

IPCC WGI SR15 First Order Draft Review Comments And Responses - Entire Report

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1031					Policy makers definitely need SPM. Their main concern is feasibility of 1.5 degree target, including mitigation/adaptation cost. Or they need to know the conditions to achieve 1.5 degree target to judge the political feasibility of 1.5 degree target. In this connection, the most important information comes from Chapter 2 where policymakers will find following sentence: "When starting from 2030 GHG levels in line with the national pledges, most integrated energy-economy-land models cannot produce scenarios in line with limiting warming below 1.5°C over or at the end of the 21st century". This policy relevant information should definitely appear in the SPM. [Mitsutsune Yamaguchi, Japan]	Accepted.
1032					For policy relevance, difference between 1.5 degree target and 2 degree target should be clearly shown, especially in key factors including climate damage and cost of mitigation/adaptation. Then policymakers can compare avoided damage of 1.5 degree and additional cost to pursue 1.5 degree target. If it may be difficult to compare avoided damages in monetary terms, authors would be able to show them in different terminologies. [Mitsutsune Yamaguchi, Japan]	Accepted. When possible, information comparing 1.5°C to 2°C is presented, according to the limited available literature (e.g. CH3).
21768					Non-overshoot 1.5°C scenarios should be considered more thoroughly and highlighted in the discussions to provide the greatest clarity to policymakers about what makes these scenarios different (and better for the climate because of avoiding feedbacks and tipping points and other issues of near-term warming) than those that overshoot the 1.5°C goal. [Durwood Zaelke, United States of America]	Agreed. A dedicated section on this has been included in the SOD of Chapter 2.
1033					By reading executive summaries of all 5 chapters, it is strange that critical uncertainty of equilibrium climate sensitivity was omitted. This point should clearly be stated both in SPM and related chapters. And because it is impossible for model experts to draw emission scenarios toward either 1.5 or 2 degree target without identifying a climate sensitivity, all such scenarios should have note showing what climate sensitivity they are based on. [Mitsutsune Yamaguchi, Japan]	Chapter 2 uses the AR5 uncertainty assessment of climate sensitivity to inform the assessment of emissions pathways consistent with 1.5°C. This uncertainty is expressed by attaching various levels of likelihood to the achievement of a particular pathway to limit warming effectively to 1.5°C or 2°C - for example, a 50% or 66% likelihood. Climate response levels are provided in the Technical Annexes where relevant
21769					The SDGs should be discussed more thoroughly in Chapter 1, particularly in context with the possibility of overshoot of the 1.5°C goal and the land-use concerns associated with carbon removal technologies that would jeopardize successful sustainable development. [Durwood Zaelke, United States of America]	Accepted. We now have a box devoted to them.
21770					When discussing the pathways and scenarios within this report, the authors should provide the greatest detail and emphasis on near- and medium-term pathways as those will be most pertinent for inspiring policymakers to enact sufficient laws and policies to make reaching the temperature goals more attainable. [Durwood Zaelke, United States of America]	Accepted. More information will be included in next versions of the report, according to available literature.
5131					Overall, the deliberate consideration of social issues in the feasibility of achieving the 1.5°C target is welcome and well done. In some instances, more consideration or more deliberate discussion of these dynamics -- and the likely trade offs to be navigated -- is needed. Where there is a lack of research/literature regarding these issues, those gaps should be emphasized in order to drive the research agenda past a frequent focus on hard science and biophysical aspects of agriculture and food production to ensure a more holistic consideration of social science and the ways in which inequality dynamics shape the feasibility of options and the potential implications of those options, if taken. [Tonya Rawe, United States of America]	Accepted. Information about social aspects is part of SOD and knowledge gaps are also identified in each chapter.
21771					For the IAMs, researchers should explore differing (and lower) discount rates as a means to generate non-overshoot scenarios. [Durwood Zaelke, United States of America]	Noted, but we are constrained by the available literature. IPCC does not commission primary research.
9740					"Obviously, 1.5 °C temperature rise goal put forward higher request to the global climate governance, therefore this report needs a separate part for discussion the challenge of 1.5 °C target compared to 2 °C target on global climate governance" [Yongping Sun, China]	Accepted. CH4 covers this aspect (section 4.4)
21772					The land-use requirements of BECCS should be discussed in such a way as to properly convey to policymakers the enormous scale of land required to implement these technologies at the scale dictated in the IPCC models. [Durwood Zaelke, United States of America]	Accepted. More information will be included in next versions of the report, according to available literature. Issues of synergies and tradeoffs inherent in BECCS are emphasised throughout, and in the SPM.
21773					The extent of the risks of SRM should be discussed in thorough detail, namely the continuous nature of SRM techniques as well as the political issues that may arise from regional usage of SRM techniques and how they may impact other regions. [Durwood Zaelke, United States of America]	Accepted. SRM will be discussed in a cross-chapter box. Issues of synergies and tradeoffs inherent in SRM, and governance challenges, are emphasised throughout, and in the SPM.
9486					To help better understandings, addition of likely or confidence levels or descriptions that show such levels are recommended. [Masato TAKAGI, Japan]	Accepted. Efforts have been made to add calibrated language.
9487					To avoid confusion, descriptions in executive summary should be accord with those in underlying chapter texts as much as possible. [Masato TAKAGI, Japan]	Accepted. Consistency and coherence across the report has been revised.
1297					The Anthropocene is a potentially useful heuristic concept as it helps highlight and explain the scale and nature of the "human agency" involved in the 1.5 challenge, but it is going to need greater explanation in Chapter 1 to enable practitioners and policy makers to fully understand its relevance. It then needs to be used appropriately in relevant chapters e.g. Chapter 5 does not pick up on the concept and its implications for sustainable development. [Debra Roberts, South Africa]	Accepted. A box (1.1) has been added in SOD.
9489					As carbon budgets have different types as shown in chapter 2, use of a more scientific expression, "cumulative amount of CO2 emissions from XX to XX", is recommended. [Masato TAKAGI, Japan]	Chapter 2 now applies clearly spelled out working definitions of the various carbon budgets it assesses.
20241					I'm pleased to see the extent to which social, environmental, and human dimensions are addressed. The issues are taken on directly but with the right amount of caution and respect. [Joshua Loughman, United States of America]	Thank you.

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1298					Some of the executive summaries (e.g. Chapter 2, 3 and 5) are not structured in a way that allows easy access to the information. The structure used by 1 and 4 is preferable i.e is more focused and concise. [Debra Roberts, South Africa]	Accepted. Executive summaries have been improved in SOD.
