuals". In chapter 1, the authors here clearly distinguished the public which means the collective body of individuals, and individuals (or consumers). But in other chapters (exclude chapter 5), the authors could not recognize the concept of the public, they only could recognize the consumer, or individuals who could take actions in the context of "behavioural change" or "changing lifestyles".</p>	Midori Aoyagi	Japan	Noted. Cross-chapter discussions on transitions have led to more cross-references and standardisation in the use of the term
5957					<p>the overall report underestimates the environmental and economic pernicious effect from bad waste management practices particularly in the developing world. For instance, many countries lack of lithium recycling - therefore - installation of solar panels and promotion of electric vehicles can be even harmful in terms of climate change mitigation. In fact, non-recycled lithium and plastic waste (such comes from PVs and EVs) are hasardeous, hence destroy biosphere and its capacity to absorb emissions! At least a chapter on waste treatment needs to be in. A general comment: a lot of emphasis is given to external references rather than to the actual case studies. However, references can be based either on inaccurate data or on deterministic assumptions (not all the peer-reviewed journals avoid bad quality articles). A focus on empirical case studies conducted for the IPCC would be of a greater value than adding up external references.</p>	Belyi Andrei	Estonia	Thank you for your comment. The report outline has been approved by the IPCC plenary in Montreal in September 2017 and therefore a new chapter on waste treatment cannot be added at this stage. Lifecycle assessment with regards to mitigation options is provided where possible in the report, including waste. Please see chapter 8 and 11 in this report. The approved outline also includes the need for case studies, more of which have been included in the second order draft

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
9927					<p>The references quoted in my comments are detailed below (1st half because of size limit):</p> <p>Agostini, A., Giuntoli, J., Boulamanti, A., 2013. Carbon accounting of forest bioenergy (JRC Technical Report). European Commission, Joint Research Centre, Ispra, Italy.</p> <p>Armenteras, D., Espelta, J.M., Rodríguez, N., Retana, J., 2017. Deforestation dynamics and drivers in different forest types in Latin America: Three decades of studies (1980–2010). <i>Global Environmental Change</i> 46, 139–147. https://doi.org/10.1016/j.gloenvcha.2017.09.002</p> <p>Baudry, J., Pointereau, P., Seconda, L., Vidal, R., Taupier-Letage, B., Langevin, B., Allès, B., Galan, P., Hercberg, S., Amiot, M.-J., Boizot-Szantai, C., Hamza, O., Cravedi, J.-P., Debrauwer, L., Soler, L.-G., Lairon, D., Kesse-Guyot, E., 2019. Improvement of diet sustainability with increased level of organic food in the diet: findings from the BioNutriNet cohort. <i>The American Journal of Clinical Nutrition</i> 109, 1173–1188. https://doi.org/10.1093/ajcn/nqy361</p> <p>Bellassen, V., Luyssaert, S., 2014. Carbon sequestration: Managing forests in uncertain times. <i>Nature</i> 508, 153–155. https://doi.org/10.1038/506153a</p> <p>Bellora, C., Bureau, C., 2016. How green is organic? Indirect effects of making EU agriculture greener (Presented at the 19th Annual Conference on Global Economic Analysis, Washington DC, USA). Global Trade Analysis Project (GTAP), Department of Agricultural Economics, Purdue University, West Lafayette, IN.</p> <p>Braun, M., Fritz, D., Weiss, P., Braschel, N., Büchsenmeister, R., Freudenschuß, A., Gschwantner, T., Jandl, R., Ledermann, T., Neumann, M., Pözl, W., Schadauer, K., Schmid, C., Schwarzbauer, P., Stern, T., 2016. A holistic assessment of greenhouse gas dynamics from forests to the effects of wood products use in Austria. <i>Carbon Management</i> 7, 271–283. https://doi.org/10.1080/17583004.2016.1230990</p> <p>Clark, M., Tilman, D., 2017a. Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice. <i>Environ. Res. Lett.</i> 12, 064016. https://doi.org/10.1088/1748-9326/aa6cd5</p> <p>Clark, M., Tilman, D., 2017b. Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice. <i>Environ. Res. Lett.</i> 12, 064016. https://doi.org/10.1088/1748-9326/aa6cd5</p> <p>Gattinger, A., Muller, A., Haeni, M., Skinner, C., Fliessbach, A., Buchmann, N., Mäder, P., Stolze, M., Smith, P., Scialabba, N.E.-H., Niggli, U., 2012. Enhanced top soil carbon stocks under organic farming. <i>PNAS</i> 109, 18226–18231. https://doi.org/10.1073/pnas.1209429109</p> <p>Geist, H.J., Lambin, E.F., 2002. Proximate Causes and Underlying Driving Forces of Tropical Deforestation. <i>BioScience</i> 52, 143. https://doi.org/10.1641/0006-3568(2002)052[0143:PCAUDF]2.0.CO;2</p> <p>Haddaway N.R., Hedlund K., Jackson J.E., Kätterer T., Lugato E., Thomsen J.K., Jørgensen H.B., Isberg</p>	Valentin Bellassen	France	Thank you for these references. They have been considered by the authors of the relevant chapters

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
9929					<p>The references quoted in my comments are detailed below (2nd half because of size limit):</p> <p>Poeplau, C., Don, A., Vesterdal, L., Leifeld, J., van Wesemael, B., Schumacher, J., Gensior, A., 2011. Temporal dynamics of soil organic carbon after land-use change in the temperate zone – carbon response functions as a model approach. <i>Global Change Biology</i> 17, 2415–2427. https://doi.org/10.1111/j.1365-2486.2011.02408.x</p> <p>Rogissart, L., Foucherot, C., Bellassen, V., 2019. Estimating greenhouse gas emissions from food consumption: methods and results. I4CE, Paris, France.</p> <p>Roux, A., Dhôte, J.-F., Achat, D., Bastick, C., Colin, A., Bailly, A., Bastien, J.-C., Berthelot, A., Bréda, N., Cauria, S., Carnus, J.-M., Gardiner, B., Jactel, H., Leban, J.-M., Lobianco, A., Loustau, D., Meredieu, C., Marçais, B., Moisy, C., Schmitt, B., 2017. Quel rôle pour les forêts et la filière forêt-bois françaises dans l'atténuation du changement climatique ? Une étude des freins et leviers forestiers à l'horizon 2050. https://doi.org/10.13140/RG.2.2.20800.12805</p> <p>Searchinger, T.D., Wiersenus, S., Beringer, T., Dumas, P., 2018. Assessing the efficiency of changes in land use for mitigating climate change. <i>Nature</i> 564, 249. https://doi.org/10.1038/s41586-018-0757-z</p> <p>Smith, P., 2014. Do grasslands act as a perpetual sink for carbon? <i>Global Change Biology</i> 20, 2708–2711. https://doi.org/10.1111/gcb.12561</p> <p>Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B.L., Lassaletta, L., Vries, W. de, Vermeulen, S.J., Herrero, M., Carlson, K.M., Jonell, M., Troell, M., DeClerck, F., Gordon, L.J., Zurayk, R., Scarborough, P., Rayner, M., Loken, B., Fanzo, J., Godfray, H.C.J., Tilman, D., Rockström, J., Willett, W., 2018. Options for keeping the food system within environmental limits. <i>Nature</i> 562, 519. https://doi.org/10.1038/s41586-018-0594-0</p> <p>Thomassen, M.A., van Calster, K.J., Smits, M.C.J., Iepema, G.L., de Boer, I.J.M., 2008. Life cycle assessment of conventional and organic milk production in the Netherlands. <i>Agricultural Systems</i> 96, 95–107. https://doi.org/10.1016/j.agsy.2007.06.001</p> <p>Tuomisto, H.L., Hodge, I.D., Riordan, P., Macdonald, D.W., 2012. Does organic farming reduce environmental impacts? – A meta-analysis of European research. <i>Journal of Environmental Management</i> 112, 309–320. https://doi.org/10.1016/j.jenvman.2012.08.018</p> <p>Valade, A., Bellassen, V., Magand, C., Luyssaert, S., 2017. Sustaining the sequestration efficiency of the European forest sector. <i>Forest Ecology and Management</i> 405, 44–55. https://doi.org/10.1016/j.foreco.2017.09.009</p> <p>Valade, A., Luyssaert, S., Vallet, P., Njakou Djomo, S., Jesus Van Der Kellen, I., Bellassen, V., 2018. Carbon costs and benefits of France's biomass energy production targets. <i>Carbon Balance Manage</i> 13, 26</p>	Valentin Bellassen	France	Thank you for these references. They have been considered by the authors of the relevant chapters
12913					Too many pre-AR5 references should be avoided. Some of them maybe no longer relevant, or even applicable.	Prashant Goswami	India	Partially accepted. The assessment is based on the most up to date and available literature, focusing on literature that is not addressed in AR5. In most cases, this will focus on post-AR5 references, but in some instances older literature is included to provide a comprehensive assessment.