1299					Given the frequency with which they are referred to throughout the report, it seems that the initial listing of the SDGs and an explanation of why they are significant should appear early in Chapter 1. [Debra Roberts, South Africa]	The FOD of the CH1 already includes information about SDG (section 1.1.3). More information is to be added depending on available information.
7189					at TSU: For the next version: add a navigation pane to the PDF. This would save much time and scarce nerves. [Nico Bauer, Germany]	Thanks for your recommendation.
7192					A major task of the report must be to investigate the meaning and size of carbon budgets. Currently it is a part of Chapter 2 relying on MAGICC runs digesting IAM scenarios. Table 2.2. matches temperature exceedence likelihoods to carbon budgets with ranges. However, for policy makers it might be easier to translate carbon budgets into exceedence probabilities. Why? Because one fixed number is translated into a fuzzy number (exceedence probability for a certain temperature). The current Table 2.2. matches fuzzy numbers into other fuzzy numbers. This makes it very difficult to digest (even for people with formal education and profession). It is better to translate a fixed number (carbon budget) into a fuzzy number (exceedence probability for temperature target). [Nico Bauer, Germany]	Carbon budgets are given for specific exceedance probabilities (50%, 66% and 90% to be below a given threshold), so we believe this valid point is addressed in section 2.2.
2073					Use of the Anthropocene is commendable. [Timothy Barker, United Kingdom (of Great Britain and Northern Ireland)]	Noted with appreciation.
1050					The IPCC depends on the amplification of global media outlets to share its reports. This report is very dense. It is in the interest to make it as easy as possible to get high level important take away messages out into the world from the report. Therefore, it is suggested to replicate one of the successful aspects of AR5 which was bolding high level messages that were easy take aways for media. [Martini Catherine, United States of America]	Noted. Thank for your recommendation. The Summary for Policy Makers will summarize all key messages which are found in the report.
12316					[1/4] is an overarching issue with the interpretation of the Paris Agreements 'well below 2°C' language throughout the full report. The expression 'holding ... well below 2 °C, pursuing 1.5' in the legally binding long term temperature goal (LTTG) of the Paris Agreement is a substantial strengthening of previous language from UNFCCC decisions at Cancun and requires increase a substantial increase in both the margin and likelihood by which warming is held well below 2 °C compared to 'hold below 2 °C' (e.g. Schleussner et al. 2016). This is the very raison d'etre of this special report which appears to be have been overlooked in the way that the 'well below 2°C' has been interpreted. Disconnecting 1.5oC from 'well below 2°C' is also problematic throughout the report as this legally interpretative. These elements are indivisible parts of the Paris Agreement LTTG. ...ctd [2/4] [Bill Hare, Germany]	Noted.
2077					Table of Acronyms could greatly benefit readability of the report. [Timothy Barker, United Kingdom (of Great Britain and Northern Ireland)]	A list of acronyms and glossary will be part of the report.
6941					In the approved outline to the specialreport (http://www.ipcc.ch/meetings/session44/f2_adopted_outline_sr15.pdf) there are specific bullets where both 1.5C and 2C are explicitly mentioned. Please be aware of this and be consistent in your treatment of both these temperature levels when you write the next draft. [Aurora Stenmark, Norway]	The SOD considers impacts at 1.5C and 2C, but 2C mitigation scenarios are already assessed in AR5, so are not reassessed here.
12317					[2/4] In the AR5, the IPCC whilst it did not use a single interpretation of 2°C pathways linked to the Cancun 'below 2°C' language it did draw a strong distinction between likely below 2oC scenarios, and the available 1.5oC pathways. This is clear from the structure of the WGIII SPM eg emphasis text ("Mitigation scenarios in which it is likely that the temperature change caused by anthropogenic GHG emissions can be kept to less than 2°C relative") and Table SPM.1 where it can be seen that there is a separate column for the 1.5oC pathways. At the UNFCCC (e.g. 1/CP21 paragraph 17) of level the hold below 2°C pathways from the AR5 are associated with the classificatin of 66% probability of holding warming below 2°C. It was concerns over the impacts identified under these pathways that led to the UNFCCC Structure Expert Dialogue and to the new LTTG in the Paris Agreement. ctd [3/4] [Bill Hare, Germany]	Noted.
5408					It is very much appreciated that the writing team delivered the draft on time. It is noted that the writing team of each chapter did its best to address the items agreed by the IPCC Plenary. However, it seems that there has not been enough time to a) enhance coherence among the chapters, b) avoid duplication and c) focus on the main issues in order to try to meet the agreed length. It would be very much appreciated if the next draft considers all those three important aspects. [Klaus Radunsky, Austria]	Considering that this was only the FOD, more care will be taken in SOD and FGD to avoid duplication and guarantee coherence and consistency across the report.
2081					Index of Figures and Index of Boxes. Would aid clarity and save flicking between pages when reading. [Timothy Barker, United Kingdom (of Great Britain and Northern Ireland)]	Thank you for the recommendation.
5409					One very important issue is that chapter 3, box 3.12 explains clearly that there is not only one '1.5oC warmer world' but many. This view is strongly supported and this information should not be lost. However, in order to enhance coherence across all chapters it seems important to be more specific with respect to the underlying scenario that is used in the other chapters of the Special Report. [Klaus Radunsky, Austria]	Noted.
4901					In general, very well written. Congratulations. [Rubén Piacentini, Argentina]	Thank you.
4902					Take care of figures. Some of them have letters (words) and numbers that are difficult to see. [Rubén Piacentini, Argentina]	Editorial - copyedit to be completed prior to publication

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7975					The report is a good compilation of references which deal with different energy providing pathways; economical and social consequences, in order to cope with 1.5°C global temperature elevation. [Jean Marie Seiler, France]	Thank you.
22055					Use of multiple baselines for GMST is quite confusing, especially in this context. [Ross Salawitch, United States of America]	These have been harmonized.
7976					However, The necessary fast transition and a massive clean energy supply in a near future cannot be based on a series of technical challenges, hypothetical yields and potential solutions. The accumulation of uncertainties and potential problems hampers the credibility of the described pathways. It is not clear if there exists a pathway for which each separate contribution is plausible. A synthetic analysis is lacking of the realism and credibility of the proposed technologies involved in the various pathways and of all the environmental and societal implications [Jean Marie Seiler, France]	This assessment is carried out by Chapter 4 and is addressed in the LED scenario in Chapter 2.
12318					[3/4] Throughout this report it seems that 'holding well-below 2°C' is solely interpreted as likely (66%) below 2°C in apparent contradiction to the factors mentioned above. This is, however, not stated explicitly apart from references on what is 'often used' (e.g. in Box 1.1). This apparent interpretation for the PA LTTG is policy prescriptive. It is clear from the UNFCCC and IPCC handlinh of this issues that 'well-below 2°C, pursuing 1.5C LTTG' means that pathways consistent with this need to be hold warming significantly lower than the warming the 66% below 2°C previously applied, and hence a direct corollary of this is that PA LTTG consistent pathways must have a substantially higher than 66% probability of warming below 2oC. In addition to interpretations focussing on probability, 'hold well-below 2oC' requires that peak warming of pathways consistent with the PA LTTG must be significantly lower than in the former hold below 2oC pathways. Given the peak-and-decline nature of most stringent mitigation pathways, this is a distinct issue from e.g. probabilities in 2100. In this report it is essential that clear quantitative distinctions are drawn between the former hold below 2oC pathways from the AR5 generation and those consistent with the PA LTTG hold well below 2oC, 1.5oC pathways in relation to peak 21st century warming, and likelihood of 1.5oC over 21st century and in 2100. ctd [4/4] [Bill Hare, Germany]	Chapter 2 has been revised and is now providing information for a set of scenario classes based on their physical properties (below 1.5°C scenarios, and return 1.5°C scenarios, with varying levels of likelihood) without linking these to the language of the Paris Agreement Long-term Temperature Goal (LTTG).
1055					<p>This report will miss a huge opportunity to provide hope if it doesn't highlight the ambition mechanism of the Paris Agreement. If this report focuses on the fact that current NDCs are on track towards 3-4c warming without explaining the iterative process of the Global Stocktake, Facilitative Dialogue and the ability to increase ambition every 5 years in NDCs, it could potentially undermine the Spirit of Paris. It is possible to achieve this educational opportunity and engage in effective climate communications in 3-4 sentences: by adding text such as the following to the report in several places: Article 4 of the Paris agreement provides countries the opportunity every 5 years to increase the the pledges outlined in their NDCs. The ambition mechanism of the Agreement (Article 14) stipulates that the international community will see if it is collectively on track to meet the long term temperature goal outlined in the agreement. This ambition mechanism provides the structure for an iterative process to increase ambition over time. It is possible in future successive rounds of NDCs that the global community could be closer to reaching the 1.5c target.</p> <p>Not to do so would be remiss and to undercut huge momentum generated by the international community over the last several years. [Martini Catherine, United States of America]</p>	Rejected. The importance of adaptive mitigation efforts is highlighted in this report. In Box 4.12 (Chapter 4) is presented a summary of the global stocktake, the facilitative dialogue (2018) and the 5 year cycles to increase ambition of the pledges.
12319					[4/4]Therefore, it is important to include a subsection in Ch 01 discussing different possible interpretations of the 'hold well-below 2°C, pursuing 1.5oC' language similar to the interpretation of 'balance' or 1.5°C. This should clearly differentiate from the earlier AR5 and UNFCCC interpretation of "hold below 2oC" and show quantitative distinctions between these in the available scenario literature (eg pathwatys with a very likely (90%) probability of not exceeding 2°C over the 21st century and being below 1.5oC by 2100. Pathways consistent with a very likely below 2°C interpretation should also be assessed in a separate category in Ch 02. The usage of 'well below 2°C, pursing 1.5oC' as a stand-alone phrase is in any case very problematic and should be replaced by classical IPCC terminology, i.e. likely or very likely below 2°C or associated probabilities. [Bill Hare, Germany]	This is a helpful suggestion, and we have endeavoured to revise chapter 1 to reflect this, while attempting to avoid going too far into (re-)interpreting the Paris Agreement. Thank you.
12320					The use of temperature stabilization framing in relation to 1.5oC and the Paris Agreement LTTG across chapters of the report is policy prescriptive (eg see Chapter 1.2.3.1 Temperature stabilization pathwaysThis report will focus on temperature rather than concentration stabilization pathways.) The Paris Agreement LTTG in Article 2.1 does nowhere refer to this, nor does it directly imply that temperature stabilization is the goal. In fact reference to the term stabilization was specifically rejected by a large number of countries in the formulation of this goal. Whereas there are scenarios in the literature that may stabilize warming at some level this does not mean they are consistent with the PA LTTG. There are several different ways in which A 2.1 can be interpreted, but one important way relevant to the vulnerable countries who sought 1.5 language in the legally binding objective of the PA is that 1.5oC is a limit in extremis. This means that it is an upper bound not to be exceeded and in the longer term to warming to be limited below this level. Consequently the stabilization framing of this section cuts across this interpretation and is hence policy prescriptive. [Bill Hare, Germany]	The word stabilization was specifically requested in the scoping document, but we no longer refer to temperature stabilization pathways.

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7977					The advantages and drawbacks of the different energy sources should be detailed and analysed in a separate subchapter. A scientific and objective approach on this subject is necessary, which is far from being the case in the present document (mainly due to omissions and technically idealised pathways). This would greatly improve the interest of the document. [Jean Marie Seiler, France]	These issues are highlighted in chapter 4. A more detailed analysis can be part of the AR6 (WGIII - Chapter 6).
14377					The usage of GtCO ₂ units instead of GtC which are typical for the climate and carbon cycle literature may be confusing – I understand the thinking behind that but I still have doubts. [JACEK PISKOZUB, Poland]	It was essential in a cross-working-group report to harmonise these units. UNFCCC uses GtCO ₂ .
7978					A credible pathway for short term (non-fossile) energy supply with controlled social impacts can only be constructed based on existing and proven technologies. Future developments and solutions can, of course, be integrated later when they are mature. Nuclear energy is still a reliable source for massive electricity production without producing GHGs. This very important point is even not discussed in the report. [Jean Marie Seiler, France]	Accepted, but the report is based in the available literature. Information related to energy and 1.5°C is very limited. These issues are highlighted in chapter 4. Nuclear is discussed as an option in Chapter 2 on energy supply.