13505					The FOD report generally does not use "geoengineering." This is helpful, as CDR and SRM have little in common and there grouping usually reduces clarity.	Jesse Reynolds	Netherlands	Noted, thanks for your positive comment.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
13699					<p>I do not see the standards of uncertainty/likelihood communication presented in the chapters (not even in the first one nor in Annex B (the glossary that defines key concepts)). It seems that the classic approach has to use the verbal lexicon used in previous iteration of the reports (from "Exceptionally unlikely" to "Virtually certain" (Mastrandea et al., 2010). To ensure an accurate communication of likelihoods., it is essential to provide readers with a table describing the lexicon and its associated numerical probability range (e.g., unlikely is used for probabilities between 10% and 33%). Previous research showed that providing a table of reference can help people better interpret the uncertainty associated with the different claims (Budescu, Broomell, & Por, 2009; Budescu, Por, & Broomell, 2012; Budescu, Por, Broomell, & Smithson, 2014).</p> <p>The IPCC could go further, and even provide percentage range together with the verbal lexicon. Providing numerical probability ranges together with the verbal ones in the text directly could help writers and readers make better predictions and avoid some biases. For example, the term "unlikely" is often used to characterise the most extreme event from a distribution, instead of, any outcome that has a probability below 33% (Juanchich & Sirota, 2017).</p> <p>Furthermore, globally, more could be done to improve readers' perceptions of uncertainty, likelihood and risks throughout the chapters of the report. I outline below a few points that could be taken into account to improve the communication of uncertainty in the reports.</p> <p>REFERENCES</p> <p>Budescu, D. V., Broomell, S. B., & Por, H. H. (2009). Improving communication of uncertainty in the ipcc reports. <i>Psychological Science</i>, 20, 299-308. doi: http://dx.doi.org/10.1111/j.1467-9280.2009.02284.x</p> <p>Budescu, D. V., Por, H.-H., & Broomell, S. B. (2012). Effective communication of uncertainty in the ipcc reports. <i>Climatic Change</i>, 113, 181-200. doi: 10.1007/s10584-011-0330-3</p> <p>Budescu, D. V., Por, H.-H., Broomell, S. B., & Smithson, M. (2014). The interpretation of ipcc probabilistic statements around the world. <i>Nature Climate Change</i>, 4, 508-512. doi: 10.1038/nclimate2194</p> <p>Juanchich, M., & Sirota, M. (2017). How much will the sea level rise? Outcome selection and subjective probability in climate change predictions. <i>Journal of Experimental Psychology: Applied</i>, 23, 386-402. doi: 10.1037/xap0000137</p>	Marie Juanchich	United Kingdom (of Great Britain and Northern Ireland)	Thank you for your comment. The IPCC uncertainty language has been elaborated in supporting documentation including the guidance note to authors which is available here: https://www.ipcc.ch/site/assets/uploads/2017/08/AR5_Uncertainty_Guidance_Note.pdf
13701					<p>Avoid using alternative uncertainty terminology, especially best not to use the term "possible". The reports include the term "possible" on quite a few occasions whereas this term should be avoided. Possible is for example used sparsely in chapters 1 and 2 (about 10 times), but the frequency increases to 32 instances in chapter 3 and 23 in chapter 4. In some of those cases, "possible" is used in lieu of the recommended 33%-66% probability term: "as likely as not" or "as likely as unlikely" (Mastrandea et al., 2010). In fact the term "as likely as not" or "as likely as unlikely" that characterise a wide range of probabilities (33%), is mostly absent from the reports and is not used a single time in chapters 3 and 4 for example.</p> <p>"Possible" is particularly ambiguous because it refers to a number of meanings: including "alternative" (as in "possible futures") or realistic (it is not possible to stay below 1.5°C). "Possible" can also refer to the minimal or maximal outcome that could happen (best or worst case scenario, which are typically unlikely), or to a 50% likely event (Juanchich, Sirota, 2017). If writers use "possible" to convey a 50% probability, then they should maybe revert to the usage of "as likely as not", but if they use it as characterising the best or worst possible outcome, then, they need to be explicit about it as readers may believe that they are 50% likely otherwise.</p> <p>REFERENCE</p> <p>Juanchich, M., & Sirota, M. (2017). How much will the sea level rise? Outcome selection and subjective probability in climate change predictions. <i>Journal of Experimental Psychology: Applied</i>, 23, 386-402. doi: 10.1037/xap0000137</p>	Marie Juanchich	United Kingdom (of Great Britain and Northern Ireland)	Noted. The use of uncertainty language has been checked and standardised across the report

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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: https://www.ipcc.ch/report/ar6/wg3/downloads/drafts-and-reviews								
Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
13703					<p>Briefing writers to review their work by paying extra attention to their use of quantitative ranges (e.g., between 10 and 20 cm) could be useful. When formulating quantitative predictions, authors may have been tempted to predict wider ranges so that they can increase the likelihood associated with their claims (e.g., saying "the temperature increase is likely between 0°C and 2°C", instead of "the temperature increase is as likely as not between 0°C and 1.5°C"). However, writers should trade carefully the width of the interval they predict for certainty because, readers perceive wider predictions as conveying MORE uncertainty (instead of less) compared to narrower predictions (Lohre, Juanchich, Teigen, Sirota, & Shepherd (2019).</p> <p>Writers may have tried to stay clear of middle probabilities because the term "as likely as not" is long and complicated - see below some recommendations on terms that could be used to replace this particular term.</p> <p>Lohre, E., Juanchich, M., Teigen, K. H., Sirota, M., & Shepherd, T. (2019). Climate scientists' wide prediction intervals may be more likely but are perceived to be less certain. <i>Weather, Climate and Society</i>.</p>	Marie Juanchich	United Kingdom (of Great Britain and Northern Ireland)	Noted. The use of uncertainty language has been checked and standardised across the report. IPCC reports apply a common approach and calibrated language for developing expert judgments and for evaluating and communicating the degree of certainty in findings of the assessment process. This common approach is outlined in: << Mastrandrea M.D., et al. (2010) Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties. Intergovernmental Panel on Climate Change (IPCC). Available at https://www.ipcc.ch >>. The same guidance has been applied in AR6 to ensure consistency across IPCC products.