20516					The lack of transparency, and insufficient treatment of cost-benefit calculations incorporated into the IAMS on which the report is fundamentally based is unacceptable, and serves only to obfuscate and misguide policymakers who struggle to grasp the implications of models and scenarios. The importance of realistic incorporation of avoided damages has recently been clearly demonstrated in the wake of destruction from hurricanes Harvey, Irma and Maria. Texas, Puerto Rico and the Caribbean Islands are faced with many billions in damages and reconstruction costs. These events and costs for reconstruction will only escalate as warming progresses and realistic treatment of such consequences should be clearly embedded in any economic analyses. [Lili Fuhr, Germany]	Rejected - the report does not use cost-benefit calculations, and is definitely not "fundamentally based" on these.
17449					<p>Throughout the chapters we encountered problems in the graphs, in the following three major categories.</p> <p>1) Visual consistency</p> <p>By visual consistency we refer to the use of a consistent design across the report. The data visualised and the type of charts chosen might differ according to the content but setting a consistent design language would create a balanced use of selected marks and attributes so that the readers could process the visuals as a large family. Design choices could be taken so that readers do not have to face different or conflicting design strategies in different charts across the report.</p> <p>2) Visual clarity</p> <p>By visual clarity we refer to the property of facilitating the readers through the process of understanding. Within each graph, marks and attributes should be set in a way that reduces visual clutter and cognitive load, the layout should follow a structured visual narrative, the labelling should be masterfully integrated to avoid unnecessary zig-zagging across the page in search of cues to understand the chart.</p> <p>3) Visual elegance</p> <p>By visual elegance we refer to the visual quality that will attract the audience and sustain that sentiment throughout the experience. Any choice made to achieve visual elegance should not undermine trustworthiness and accessibility. Visual elegance would be a by-product of clarity and consistency. The importance of aesthetic should not be ignored. Evidence shows a strong link between beauty and memorability in data visualisation. Visual elegance in design is not achieved by improvisation but through theoretical principles and experience of the designers.</p> <p>The problems could be resolved by using the following elements in a more appropriate way:</p> <ol style="list-style-type: none"> 1. Layout (the use of positive and negative space, the narrative of the page, the grid) 2. Marks (visible features like dots, lines, areas) 3. Attributes (variations applied to the appearance of marks such as size, position or color) 4. Labeling (the use of text to provide observations and explanations about the images, typically this text takes familiar forms such as headlines, captions, labels, and annotations) <p>Aim of this review is to provide a first feedback on the type of interventions required to improve the graphs. We categorised interventions in three degrees of importance:</p> <p>A- ADJUSTMENT (the design of the graph would be easy to improve) B- CONFIGURE (the design of the graph would require a moderate intervention in order to be improved) C- RE-CONFIGURE (the design of the graph would require a substantial intervention in order to be improved)</p> <p>We have labeled A, B, C the visuals IN CHAPTER 1 and 2.</p>	Noted: these are helpful comments that have been used to substantially improve graphics in later drafts.
2092					Would an ANNOTATED (e.g. keywords) bibliography be of use? i.e. there are some excellent citations! They could be better used! [Timothy Barker, United Kingdom (of Great Britain and Northern Ireland)]	Noted, although for reasons of time, an annotated bibliography is beyond our scope.

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7980					An important parameter for the limitation of the energy demand is ... the limitation of the world population. This fundamental aspect of the problem is only slightly discussed. [Jean Marie Seiler, France]	This is addressed in the LED scenario in Chapter 2.
7981					There is no real technical discussion of the problems linked to the intermittency of renewables like wind and solar that affects the stability of the electricity grid. The problem of feasibility of massive electricity storage is not technically discussed. The problem of the efficiency of recovery technologies is also not discussed. These omissions raise great suspicion concerning the feasibility and realism of the proposed paths. [Jean Marie Seiler, France]	These issues are highlighted in chapter 4.
3118					In general, there are far too many references cited in the text, which makes it often quite hard to read. So I suggest just essential new references be used, and that they be put into end-notes at the end of each chapter, and not in parentheses within sentences. This change alone would greatly increase the readability of the whole report. The text should not read like an academic paper!!! [Richard Rosen, Germany]	Rejected. Thanks for the recommendation, but the IPCC make use of a citation style in its reports and the authors have followed it. Efforts have been made to reduce information not directly related to 1.5°C.
2095					Overall, it seems to be a noble, though maybe exceedingly ambitious goal. Apologies for not finding time to review subsequent chapters due to personal circumstances. Wishing all well. Peace. [Timothy Barker, United Kingdom (of Great Britain and Northern Ireland)]	Thank you.
7983					The impact on biodiversity of large biomass production for energy application is generally not discussed in the document. How can 100 EJ to 300 EJ of energy crops be produced without impact on biodiversity? What is the maximum production which would be compatible with biodiversity? [Jean Marie Seiler, France]	These issues are highlighted in chapter 4.
12080					Soil and ecosystem fluxes of CO ₂ , CH ₄ , and N ₂ O are likely to play a significant role as biotic feedbacks to climate change. Climate change may be exacerbated if it accelerates loss of soil/ecosystem GHGs to the atmosphere but lot of uncertainty associated with this feedback based on existing ESMs/climate models estimations. Therefore, to meet COP21 target, improving feedback projections of soil and ecosystem GHG fluxes is pertinent for establishing GHG emission targets that limit climate change. So, we need more studies that investigate the environmental drivers of soil GHGs emission. I believe, the above message should be considered for meeting COP21 target. [Debjani Sihi, United States of America]	Noted.
1078					At the very least bold key takeaway sentences in the Executive Summary in the front of each chapter for media and amplifiers. This was a great aspect of AR5 suggest it be repeated in this 1.5SR [Martini Catherine, United States of America]	Accepted. In SOD, all executive summaries present the takeaway sentences in bold.
15672					It is part of the mandate of the IPCC to, inter alia, "formulat[e] realistic response strategies" (AR6 SCOP/Doc. 2, p. 34). The reliance on inherently high-risk, undeveloped technologies with profound and unevenly distributed impacts to "fix" climate change, in our view, cannot be considered a realistic and responsible response strategy. [Elenita Daño, Philippines]	Authors have attempted to assess the available literature: these technologies have been included in 1.5C pathways, so we have to consider them.
17208					SR1.5 needs a common summary for the 5 Chapters. [Carlos Garcí Soto, Spain]	Thanks. The SOD will be accompanied by the Summary for Policy Makers which will include the key messages from the report.