13705					<p>Adapting the standard uncertainty communication lexicon.</p> <p>Using positively framed uncertainty quantifiers instead of negative ones would be a great improvement (e.g., using "there is a small probability" instead of "it is unlikely"; and using "evenly likely" instead of "as likely as unlikely").</p> <p>Negative expressions of uncertainty are perceived as advice not to take action and hence they trigger less cautious decisions (e.g., "it is unlikely there will be a landslide" will lead to less evacuations than "there is a small probability there will be a landslide" (Teigen & Brun, 1999; Juanchich et al., in press). The use of positive terms would be better as well because positive terms are the norm, most common way to express uncertainty whereas negative ones tend to mark changes or disruptions; this is evidenced by a form of positivity bias in the language of uncertainty (Juanchich, Teigen & Villejoubert, 2010).</p> <p>The negative lexicon is also problematic because it reduces climate action when it is used to describe climate change consequences (e.g., "the sea is unlikely to rise 2 meters" implies that it is not needed to worry about that).</p> <p>REFERENCES</p> <p>Juanchich, M., Teigen, K. H., & Villejoubert, G. (2010). Is guilt 'likely' or 'not certain'? Contrast with previous probabilities determines choice of verbal terms. <i>Acta Psychologica</i>, 135, 267-277. doi: 10.1016/j.actpsy.2010.04.016</p> <p>Juanchich, M., Shepherd, T. G., & Sirota, M. (in press). Negations in climate-change uncertainty lexicon affect framing perspective, decision making and trust. <i>Climatic Change</i>.</p> <p>Teigen, K. H., & Brun, W. (1999). The directionality of verbal probability expressions: Effects on decisions, predictions, and probabilistic reasoning. <i>Organizational Behavior and Human Decision Processes</i>, 80, 155-190.</p>	Marie Juanchich	United Kingdom (of Great Britain and Northern Ireland)	Thank you for your comments. IPCC reports apply a common approach and calibrated language for developing expert judgments and for evaluating and communicating the degree of certainty in findings of the assessment process. This common approach is outlined in: << Mastrandrea M.D., et al. (2010) Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties. Intergovernmental Panel on Climate Change (IPCC). Available at https://www.ipcc.ch >>. The same guidance has been applied in AR6 to ensure consistency across IPCC products.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
15725					The way the whole report is written is of difficult lecture, and it takes much time. Getting the whole picture of the report means trying to understand the interrelationships of all the chapters, they way they related to others, and the real meaning of each phrase. My suggestion is that readability should be enhanced and required reading time reduced, so that much more people can understand the content of the report.	EDUARDO PEDRO FRACASSI	Argentina	Noted, thank you for your suggestion. Cross-chapter efforts are underway to enhance links between chapters while at the same time ensuring the chapters can be read as a standalone part of the wider report. The length of the chapters is also being considered.
15727					<p>The whole report has many recommendations for people switching to a "plant based diet" for reducing CO2, NO2 and CH4 emissions. The FAO recently published "FAO sets the record straight on flawed livestock emission comparisons—and the livestock livelihoods on the line" where it states: "Hence, we cannot compare the transport sector's 14% as calculated by the IPCC, to the 14.5% of livestock using the life cycle approach.", so that the recommendation to switch to plant based foodsmight be based on a flawed comparison: "However, more than 820 million people are suffering from hunger and even more from nutrient deficiencies. Meat, milk and eggs are much sought after to address malnutrition. Out of the 767 million people living in extreme poverty, about half of them are pastoralists, smallholders or workers relying on livestock for food and livelihoods. The flawed comparison and negative press about livestock may influence development plans and investments and further increase their food insecurity."</p> <p>The WHO has recently retired its former support to the EAT Lancet diet, low in proteins, based on health issues and other reasons. For example: British Medical Journal BMJ reports WHO withdraw support for the "Planetary Diet" https://www.bmj.com/content/365/bmj.11700, so there seems to be some discussion on whether such a diet would be applicable to all the world's population and whether it is indeed healthy. I checked the WHO recommended diet at https://www.who.int/en/news-room/fact-sheets/detail/healthy-diet and there is no reference on recommended protein or carbohydrate intake. There are other critics who state that the "EAT Lancet report not backed by rigorous science: https://www.nutritioncoalition.us/news/eatlancet-report-one-sided The US Dietary Guidelines, one key pillar of the EAT Lancet report, is also questioned: https://www.nutritioncoalition.us/there-is-concern-about-the-dietary-guidelines Stating that "low meat diets are healthier" needs to be supported by research. For example, this article states that "Unless vegans regularly consume foods that are fortified with these nutrients, appropriate supplements should be consumed. In some cases, iron and zinc status of vegans may also be of concern because of the limited bioavailability of these minerals." Others state "The reduced mortality from cancer among those not eating meat is not explained by lifestyle related risk factors, which have a low prevalence among vegetarians. No firm conclusion can be made about deaths from ischaemic heart disease. These data do not justify advice to exclude meat from the diet since there are several attributes of a vegetarian diet apart from not eating meat which might reduce the risk." cited from Risk of death from cancer and ischaemic heart disease in meat and non-meat eaters BMJ 1994; 308 doi: https://doi.org/10.1136/bmj.308.6945.1667 (Published 25 June 1994) BMJ 1994;308:1667 https://www.bmj.com/content/308/6945/1667.abstract Countries like UK and Brazil are following Australia's work to diminish emissions from livestock and have vowed to reach "carbon neutral beef" production: In the UK, the NFU states "The NFU has reiterated that improvements in productivity, carbon capture and renewable energy production are the most effective ways to reach agricultural net zero targets, as part of its ambition to</p> <p>Glossary: Please do not use the definitions of afforestation and reforestation from the KP, where they have been defined with regard to accounting purposes and lack ecological and managerial coherence. For example, applying the definition from the glossary, all re-establishment of forests in Europe would be reforestation because at some point in time after the last glaciation the respective area did carry forest, Please use a definition based on the definitions used in forest sciences and forest management (e.g. included in FAO FRA (http://www.fao.org/3/a-am665e.pdf), or compiled by forest experts (https://efi.int/sites/default/files/files/publication-bank/2018/r_06.pdf)). They define reforestation as being done on land that still is considered as forest (no land-use change) in contrast to afforestation, being done on land that historically did not carry forests or that had been converted to other land uses</p>	EDUARDO PEDRO FRACASSI	Argentina	Thank you for your comment. Discussions related to plant based diets have been carefully assessed in the report. This includes discussions in Ch7 and Ch5 assessing the literature on this topic.
17343					<p>Glossary: Please do not use the definitions of afforestation and reforestation from the KP, where they have been defined with regard to accounting purposes and lack ecological and managerial coherence. For example, applying the definition from the glossary, all re-establishment of forests in Europe would be reforestation because at some point in time after the last glaciation the respective area did carry forest, Please use a definition based on the definitions used in forest sciences and forest management (e.g. included in FAO FRA (http://www.fao.org/3/a-am665e.pdf), or compiled by forest experts (https://efi.int/sites/default/files/files/publication-bank/2018/r_06.pdf)). They define reforestation as being done on land that still is considered as forest (no land-use change) in contrast to afforestation, being done on land that historically did not carry forests or that had been converted to other land uses</p>	Joachim Rock	Germany	Thank you for your comment. To ensure consistency between IPCC reports, the definitions of afforestation and reforestation in the glossary are consistent with those used in the Special Report on Climate Change and Land.