15673					Geoengineering was not included in the agreed outline of SR 1.5. We are seriously concerned to see geoengineering technologies, including SRM technologies, mentioned in almost every chapter and given broad consideration throughout the report. [Elenita Daño, Philippines]	Authors have attempted to assess the available literature: SRM was not explicitly excluded from the agreed outline, hence we have to consider it.
17209					SR1.5 needs an appendix showing the authorship by countries and roles, with emphasis in the roles of coordinating lead authors and lead authors. The report needs to show the involvement of vulnerable countries for which climate change is a fundamental threat [Carlos Garcí Soto, Spain]	Thanks. The final version of the report will have such an Annex.
15674					Since AR5, the IPCC has been criticized for the use of BECCS in RCP scenarios. Now, it broadens the inclusion of other geoengineering technologies, including a long list of CDR "options." Some techniques are either just theoretical, untested or full of risks, like Solar Radiation Management (SRM), others have already been shown to have unacceptable negative impacts. Specifically, ocean fertilization is included in the list of banned marine geoengineering technologies adopted by the London Protocol of the London Convention on the Prevention of Marine Pollution by Dumping of Wastes. Only small-scale legitimate research experiments are exempted after thorough scientific peer review. How can the IPCC include such a technology as an "option" when the experts on the issue recommend its ban? Geoengineering technologies are at best speculative, underdeveloped, high-risk and come with large-scale and transboundary negative impacts for ecosystems and human communities, as established by peer-reviewed literature and various NGO reports. Treatment of these technological ideas as realistic "options" in the Special Report undermines the credibility of the report and risks giving policy-makers a dangerously biased picture of potential pathways and possibilities. [Elenita Daño, Philippines]	Authors have attempted to assess the available literature: these technologies have been included in 1.5C pathways, so we have to consider them.
11068					I focused my review on chapter 3, and particularly sections that relate to glaciers, streamflow and freshwater and anadromous fish species -- my areas of expertise. [Robert Daniel Moore, Canada]	Noted.
15425					It is part of the mandate of the IPCC to, inter alia, "formulat[e] realistic response strategies" (AR6 SCOP/Doc. 2, p. 34). The reliance on inherently high-risk, undeveloped technologies with profound and unevenly distributed impacts to "fix" climate change, in our view, cannot be considered a realistic and responsible response strategy. [Elenita Daño, Philippines]	Authors have attempted to assess the available literature: these technologies have been included in 1.5C pathways, so we have to consider them.

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3138					Again, there should be far fewer references in all chapters, and they should just focus on what's new since the AR5 reports were issued in 2013-2014. [Richard Rosen, Germany]	Rejected. Thanks for the recommendation, but the IPCC make use of a citation style in its reports and the authors have followed it. Efforts have been made to reduce information not directly related to 1.5°C.
15426					Geoengineering was not included in the agreed outline of SR 1.5. We are seriously concerned to see geoengineering technologies, including SRM technologies, mentioned in almost every chapter and given broad consideration throughout the report. [Elenita Daño, Philippines]	Authors have attempted to assess the available literature: SRM was not explicitly excluded from the agreed outline, hence we have to consider it.
13380					Figures across the entire report would benefit from greater consistency. For example, consistent use of colour to represent 1.5/2.0; and consistent layout of information content - e.g. sometimes legend information is shown in plots, sometimes in figure captions. Providing a clear heading and subheading for each figure to highlight the main message of the figure would support readers' comprehension (this is addition to a figure caption and text in the body of the report). [Jordan Harold, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. This will be improved after the SOD, once final figures have been decided.
5703					Chapter 1 is the only chapter in the special report that is in a complete draft status. All other chapters have some sections not completed and much more work is needed. [Hong Yang, Switzerland]	Noted.
2895					The IPCC's products are intended to be policy relevant but not policy prescriptive. Statements about what "needs" to happen must be removed. [Alice Alpert, United States of America]	Accepted. This have been improved in the SOD and will be checked again in the FGR.
2900					Statements based upon "limited evidence" should be avoided, and when unavoidable acknowledged in their framing. [Alice Alpert, United States of America]	Accepted. This has been improved.
2904					The word "rainfall" occurs often, when it should read "precipitation". Please make sure if you write rainfall that really only rainfall is meant. [Sabine Wurzler, Germany]	Accepted. Revision of term will be made for the preparation of next drafts and prior to publication.
14936					Bring out a much stronger connection to SDGs in Chapter 4-5. This is another case where clear effort was made by some section authors but the coordinating authors need to ensure consistent treatment and attention to all SDGs and coordinated messaging across chapters. FOr instance, I really like Figure 1.6 in CHapter 1 but it seems rather isolated here and could be coupled well with several sections in Chatpers 4-5 [Christopher Weber, United States of America]	Accepted. Efforts have been made to improve consistency and treatment of the different topics.
2909					A list if acronyms and abbreviations (glossary) would be an asset. [Sabine Wurzler, Germany]	A list of acronyms and glossary will be part of the report.
22130					Assessment of 1.5c relative to what reference is not yet clear across the report. The framing of 1.5c analysis needs to be clearly stated in chapter and followed consistently across all chapters. For polciy relevance (Paris Agreement) comparing 1.5c to 2c is of special interest. [Khalid Mohamed Abuleif, Saudi Arabia]	This has been clarified in chapter 1.
15427					Since AR5, the IPCC has been criticized for the use of BECCS in RCP scenarios. Now, it broadens the inclusion of other geoengineering technologies, including a long list of CDR "options." Some techniques are either just theoretical, untested or full of risks, like Solar Radiation Management (SRM), others have already been shown to have unacceptable negative impacts. Specifically, ocean fertilization is included in the list of banned marine geoengineering technologies adopted by the London Protocol of the London Convention on the Prevention of Marine Pollution by Dumping of Wastes. Only small-scale legitimate research experiments are exempted after thorough scientific peer review. How can the IPCC include such a technology as an "option" when the experts on the issue recommend its ban? Geoengineering technologies are at best speculative, underdeveloped, high-risk and come with large-scale and transboundary negative impacts for ecosystems and human communities, as established by peer-reviewed literature and various NGO reports. Treatment of these technological ideas as realistic "options" in the Special Report undermines the credibility of the report and risks giving policy-makers a dangerously biased picture of potential pathways and possibilities. [Elenita Daño, Philippines]	Authors have attempted to assess the available literature: these technologies have been included in 1.5C pathways, so we have to consider them.
9804					General comment on Figures: Communication science clearly shows, that figures should be as easy as possible, contain as little information as possible and the main message should be understandable without reading the figure caption (experiments show that the understanding of IPCC graphs does not improve, when readers read the figure caption). Technical terms should be avoided or explained in the legend. More complex graphs may be used in the report, but when using these graphs in the SPM, they should be strongly simplified and legends should contain the most important information. E.g. Figure 1.1: Graph: do not show more than two or three different lines (e.g. forced changes and Holocene temperature range), explain "Holocene" (last 10'000 years), explain "Reference Period" (reference period for pre-industrial). Not more. [Urs Neu, Switzerland]	Noted: these are helpful comments that have been used to substantially improve graphics in later drafts.
2893					In several instances in this report, the 1.5C degree goal and the Paris Agreement are referred to interchangeably. It is true that one of the goals of the Paris Agreement is to pursue efforts to limit the temperature increase to 1.5C, but that does not mean that evaluating the physical, social, and technological dimensions of a warming of 1.5C necessarily always relates to the Paris Agreement. The report would be stronger to only refer to what is in each instance being evaluated. When referenced, Nationally Determined Contributions (NDCs) should always be referred to as "The Nationally Determined Contributions (NDCs) announced by Parties to the Paris Agreement submitted by Parties to the Paris Agreement," not "NDCs under the Paris agreement" [Alice Alpert, United States of America]	Accepted. Text will be revised.

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14925					While I recognize this is only a FOD, there were still some rather surprising inconsistencies across chapters that need to be addressed before the second draft. In particular I found the discussion of the Paris Agreement and its structure (pledge and review cycles, long term goal, etc.), negative emissions and SRM to need much better coordination across the chapters. These are incredibly difficult issues both to understand and discuss and decision-makers will need a very clear understanding of the tradeoffs (particularly intertemporal and between different sustainability issues) in these interpretations. Please ensure that discussions of the PA and NETs in particular are better coordinated and communicated across the key sections of Chapters 1, 2, and 4 in particular in the next draft. [Christopher Weber, United States of America]	Accepted. Efforts have been made to improve consistency and treatment of the different topics.
18776					A substantial shortcoming of the FOD is the lack of serious discussion of the differences of non-overshoot scenarios/pathways, compared to a strong focus on overshoot scenarios. Even if the analyses available by the time of the FOD are all (or almost all) including overshoot of 1.5C sometime this century, in light of the fact that the Paris Agreement speaks of "limit to 1.5C" non-overshoot pathways require more in-depth discussion in the next stage of the report. This also relates to the risks of climate change impacts perspective as Chapter 4, page 126, lines 54 following notes that "The implications of overshooting are very important for impacts, especially if the temperature at peak warming is high, because some impacts may be long-lasting and irreversible in the time frame of the current century, for instance sea ice melting and ecosystem mortality". [Sven Harmeling, Germany]	The SOD now includes a discussion of both overshoot and non-overshoot pathways.
22131					Mitigation costs of achieving 1.5c are not explicitly dealt with. For example there are specific titles on the benefit (impact) analysis of 1.5c in relation to 2c in chapter 3 but not such specific focus of costs of 1.5c in relation to 2c in either chapter 2 or chapter 4. This suggests some imbalances that need to be corrected. [Khalid Mohamed Abuleif, Saudi Arabia]	Accepted. Literature dealing with 1.5°C cost is limited, but information - when available- has been added in SOD. Chapter 2 now reports both on implied carbon prices and on investments consistent with a 1.5°C pathway.
1396					I think the authors have done an excellent job of tackling a very complex issue. My comments are largely along the lines of my expertise, which is in SRM. I find that the treatment of SRM throughout this report needs some substantial improvement. It is often treated as totally separate from any other method of addressing climate change, and sometimes it is treated as an afterthought. [Ben Kravitz, United States of America]	Accepted. Consistency and treatment of SRM throughout the chapter has been revised.
2932					This report suffers from being far, far too long. I am sure that a more succinct report would be better received by the community. [Jim Haywood, United Kingdom (of Great Britain and Northern Ireland)]	Noted.
22132					The feasibility of 1.5c warming from technological, physical, economic, social, and political perspectives is not well reflected in the report. This is a primary question that the 1.5c special report is expected to answer. [Khalid Mohamed Abuleif, Saudi Arabia]	Rejected. Feasibility is extensively discussed, including a specific box. Elements of technological, physical, economic, social and political perspectives are part of the FOD (e.g. Box 1.1). SOD presents more information, considering new information available.
21365					Experts conclude BECCS is implausible. Vaughan and Gough convened experts to assess the ability of bioenergy and BECCS to deliver reductions in CO2 loading (Vaughan and Gough 2016). Overall, the group was extremely skeptical. The proportion of energy to be supplied by bioenergy was in particular scored as implausible, with the conclusion extending to bioenergy alone, or bioenergy in conjunction with CCS. Land-use requirements alone are massive – eg a quarter to one-half of the agricultural land in the world (Field and Mach, 2017). [Mary Booth, United States of America]	Noted, although there are a range of views on the feasibility of BECCS.