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
17345					Please apply one definition for afforestation, reforestation and forest restoration consequently throughout the report. including when evaluating or referencing literature. As it is now, different definitions are used and this leads to a high variability in the estimates and assessments provided here. For example, at one place the definitions from the KP are used (which are way off from the definitions used e.g. in forest sciences and forest management), at another place reforestation is subsumed in forest restoration, natural and virgin forests are distinguished and differentiated at another place, someplace reforestation is defined to be done after land use change, other definitions explicitly exclude land-use change and define reforestation as done on lands that were just temporarily not covered by trees, e.g. following a clearcut harvest or a large-scale disturbance. I strongly suggest to use definitions from the forest and forest management sciences, e.g. included in FAO FRA (http://www.fao.org/3/a-am665e.pdf), or compiled by forest experts (https://efi.int/sites/default/files/files/publication-bank/2018/ir_06.pdf). Please do not use definitions from frameworks where formalities were more important than biological or natural situations (e.g., the differentiation in the KP definitions is practically worthless for mitigation planning). If you want the assessments to be correct, you want to use but one definition. If you want the results to be applicable in the real world, you want to use a definition coherent with the understanding in forest sciences and forest management.	Joachim Rock	Germany	Accepted. Use of terminology has been harmonised as far as possible.
18041					Overall, for a FOD a good report, feels better balanced on CCS than AR5 and SR1.5. Well done all!	Tim Dixon	United Kingdom (of Great Britain and Northern Ireland)	Thanks for your positive comment
18451					<p>Unfortunately we only became aware of the opportunity to offer input a few days before the deadline so the following notes refer to themes we would have wanted to document at length if more time had been available. The hoped is that the editors of the Report will agree that it is desirable that the Report should draw attention to the following themes, which we believe have not been appropriately recognised in previous reports.</p> <p>In general we understand the importance of the IPCC's Mitigation Report reflecting the weight of evidence, as indicated by references to supporting research on the points being made. However with respect to the main point we wish to draw attention to this is not crucial. We are arguing that far more attention needs to be given to a line of thought on the mitigation issue which has been almost entirely neglected, yet which we see as the most important one to be attended to. We hope that IPCC editors can take some steps to remedy this, by at least giving this theme a prominent position in the coming Mitigation report. (An effort to ensure this regarding an earlier IPCC Mitigation Report had no effect. Trainer, 2007.)</p>	Ted Trainer	Australia	Noted, authors will consider topics and issues related to mitigation based on the latest available literature

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18453					<p>Main theme.</p> <p>Almost all of the discussion of the major global problems now threatening us focuses only on supply side solutions, that is on how to deal with the problems involved in maintaining inputs to a globalised, industrialised, high-tech society characterised by extremely high consumption of resources and impacts on ecosystems. This directs attention to how to produce and consume resources more efficiently, technical advance, substitution of renewable for traditional energy sources, recycling etc. The underlying taken-for-granted assumption is that maintaining and increasing affluent "living standards" and GDP is possible and desirable, indeed crucial, and need not be questioned.</p> <p>However over the past fifty years there has accumulated a huge amount of "limits to growth" literature which many now recognise completely invalidates the foregoing perspective. This beginning point leads to the conclusion that the major problems cannot be solved by effort to enable sufficient supply, and must therefore be considered from the demand side. That is, solutions to sustainability problems will not be found unless ways of dramatically reducing consumption are found, solutions which go far beyond attempting to meet existing demand and to maintain existing socio-economic systems. Yet the overriding goals in virtually all countries (Bhutan is an exception) are limitless increases in affluence and in economic growth; that is to increase levels of production and consumption as fast as possible, and without limit. There is now rapidly growing recognition of this need for reductions requiring system change, evident in the emergence of the "De growth" movement.</p> <p>Few understand the magnitude of the De growth that would be required to enable a sustainable economy that all the world's people could live in. There is a considerable literature showing that rich world per capita levels of resource use would have to be reduced to the region of 10% or less of their present levels. (Alexander and Rutherford, 2020.) This cannot be done in the present form of economy, which is founded on growth and the market principle, and associated elements such as the freedom of corporations and the owners of capital to invest in whatever will maximise their profits. These principles determine that most of the world's people are locked into forms of "development" which determine that their resource wealth flows out to the benefit of corporations and rich world supermarket shoppers, and delivers little or no benefit to them. (Trainer 2019, Leahy, and the "Post-development" literature.)</p> <p>The common response to these themes, evident in previous IPCC reports, is that technical advance will make it possible for affluent "living standards" and limitless economic growth to continue, because it will cut the</p>	Ted Trainer	Australia	Partially accepted. These discussions are reflected in the revised Second order draft
18455					<p>CCS, etc.</p> <p>It is assumed here that the large amount of literature pointing to the difficulties involved in CCS and related technical solutions needs no reinforcement. These uncertainties should be stressed along with the fact that most of the strategies claiming that the atmospheric carbon levels can be kept to sustainable levels assume that very large quantities of carbon can be extracted from the atmosphere later in this century. The technologies capable of doing this on the scale required have not been shown to exist and there is at least considerable doubt that they can be developed. The IPCC needs to think careful about how optimistic a message it delivers.</p>	Ted Trainer	Australia	Partially accepted. The risks of large-scale adoption of carbon dioxide removal technologies are discussed in chapter 12
20481					<p>CCUS' is a highly misleading wording and requires major revision. Correct is to separate 'CCU' and 'CCS'. These two aspects are COMPLETELY different, since CCU describes the reuse of CO2 (for point sources), while even CO2 direct air capture is included as DACCU. CCU of renewables sources (e.g. pulp & paper industry, or renewable energy based DAC) is part of a zero GHG emission system and also required earlier throughout the transition. CCS is used later, in particular for negative CO2 emissions. Literature for a clear separation are Breyer et al. (https://www.cell.com/joule/fulltext/S2542-4351(19)30413-1) and Bruhn et al. (https://www.sciencedirect.com/science/article/pii/S1462901116300508). This aspect requires major revision in separation of CCUS. Please also notice that many use Power-to-X (PtX) synonymus to CCU (see also Breyer et al. for that), this should be better reflected in the entire chapter.</p>	Christian Breyer	Finland	Thank you for your comment. These concepts have been separated as far as possible in the report, where the literature makes a distinction

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20529					the wording 'decarbonisation' for the transport sector is physically and chemically wrong and shall be adjusted by 'defossilisation'. This affects the entire report and several chapters. The point is hydrocarbons are most likely still used in the transport sector, in particular in the transport modes marine and aviation, but based on either biofuels or synthetic fuels. In any case there are still hydrocarbon fuels used, but not anymore with fossil carbon, in particular for the Power-to-fuels route using CO2 via direct air capture. 'Decarbonisation' however is <u>physically and chemically wrong</u>	Christian Breyer	Finland	Rejected. Thank you for your comment. Decarbonisation is a term used in the literature. The use of the term is also consistent with the IPCC glossary definition of the term.
20533					knowledge about PV is low throughout the entire report, in particular in chapter 4 and most prominently in chapter 6. Obviously no PV expert contributed to chapter 6, otherwise such low quality in all PV aspects in chapter 6 could not be explained. How to fix such a major failure in the team composition for chapter 6? WG III will receive huge critique, if the low level of PV is not fixed, in particular in chapter 6. Please have in mind, there are studies that PV will become the MOST important energy supply technology from mid-century onwards, in <u>Nature in Science - and then such a disaster in chapter 6. Action is needed</u>	Christian Breyer	Finland	Thank you for your comment. An assessment of PV is included in various chapters of the report, including Ch2, Ch6 and Ch12
20547					In multiple places the term "climate mitigation" is used. This doesn't make much sense as climate cannot be mitigated. It should be "climate change mitigation". I know that "climate mitigation" is widely used by the scientific community without confusion about its meaning, but I think that in a report such as AR6 this should be <u>avoided</u> .	Vassilis Daioglou	Netherlands	Noted, harmonised where possible
22401					The carbon budgets for 2 degree and 1.5 degree have been mentioned in the whole report, one major concern is that, whether the consistency has been well maintained across these three working group reports, and even between AR5 and AR6, particularly for the 2-degree budget space. It is suggested that, some fundamental texts or background information should be presented somewhere appropriate to highlight possible evolutions or updates ever since TAR, to enable the audience to have a good and systematic understanding of this important <u>topic</u>	Xiusheng Zhao	China	Partially accepted. Cross-WG coordination has taken place regarding carbon budgets to ensure consistency across the reports.
22937					Atmospheric CO2 is not an emissions issue. We have tried and spent \$2.8 over 30 years. We have a 16% drop in USA emissions since 2006, 21% in Europe since 1990. However atmospheric carbon dioxide was still increasing, the rate of rise is increasing and the residence time is increasing. Stop this emissions solution which has not worked and won't work. https://actascientific.com/ASAG/pdf/ASAG-03-0393.pdf	Dave White	United States of America	Thank you for your comment. IPCC reports provide an assessment of the latest available science related to climate change. It identifies where there is agreement in the scientific community on topics related to climate change, and where further research is needed. Trends in atmospheric CO2 emissions are further explored in this report in Chapter 2: Emissions trends and drivers.
22945					Northern Hemisphere (NH) forests consume 2.6 Gt yr ⁻¹ (2.6 billion tons per year) of carbon dioxide. We have 36 Gt yr ⁻¹ (36 billion tons per year) in emissions. This is not what lowers Mauna Loa in the NH summer with more economic activity and more CO2 emissions. http://www.eeb.cornell.edu/goodale/2002%20GoodaleEcolAppl.pdf	Dave White	United States of America	Thank you for your comment. IPCC reports provide an assessment of the latest available science related to climate change. It identifies where there is agreement in the scientific community on topics related to climate change, and where further research is needed. The role of sources and sinks are explored throughout this report. The role of forests is further assessed in Chapter 7: Agriculture, Forestry and Other Land Use. The physical scientific basis of the climate system is also assessed in detail in IPCC WG I reports

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
22947					The WG II SR 1.5 report "Mitigation" is garbage. Their solution wont work. https://cctruth.org/expert_review_SR1.5_mitigation.pdf	Dave White	United States of America	Thank you for your comment. IPCC reports assess the science related to climate change. The Special Report on Global Warming of 1.5C cited more than 6000 scientific references and involved the dedicated contribution of thousands of expert and government reviewers worldwide
22949					Use of highly or otherwise likely is not proper science. No published manuscript uses these terms. You must use % probability. Also if you don't use my comments in your final AR6 report then I will perform expert review and send it to 1500 email addresses including all the media.	Dave White	United States of America	Thank you for your comments. IPCC reports apply a common approach and calibrated language for developing expert judgments and for evaluating and communicating the degree of certainty in findings of the assessment process. This common approach is outlined in: << Mastrandrea M.D., et al. (2010) Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties. Intergovernmental Panel on Climate Change (IPCC). Available at https://www.ipcc.ch >>. This outlines the two metrics for communicating the dgree of certainty in findings: 1) Confidence in the validity of a finding, expressed qualitatively, and 2) Quantified measures of uncertainty in a finding expressed probabilistically. 'Likelihood' as used in IPCC reports provides calibrated language for describing quantified uncertainty, and each likelihood term used in the reports correspond to a probabilistic estimate.
25585					Many Chapter Executive ummaries are missing the {} callouts, making it very hard to check for treacability to the chapters.	Sarah Connors	France	Accepted. Callouts now added with <u>appropriate chapter links</u>
28339					consistent use of either developing "countries" or "economies"	Hoy Yen Chan	Malaysia	Thank you for your comment. This has been harmonised across the report .
28363					All chapters are very comprehensive reviews and very informative. However, some of the chapters are too long. Perhaps some of the very basic information could be introduced in brief but the detailed descriptions to be elaborated at the end of the chapter as "FAQ".	Hoy Yen Chan	Malaysia	Accepted. Chapter lengths reduced where possible without removing scientific assessments of relevant topics.
28365					Some chapters consist "knowledge gap", some with "research gap", some with section conclusions. Though each chapter is stand alone, not sure would be good to consider consistency of structure. Maybe can consider to add FAQ foe each chapter.	Hoy Yen Chan	Malaysia	Accepted. Harmonised throughout the report to ensure chapters use the same <u>subheadings for these topics</u>
29977					Please check all the units.	RAEHYUN KIM	Republic of Korea	Accepted. Checked
30915					My overall impression of the chapters I reviewed is that they are very balanced and nuanced in terms of CCUS technologies, especially when compared with other mitigation options. The current FOD delivers a more complete and balanced view of CCUS than either AR5 or SR1.5.	Jasmin Kemper	United Kingdom (of Great Britain and Northern Ireland)	Thank you for your positive comment
33819					Ensure consistency in the way the terms 'transition' and 'transformation' (and related derivatives) are used.	Debra Roberts	South Africa	Accepted. Checked for consistency

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
33827					In every element of the assessment presented there must be a clear climate link - there are sections in some chapters where the climate link is not immediately obvious.	Debra Roberts	South Africa	Accepted. Chapters redrafted to provide a stronger climate link
33839					Many chapters are still reviews rather than assessments.	Debra Roberts	South Africa	Noted. Chapters redrafted to provide assessments rather than reviews
33841					The report must make clear the distinction between development and sustainable development - sustainable development is not a synonym for development.	Debra Roberts	South Africa	Accepted. This is addressed in the Second order draft. A new x-chapter box on sustainable development is added to address this
36999					Terms like equity, equality, inequality are used in various chapters in various ways, somewhere to mean equity an fairness (in allocation) while some others have used to mean equity (distribution according to level of need) in terms of gender, poverty....	Joyashree Roy	Thailand	Thank you for your comment. Terminology has been checked to ensure consistency in how to treat these concepts throughout the report.