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17489					<p>Throughout the chapters we encountered problems in the graphs, in the following three major categories.</p> <p>1) Visual consistency</p> <p>By visual consistency we refer to the use of a consistent design across the report. The data visualised and the type of charts chosen might differ according to the content but setting a consistent design language would create a balanced use of selected marks and attributes so that the readers could process the visuals as a large family. Design choices could be taken so that readers do not have to face different or conflicting design strategies in different charts across the report.</p> <p>2) Visual clarity</p> <p>By visual clarity we refer to the property of facilitating the readers through the process of understanding. Within each graph, marks and attributes should be set in a way that reduces visual clutter and cognitive load, the layout should follow a structured visual narrative, the labelling should be masterfully integrated to avoid unnecessary zig-zagging across the page in search of cues to understand the chart.</p> <p>3) Visual elegance</p> <p>By visual elegance we refer to the visual quality that will attract the audience and sustain that sentiment throughout the experience. Any choice made to achieve visual elegance should not undermine trustworthiness and accessibility. Visual elegance would be a by-product of clarity and consistency. The importance of aesthetic should not be ignored. Evidence shows a strong link between beauty and memorability in data visualisation. Visual elegance in design is not achieved by improvisation but through theoretical principles and experience of the designers.</p> <p>The problems could be resolved by using the following elements in a more appropriate way:</p> <ol style="list-style-type: none"> 1. Layout (the use of positive and negative space, the narrative of the page, the grid) 2. Marks (visible features like dots, lines, areas) 3. Attributes (variations applied to the appearance of marks such as size, position or color) 4. Labeling (the use of text to provide observations and explanations about the images, typically this text takes familiar forms such as headlines, captions, labels, and annotations) <p>Aim of this review is to provide a first feedback on the type of interventions required to improve the graphs. We categorised interventions in three degrees of importance:</p> <p>A- ADJUSTMENT (the design of the graph would be easy to improve) B- CONFIGURE (the design of the graph would require a moderate intervention in order to be improved) C- RE-CONFIGURE (the design of the graph would require a substantial intervention in order to be improved)</p> <p>We have labeled A, B, C the visuals IN CHAPTER 1 and 2.</p>	<p>Noted: these are helpful comments that have been used to substantially improve graphics in later drafts.</p>
20575					<p>Overall comments: to whom is this report destined? At this moment it seems that it is neither for scientists (as it does not present full data: e.g. much of the data presented could be presented as results from meta-analysis, including several studies on the subject and presenting forest plots) but it is also relatively complex (with the use of several discipline specific acronyms with very thorough considerations around the scientific methods) to be understood by all. More specially: it would be important to make sure that each key section would present a lay summary. As a behavioural scientist I have experience in developing interventions that facilitate change. Understanding the message takes us closer to this, having the knowledge is key, but in a document like this understanding who will have the power to implement specific changes that can lead to the overall goal of capping global warming at 1.5 is crucial, otherwise there will be a clear diffusion of responsibility. As I state above it would be crucial to have a section at the end of this report that would list specific actions that can be conducted and by whom and when (if the target is to be met). Some actions will be linked to legislation, others with service provision, some others will be linked to regulation, others with fiscal measures, others to guideline implementation, others with environmental and social/town planning, others with communication and marketing. Given this there is a paper that could support in framing all these possible changes: see Michie et al., 2011 paper in Implementation Science on the Behaviour Change Wheel. [Vera Barbosa Araujo Soares Sniehotta, United Kingdom (of Great Britain and Northern Ireland)]</p>	<p>Noted. The report is the basis of the Summary for Policy Makers, which is prepared in a clear and easy to understand way. IPCC reports are not prescriptive, therefore actions to be taken are not listed.</p>
22133					<p>The assessment of incremental costs and benefits of 1.5c warming relative to 2c warming is of particular policy relevance to Paris agreement. Framing the key chapters 2,3, and 4 around this theme is important but not clearly there in the current version of the report. [Khalid Mohamed Abuleif, Saudi Arabia]</p>	<p>Accepted. There is still limited literature about costs and benefits, but efforts have been made to present more information about this aspects. A full cost-benefit analysis is not supported by the literature because of incommensurability of different costs and avoided costs.</p>

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22134					The incorporation of the SDG goal of "access to clean, affordable, reliable, and sustainable modern energy" as a package and its implications for climate change and the 1.5c warming. [Khalid Mohamed Abuleif, Saudi Arabia]	It was not possible to identify if any action was required in this comment.
1399					My recommendation is to treat SRM honestly. If there are issues with justice, side effects, governance, etc., talk about those issues openly, with citations, right alongside the place where you talk about those same issues for mitigation, adaptation, or carbon dioxide removal. If SRM really is different, say so there. But don't try to make it special, avoid treating it, or claim that it's too problematic to consider, especially when talking about issues of justice. Without doing so, any discussion of the methods of addressing climate change runs the risk of coming across as dishonest. [Ben Kravitz, United States of America]	Accepted. Consistency and treatment of SRM throughout the chapter has been revised.
14967					The correct title is simply "Paris Agreement" not "Paris COP21 Agreement" [Farhan Akhtar, United States of America]	Noted - editorial.
6264					Figures are unreadable because graphs are blurry. Should be shown with higher resolution. [Milton Nogueira da Silva, Brazil]	Editorial - copyedit to be completed prior to publication
6521					Typos, grammar, BE/AE inconsistencies and unreadable figures are not mentioned, as it is a first order draft. It is expected they will be corrected in future drafts. [Heike Hebbinghaus, Germany]	Editorial - copyedit to be completed prior to publication
3168					As stated above in several places, this entire report needs to be completely reoriented around discussions of what kinds of policy decisions do policy makers need to make, and by when, in a 1.5 degree non-overshoot scenario versus other 1.5 degree and 2.0 degree scenarios. It needs to focus on the pros and cons of the types of decisions that need to be made in all sectors of the economy over the next 10-15 years, depending on which temperature scenarios policy makers want to pursue. In discussing these pros and cons the report should provide policy makers with a sense of what the existing literature on these topics says, but this literature review must be relatively brief, otherwise the entire report will remain far too long, as it currently is. [Richard Rosen, Germany]	Accepted. The report follows the approved outline for its preparation. The Summary for Policy Makers (SPM) will summarize the most important findings of the report, so that they can guide decision-making. When available, information about cost and benefits is given.
11111					<p>There is an overarching issue with the interpretation of the Paris Agreements 'well below 2°C' language throughout the full report.</p> <p>The expression 'holding ... well below 2 °C' is a strengthening of previous language and signals an increase in both the margin and likelihood by which warming is to be kept below 2 °C compared to holding below 2 °C (e.g. Schleussner et al. 2016).</p> <p>In the AR5, the IPCC rightly did not use a single interpretation of 2°C pathways linked to the Cancun 'below 2°C' language. However, a common interpretation including in the UNFCCC (e.g. 1/CP21 paragraph 17) of below 2°C pathways from the AR5 is associated with the classification of 66% probability of holding warming below 2°C.</p> <p>Throughout this report it seems that 'well-below 2°C' is solely interpreted as likely (66%) below 2°C. This is, however, not stated explicitly apart from references on what is 'often used' (e.g. in Box 1.1). Providing a single interpretation for the PA language could be seen as being policy prescriptive, in particular as an interpretation that links 'well-below 2°C' to pathways holding warming below 2°C with a probability well above 66% is very plausible given the history and context of the PA language.</p> <p>In addition to interpretations focussing on probability, possible interpretations relating 'well-below' to peak warming need to be explored. Given the peak-and-decline nature of most stringent mitigation pathways, this is a distinct issue from e.g. probabilities in 2100. As any interpretation of 'well-below' involves subjective judgement, different interpretations including limiting peak warming to 1.5°C (arguably well-below) should be explored.</p> <p>Therefore, it is important to include a subsection in Ch 01 discussing different possible interpretations of the 'well-below 2°C' language similar to the interpretation of 'balance' or 1.5°C. This should also explore more stringent interpretations, i.e. a very likely (90%) probability of not exceeding 2°C over the 21st century. Pathways consistent with a very likely below 2°C interpretation should also be assessed in a separate category in Ch 02. The usage of 'well below 2°C' as a stand-alone phrase is in any case very problematic and should be replaced by classical IPCC terminology, i.e. likely or very likely below 2°C or associated probabilities. [Michiel Schaeffer, Netherlands]</p>	This is addressed in chapter 1, but we are also limited by the available literature -- and also the evident challenges in quantifying these probabilities precisely.