37035					Cross chapter referencing need to improve in SOD	Joyashree Roy	Thailand	Accepted. Cross-chapter links strengthened in the SOD
37051					The reference mentioned has many upto date information relevant for the ocean sector based mitigation potential and Blue economy which is almost missing in WGIII report. Ocean as a solution to climate change: five opportunities for action Report Washington DC, World resources institute. http://www.oceanpanel.org.climate .	Joyashree Roy	Thailand	Thank you for your comment. Chapter 12 includes assessment on ocean-based CDR methods
38751					Please use consistent language when referring to the temperature goals from Article 2 of the Paris Agreement. There are no "targets" written in Article 2, but rather goals.	Julian Reyes	United States of America	Accepted. References to the Paris Agreement checked
39067					<p>LIST OF REFERENCES FOR THE COMMENTS ON CCUS AND POWER TO X: • Aldaco et al., 2019, Science of the Total Environment, 663, 738-753.</p> <ul style="list-style-type: none"> • Ampelli et al., 2015: CO2 utilization: an enabling element to move to a resource and energy-efficient chemical and fuel production, Phil.Trans.R.Soc.A, 373. • Anderson and Peters, 2016, Science, 354, 182–183. • Anwar et al., 2020, J. of Env. Manag., 260, 110059. • Arning et al. 2019, Energy Policy, 125, 235–249. • Artz et al., 2019: Sustainable Conversion of Carbon Dioxide: An Integrated Review of Catalysis and Life Cycle, Assessment, Chem. Rev., 118, 2, 434-504. • Ball and Weeda, 2015, International Journal of Hydrogen, 40/25, 7903-7919. • Bednar et al. 2019, Nat. Commun., 10, 1783. • Bodénan et al., 2014, Minerals Engineering, 59, 52-63. • Breyer et al., 2015, Energy Procedia, 73, 182-189. • Breyer et al., 2019, Joule, 3, 2053-2057. • Bruhn et al., 2016, Environmental Science & Policy, 60, 38–43. • Brunsting et al., 2011, Int. J. Greenhouse Gas Control 5, 1651–1662. • Byrnolf et al., 2018, Renewable and Sustainable Energy Reviews, 81/2, 1887-1905. • Castillo-Castillo, 2019, Policy analysis and recommendations for EU CO2 utilisation policies. In: CEST2017 15th International Conference on Environmental Science and Technology, Rhodes, Greece. • CCES, 2019: Carbon Utilization – A vital and effective pathway for decarbonization, Center for Climate and Energy Solutions. • Chen et al., 2016, J. of Cleaner Production, 124, 350-360. • CONCAWE, 2019: A look into the role of e-fuels in the transport system in Europe (2030–2050) (literature review), CONCAWE. • Creutzig et al. 2017, GCB, Bioenergy. • Cuéllar-Franca and Azapagic, 2015, J.CO2.Utili., 9, 82-102. • Daggash et al., 2018, Sustainable Energy Fuels, 2, 1153-1169. • DENA, 2017, The potential of electricity-based fuels for low-emission transport in the EU: An expertise by LBST and dena (German Energy Agency). • Detz and Zwaan, 2019, Energy Policy, 133, 110938. • Deutz et al., 2018, Energy Environ. Sci., 11, 331. • Di Maria et al. 2020: Environmental assessment of CO2 mineralisation for sustainable construction materials 	Célia Sapart	Belgium	Thank you for these references. They have been considered by the authors of the relevant chapters

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Comment ID	From Page	From Line	To Page	To Line	Comment	Reviewer	Country	Response
39111					In Chapter 1, page 8 line 36 to line 43, the sentence "It is crucial however to devise these responses by keeping into the pictures all potential trade-offs and synergies" is very important and relevant for international policies on financing and investment (as summarised in subsection 1.4.4 on page 25) for climate change mitigation and adaptation, especially for developing countries. This report should consider the possible options available, for example for each of the four main consumption (/end-use) drivers of AFOLU, buildings, transport and industry; as listed in the approved outline "Sector specific barriers, policies, financing, and enabling conditions" I make this comment without reading the relevant chapters and only viewing the chapter table of contents; Chapters 7 AFOLU (no subsection heading on financing and investment), 9 Buildings (9.9.4 and 9.9.5 includes financing discussions), 10 Transport (no section heading on financing and investment), or 11 Industry (11.6 does include topics related to financing and investment). It may be that the topics are discussed within other subsection headings, however, I think it is important to highlight financing (and investment) as a distinct subsection topic, consistently across chapters 6 to 11. The reader should not have to do a search for the term "financing" to find the relevant information. This topic should not be left to Chapter 15 only.	Zelina Ibrahim	Malaysia	Partially accepted. Yes this issue is important. The sectoral chapters (6-11) all broadly adopt a similar outline, but with important differences between them in order to highlight sectoral differences. Sector-specific financing is addressed within the sectoral chapters, as well as in Chapter 15.
39131					It would be very useful to have a Table of Contents of the whole report in one file, instead of having to look at each of the chapter files, in order to assess the spread of topics in the subsections. This comment is for TSU (of all the WGs) to take note for subsequent drafts.	Zelina Ibrahim	Malaysia	Noted. Please note that the approved scoping meeting outline is available on the IPCC website .
39163					Chapter 6 on Energy Systems is missing important insights that arise from recent reductions in the costs of renewable energy sources, particularly PV, and storage, particularly Li-ion batteries, which strongly impact mitigation costs, see e.g. https://doi.org/10.1002/pip.3189 . Ideas from the last 40 years on cross-sectoral integration of electricity, heat and gas systems are also largely absent. Many insights from the energy systems modelling community that would be valuable to the integrated assessment modelling community are missing (e.g. role of power-to-gas/heat/steel thermal energy storage, etc.)	Tom Brown	Germany	Thank you for your comment. This has been taken into account in Chapter 6. It includes an assessment on dynamic energy technologies. This is also reflected in Ch2
41327					Check time periods used in WGI for pre-industrial or approximations of pre-industrial conditions (mainly 1850-1900 but also 1750). See WGI Chapter 1. Please also check consistent use and labelling. Comments and feedback to WGI would be useful.	Jan Fuglestedt	Norway	Noted - thank you. We will ensure consistency in FOD submission.
42101					Corresponding to the invitation made by Working Group III, I would like to highlight an opportunity for improvement, with regard to the structure and somehow to the scope. Across the report many references have been done to the role played by ICT, digitalization and control techniques to mitigation even adaptation to climate change (for instance section 17.3.3.8. in Chapter 17). They are cross-cutting technologies which consequently have recurrently appeared when approaching any technological aspect assessed in the report. The importance played by these technologies, also by more conventional electronics (for instance, power electronics) hints the possibility of a dedicated chapter for them. A dedicated chapter gathering and deepening all the references across the FOD to these technologies would allow also the assessing of the less "nice" aspects of ICT, digitalization and electronics in general, which are the energy consumption during manufacturing, the environmental impact of manufacturing and disposal (although the latter is not the core of this assessment report) and the aspects related to reduction, reuse and recycling of such equipment. The (kind-of) life cycle assessment of these technologies would allow a trade-off showing black over white their positive contribution to mitigation to climate change. The contribution of these technologies to adaptation to climate change could be also included in this chapter. If Working Group III finds it appropriate I could provide a more detailed document substantiating this proposal. I take this opportunity to thank Working Group III for the impressive and high-quality work done. I have never been in front of such an extensive, comprehensive and detailed report. I also thank Working Group III for having invited me to provide my feedback.	Francisco Javier Hurtado Albir	Germany	Thank you for your positive comments on the report. Thank you as well for the recommendations on digitalisation, ICT etc. Since IPCC report outlines are approved by governments, a new chapter cannot be added at this stage. A coordination effort across the chapters has taken place to ensure the topic is adequately covered in the SOD, and to avoid overlap in content. Linkages are now drawn between chapters to ensure readers are aware of where the topic is discussed in the report. Please see chapters 5 and 16 for these
42689					FOD of WG-III is well-prepared. In few chapters, adding regional case-studies or recent published research may help.	ABHA CHHABRA	India	Thank you for your positive comment. More regional case studies have been added for the second order draft

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42827					From a transport mitigation perspective there is an overall bias towards technology based "improve" solutions (electric vehicles, low carbon fuels etc. etc.) - where it is estimated that 40-60% (Klimaschutzbeitrag des Verkehrs bis 2050, 2016 https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/texte_56_2016_klimaschutzbeitrag_des_verkehrs_2050_getagged.pdf (English Summary pages 26-50) of reductions will come from avoiding transport (local shops and services) and shifting transport to more efficient modes (e.g. rail freight, cycling and public transport). These avoid and shift policies should get appropriate treatment in the transport sections of the report	Mark MAJOR	Spain	Accepted. The second order draft is revised to provide a more comprehensive overview of response options in the transport sector
42829					The issue of global fossil fuel subsidies is not sufficiently addressed. They are equivalent to 6% of global GDP and rising (IMF Working Paper, 2019/89 - Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates). Eliminating these subsidies would reduce GHG emissions by 28%.	Mark MAJOR	Spain	Noted. Fossil fuel subsidies are covered in Chapter 13: National and sub-national policies and institutions, and Chapter 15: Investment and Finance
42871					Lack of consistency across report.	Mark MAJOR	Spain	Noted. Consistency issues checked and harmonised across the report
43577					I am shocked that it seems that not a single IAM is able to model electricity based heat pumps for low-cost heat supply - see Annex C - supplementary material - heat generation. Is it simply forgotten in Annex C, or ignore the IAMs this state-of-the-art heating technology? Please double-check that! This is standard technology in various countries since years, and not a single IAM is adjusted to this major technology and trend in sustainable energy systems!!?? All global ESMs are able to do that, and also successfully. They all conclude that heat pumps are very important and part of an efficient and least cost solution for GHG reduction in space heating, see Ram et al. (http://energywatchgroup.org/wp-content/uploads/EWG_LUT_100RE_All_Sectors_Global_Report_2019.pdf), Teske (https://www.springer.com/gp/book/9783030058425), Pursiheimo et al. (https://www.sciencedirect.com/science/article/pii/S096014811831156X), Jacobson et al. (https://www.sciencedirect.com/science/article/pii/S0960148118301526) and Loeffler et al. (https://www.mdpi.com/1996-1073/10/10/1468). Ram et al. and Loeffler et al. are uploaded to the AR6 scenario database. A MASSIVE disclaimer at various positions in the entire report, in particular in chapters 2, 3, 4, 6, 8, 9 is needed that the IAMs have obviously methodological shortcomings so that they are not able to model attractive electricity-based routes which are needed for sustainable solutions in the energy system, in particular for heating. Not surprising in chapter 4 'heat pump' has zero matches in a simple keyword search.	Christian Breyer	Finland	Thank you very much for your comments. Electricity based heat pumps is a key technologies response to mitigate climate change. This is address in chapter 6 in bottom-up models. Annex C section on models will include this aspect under the energy systems models sub-section.
43719					I reviewed Chapters 6, 15 and 16. Overarching comments: 1) I strongly commend the Ch6 starting point (page 7 lines 19-20) to 'provide guidance that might be valuable for national decision-making' as an organising principle for other chapters. 2) There are some overlapping areas, such as renewable energy, that appear in all of the chapters (presumably as there is a track record and researcher-led work is appearing in literature) - but it would be useful to clarify what should go into which chapter. 3) I note as a WG3 reviewer that WG2 (Professor David Viner) is organising a roundtable to assist with input for a WG2 'Cross Chapter Box on Finance for Adaptation and Resilience' [The physical meeting has been postponed due to Covid-19]. I was due to attend and intend to find out more about what kind of content was sought: it could be relevant for Chapter 15 to consider whether direct finance practitioner input would be useful. I would be happy to assist this, if seen as useful - including identifying where this could be useful for the chapter. I note there are relatively few references to commercial reports or surveys which are generally a source of a more up-to-date evidence-base from private sector providers of capital, but obviously not peer reviewed.	Kirsty Hamilton	United Kingdom (of Great Britain and Northern Ireland)	Thank you for your positive comments. Overlaps have been harmonised or removed throughout the report where necessary. Cross-WG efforts are ongoing to ensure coordination and coherence
43921					Executive summaries should provide more representative numbers to support development of a quantitative understanding.	Hans Poertner and Elvira Poloczanska	Germany	Noted. Quantification provided where possible and applicable
44205					AR6 has to be indexed by Scopus, the most important scientific database in recent years.	Mohammad Fahmy Ramadan	Egypt	Noted. Indexing will be carried out during the production phase of the report, after the AR6 approval.

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44499					Throughout the report, there are inconsistencies in how authors refer to quantified mitigation goals/targets, and it would be preferable to streamline this, which is not only a question of proper use of language, since many authors don't seem to realize how the Paris Agreement is structured. Ch14 (rightly) speaks of only one "long-term temperature goal" (which is basically a range, 1.5 to below 2C). When referring to "Paris", WGIII therefore shouldn't talk about two temperature targets, but only one. A second mitigation target would be "net zero (GHG) emissions" (in the 2nd half of the century), although I'm not sure if 'target' is the best term here. I'm also not sure which language to use when referring to the targeted temperature levels of the "Illustrative Pathways" (mainly, but not only in ch3).	Oliver Geden	Germany	Accepted. Language surrounding the Paris Agreement has been checked and harmonised
44501					Throughout the report, the use of "net zero" is quite inconsistent or ambiguous. Wherever possible, authors should make clear what they are referring to, the geophysical requirement (= net-zero CO2) or the Paris Agreement's Article 4 mitigation target (= net zero GHG). I think there's some guidance needed because it is doubtful that the majority of authors has a clear understanding why this difference matters, in term of pathways, net-zero years, CDR requirements and sectors affected	Oliver Geden	Germany	Accepted. A cross-Working Group effort is underway to harmonise the use of these terms across the AR6. These concepts have also been clarified within the WG III report, and a cross-chapter box has been added.
45659					I had to focus on just two chapters (Chapter 1 and Chapter 15). Unfortunately I couldn't devote as much time as I wanted to, but the report looks great and really interesting. These two chapters seemed most appropriate for me to comment based on my role, and judging by the content, my role of linking science to the finance and risk sectors is potentially very influential. I shall use the content to build towards new and useful financial flows. Hopefully I can encourage more science that can help advance the cutting edge of climate risk analysis and finance flows to green investments. If there is a second round of reviews I hope to be able to contribute again, but next time to more chapters.	Geoffrey Saville	United Kingdom (of Great Britain and Northern Ireland)	Thank you for your positive comment
46297					The overall text of WG III constantly repeats certain points (drivers, instruments, equity). This is firstly unnecessary and secondly leads to contradictory statements.	Felix Ekardt	Germany	Noted. Repetition reduced in the second order draft
46299					The IPCC considers the effectiveness of policy instruments from a perspective that is methodologically problematic. Empirical observation of experiences in various countries is of little help here. The Paris Agreement and human rights imply global zero emissions in all sectors in about two (not three) decades, if understood correctly - and for such a drastic change there is no empirical experience to observe. One must therefore assess the effectiveness of instruments on the basis of the motivations of various actors and various governance problems typically resulting from them. In this way, instruments can be proposed specifically for dealing with fossil fuels, livestock products and peatland. The debate becomes even clearer if the misunderstanding is removed that the primary advantage of economic instruments is their cost efficiency. See https://www.mdpi.com/2071-1050/12/5/2053 and https://www.mdpi.com/2073-445X/9/3/83 and http://felix-ekardt.eu/files/texts/LULUCF.pdf and https://www.springerprofessional.de/defending-environmental-economic-instruments-against-the-economy/12216420 and http://www.sustainability-justice-climate.eu/files/texts/Sustainability-Springer.pdf and https://www.mdpi.com/2071-1050/10/8/2812/html	Felix Ekardt	Germany	Thank you for your comment. Literature regarding policy effectiveness has been assessed in the underlying report. Such case studies are useful, as experiences differ based on contexts. Sections on accelerating climate change mitigation have also been added and strengthened in several chapters
46301					Many parts of the text are based on a cost-benefit analysis (and overall on a dominance of neoclassical economic thinking). This overlooks the fact that CBA meets unsolvable concerns - from the law, from epistemology and from application problems. See http://www.sustainability-justice-climate.eu/files/texts/Sustainability-Springer.pdf (Chapter 3.9).	Felix Ekardt	Germany	Partially accepted. The AR6 attempts to look at alternate approaches and not just cost benefit analysis. For instance Chapter 1 discusses non-conventional economic methods for assessment. Chapter 5 does a detailed assessment of other metrics to evaluate mitigation policies. All sectoral chapters assess options against their impacts on sustainable development goals. The second order draft is revised to reflect these more explicitly
46303					The IPCC is too strongly focused on individual scientific disciplines (like economics and sociology) in its considerations of transformation, although at least ten to twelve disciplines examine questions of social change. As a result, the complexity of change is misunderstood. It is overlooked that in the "world of politics" various actors are interdependent - and that in the "world of production and consumption" various actors are also interdependent - and that the "world of politics" and the "world of production and consumption" are in turn inextricably intertwined. See http://www.sustainability-justice-climate.eu/files/texts/Sustainability-Springer.pdf (Chapter 2).	Felix Ekardt	Germany	Thank you for your comment. The report attempts to be cross-disciplinary in nature to draw together various scientific strands of literature when making its assessment. This includes on transitions and transformations.

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46305					The IPCC shows a biasased fixation on technical sustainability strategies, i.e. on "producing and consuming smarter". It overlooks the option "produce and consume less (at least in the industrialized countries)" because of two errors: First, the IPCC equates "consume less" with voluntary (!) sufficiency, although political measures for more frugality are also conceivable (and by no means all of them reduce human happiness). Secondly, the economic compatibility of frugality is underestimated, because vice versa the costs of climate change are determined too optimistically, for example by ignoring the costs of foreseeable violent conflicts caused by climate change. See http://www.sustainability-justice-climate.eu/files/texts/Sustainability-Springer.pdf (Chapter 1-3)	Felix Ekaradt	Germany	Rejected. The IPCC report does not ignore these. This discussion is reflected in detail in Chapter 5
46695					For consistency, it would be great if WGIII could somehow adapt its regional definitions to be more or less compatible with the AR6 Reference Land Regions defined by WGI.	Sergio Henrique Faria	Spain	Thank you for your comment. The regional classification used in this report are mostly consistent with WG III AR5 to ensure consistency across IPCC products. The low level classification corresponds closely to the 22 UN M49 intermediate regions
47269					The PV costs used throughout the report seem too high. Like 3x too high or more in 2050. The best IAM scenario I could find is https://doi.org/10.1038/nenergy.2017.140 but it is still too high and is not mentioned in chapter 6. I recommend e.g. BloombergNEF (Jenny Chase) or Krey et al. (https://doi.org/10.1016/j.energy.2018.12.131) for what I think are accurate up to date PV numbers and learning curves.	Auke Hoekstra	Netherlands	Thank you for your comment. All costs and potentials have been carefully checked. A discussion is included in Ch2 and Ch6
47397					Solar radiation management was covered in AR-5 Working Group III Section 6.9.2, including descriptions of proposed techniques, discussion of environmental considerations and considerations with respect to transformation pathways. It is not covered in AR-6 except in Chapter 14 regarding considerations for international governance. Environmental and economic aspects are not covered at all in the report and developments in the field since AR-5 are not included.	Kelly Wanser	United States of America	Noted. SRM is addressed across the Working Groups, and Working Group I assesses the scientific principles and consequences of SRM. Working Group III Chapter 14 covers governance aspects related to SRM
47399					In its 2015 studies of SRM and CDR, the National Academy of Science, Engineering and Medicine adopted the term "Climate Intervention" to replace the previously used "geoengineering" to promote more accurate understanding among a wider array of audiences. It used the term "Albedo Modification" in lieu of "Solar Radiation Management", where "radiation" could be mistakenly associated with nuclear energy or waste and "management" with a high degree of control. In the prospectus for follow-on study to develop a research and governance agenda for Solar Climate Intervention, the committee has replaced "Albedo Modification" with "Solar Climate Intervention", further advancing the use of more intuitive and accessible language. As with the evolution of terminology from more technical language to "carbon dioxide removal" and "negative emissions technologies", evolution to the use of more intuitive and accessible language for SRM is likely to be beneficial to democratic engagement and societal consideration of these techniques. For these reasons, consideration of the adoption of the term "Solar Climate Intervention" in place of "Solar Radiation Management" for use in AR-6 may be warranted. (National Academies of Science, Engineering and Medicine (2015), Climate Intervention: Reflecting Sunlight to Cool Earth, NASEM, https://www.nap.edu/catalog/18988/climate-intervention-reflecting-sunlight-to-cool-earth)	Kelly Wanser	United States of America	Noted. SRM is addressed across the Working Groups, and Working Group I assesses the scientific principles and consequences of SRM. Working Group III Chapter 14 covers governance aspects related to SRM
47911					Congratulations for this FOD and good luck for the next steps in the Covid19 pandemic context. I apologize but due to the completion of WGI SOD I could only read the table of contents and the executive summaries of most chapters, leading to these comments. I am looking forward for closer coordination between WGI and WGIII to ensure integration towards the AR6 synthesis report.	Valérie Masson-Delmotte	France	Thank you for your positive comment
47913					The issue of "acceleration" needs to be considered with a common methodology across WG.	Valérie Masson-Delmotte	France	Accepted.
47915					The issue of air quality (mitigation benefits for short lived climate forcers related to public health and ecosystem health) needs close coordination especially with chapter 6 of WGI. The current chapter outlines do not allow to clearly identify where these aspects are addressed, and how to better coordinate across WG.	Valérie Masson-Delmotte	France	Accepted
47917					The issue of education and climate literacy needs coordination across WG	Valérie Masson-Delmotte	France	Accepted

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47919					What is the approach in WGIII AR6 report of the issue of gender and climate action? So far it is not very visible in the outline and ES from chapters. There are gender dimensions for mitigation which are currently not visible in the outline nor ES.	Valérie Masson-Delmotte	France	Accepted. While gender does not appear in the approved outline of the WGIII report, it is a significant dimension. Several mitigation actions (clean energy), food supply and demand, and transportation impact gender goals. These are addressed in sections on SDG synergies and tradeoffs in chapters 8-10. The finance chapter discusses the importance of including gender in assessing climate finance needs, delivery and monitoring
47921					I note that some chapters include in their outlines a section on "gaps in knowledge and data". Given the misunderstanding within some parties of UNFCCC of SR15 knowledge gaps (see https://enb.iisd.org/vol12/enb12759e.html), WGI has decided to provide more clarity and frame these sections as "limits to the assessment", so as to make clear that these gaps do not undermine key findings of the report. There is an opportunity for improved cross WG coordination on this matter.	Valérie Masson-Delmotte	France	Accepted: Thank you for your suggestion. Cross working group co-ordination is an important aspect of producing IPCC reports and we will discuss your suggestion with other WGs
47933					There is a need for coordination with WGI on emission metrics for aviation accounting for non CO2 effects (GHG-equivalence, total radiative forcing...)	Valérie Masson-Delmotte	France	Noted - thank you. We are working with WGI on GHG metrics to ensure consistency
47967					There are a number of issues which require close coordination with WGI, especially on : remaining carbon budgets related to different levels of warming; a common approach to greenhouse gases (I strongly recommend to assess CO2 on one side and non-CO2 separately); global warming potential metrics; geophysical constraints in a warmer climate considering climate impact drivers (eg for biomass, hydropower, cooling and warmind demand etc). Many sections of WGIII refer to "decarbonization pathways" without a clear definition (does this include CO2 only or also other well mixed GHG?)	Valérie Masson-Delmotte	France	Noted - thank you. We are working with WGI on GHG metrics to ensure consistency
47975					In my understanding, the Paris agreement has only one goal (well below 2°C) + the aspiration (1.5°C). References to several "long term goals" are ambiguous.	Valérie Masson-Delmotte	France	Accepted. This has been harmonised and clarified across the report.
47999					There is a need for a coherent assessment of the mitigation potential of reforestation / afforestation (considering the biogeophysical aspects, including biophysical feedbacks - WGI, and the other dimensions of pressure on land and feasibility, cobenefits and tradeoffs, WGIII), in a context of growing aspiration to plant trees without acting to reduce emissions (country scale, whole sectors eg aviation)	Valérie Masson-Delmotte	France	Noted - thank you. We are working with WGI on GHG metrics to ensure consistency
48091					By analogy with the notion of "maladaptation", is there a concept of "malmitigation"? (eg actions that are more harmful than helpful, considering social and/or ecological systems)?	Valérie Masson-Delmotte	France	Thank you for your comment. Malmitigation is not as common as maladaptation in the underlying literature. Trade-offs (and synergies and co-benefits) of mitigation measures on other objectives (including social and ecological) is assessed throughout the report and synthesised in Chapter 17