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20327					We are troubled by the inclusion of climate geoengineering options in this report which seems inappropriate given the many serious risks and also technical barriers that are likely to limit the feasibility and effectiveness and only exacerbate environmental and socioeconomic woes. For example, Direct Air Capture, Enhanced Weathering or Ocean Liming all would require very large energy inputs, a barrier that renders them ineffective and is unlikely to be overcome. SRM is extremely problematic. Among other concerns raised in numerous reviews and reports on the topic, please note a very recent paper reports that chemical reactions in the troposphere could result in an increased persistence of methane. https://www.atmos-chem-phys.net/17/11209/2017/ Legal restrictions on ocean iron fertilization are in place and cannot simply be ignored. None of these geoengineering options are viable, nor do they appear to have realistic potential to become viable or be effective. Serious, thorough investigation of geoengineering options was not part of the mandate for this report and the current inadequate treatment is highly problematic. [Lili Fuhr, Germany]	We have endeavoured to reflect the current state of the literature.
1397					There are many claims throughout the report regarding the hardships of climate change, climate justice, and arguments about why society should attempt to limit global warming to 1.5°C. The problem with these claims is that they often don't mention SRM throughout the bulk of the arguments. Reaching 1.5°C with SRM is, compared to the other methods, easy. There may be other reasons why one might not want to do that, which is fine, but I don't think SRM should be swept under the rug. Talk about it in a fair, upfront way, just like you do for mitigation, adaptation, and every other method of addressing climate change. I'm not asking you to be pro-SRM – I'm asking for it to be treated fairly. [Ben Kravitz, United States of America]	Accepted. Consistency and treatment of SRM throughout the chapter has been revised.
7547					Since this draft was written it seems to be several new publications relevant for the report. We expect that new relevant literature is assessed in the next draft. [Øyvind Christophersen, Norway]	Accepted. New available literature was added in the SOD.
6782					It is no good governance, if working group chairpersons act as Review Editors for the report. [Arnulf Jaeger-Waldau, Italy]	Noted.
6783					It is surprising that no 100% renewable energy scenario is used, but a lot of emphasis is given to high penetration of CCS, a technology, which is still not in commercial use. [Arnulf Jaeger-Waldau, Italy]	Accepted: the inclusion of the LED scenario in the SOD addresses this concern.
2689					The report contains an impressive level of detail considering the lack of targeted literature, but it is not always easy to see the wood for the trees. To enhance clarity it will be important to sharply reduce the length of the report, remove overlaps between chapters and tighten up the storyline for the SOD. [Penny Urquhart, South Africa]	Accepted. More effort will be made to make the report more concise, according to the available literature, to reduce overlaps.
2690					Chapters 2, 3 and 4 all deal with mitigation pathways and it is not always clear what their respective ambitions are, despite statements made in this regard. This needs to be clarified and redundancies / overlaps removed. [Penny Urquhart, South Africa]	Accepted. Efforts have been made to clarify this and to avoid overlaps.
20099					It is laudable and appropriate that the IPCC has decided to raise the profile of social science literature and their considerations, recommendations and concerns in the SR1.5. However, social science literature is not granted sufficient priority if it doesn't feature in Chapter 2 on response strategies, but only as an afterword in later chapters. The concerns raised by such literature, e.g. about the risks and large-scale adverse impacts of geoengineering technologies, must be taken seriously and drawn adequate conclusions from. [Lili Fuhr, Germany]	Chapter 2 presents a more detailed list of response strategies, which include social science aspects (e.g. behavioural change, dietary changes, etc.)
1398					An example is the treatment of BECCS in the report and how that compares to the treatment of SRM. BECCS is talked about prominently, given that it's one of the few methods of carbon dioxide removal that can be represented in integrated assessment models. The problem is that BECCS cannot be scaled up rapidly enough to avoid negative climate impacts of global warming. Also, the amount of BECCS required to achieve these ultimate objectives is tantamount to terraforming. This would likely be far more disruptive than many discussed global SRM efforts and is likely to have serious governance issues, given its projected effects on food-water-energy and world economies. However, BECCS is treated seriously and is central to many discussions in the report, whereas SRM is often relegated to its own small section. [Ben Kravitz, United States of America]	Accepted. Consistency and treatment of SRM throughout the chapter has been revised.
6263					The report has a serious flaw. The language is not fitted to non-scientists and laypeople who are seldom aware of models, chemistry, meteorology, flows etc. The report uses expressions such as "hydraulic resources" instead of "water"; "spatial trade-offs" instead of "scarcity here and there"; "climate resilience" instead of "reliable weather"; "underprivileged sector of population" instead of "poor". However the ones who really matter in climate decisions are prime-ministers, presidents, government officers, diplomats, politicians, entrepreneurs. Other readers such as consumers, community leaders, journalists also deserve reading a simple but cogent language, leading to actual understanding. The WGs may wish to hire science writers and experts in Plain Language in English. [Milton Nogueira da Silva, Brazil]	Accepted, but the report is a scientific report which makes use of scientific terms. The Summary for Policy Makers (SPM), which presents the key messages or takeaway messages for policy-makers will be developed based on the SOD. The SPM is revised and approved by governments.

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14969					When referring to Article 2 of the Paris Agreement, authors should be careful to quote directly from the agreement. Article 2 says: This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by: (a) Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;" and so on. This should guide the framing of the report and in particular any discussions of the aims of the Paris Agreement. [Farhan Akhtar, United States of America]	Accepted. Text will be revised.
641					Policy-makers and public paid more attention to those scientific basic issues: (1) When (which years) will reach 1.5C global warming relative to 1850-1879 for the various scenarios and passways? (2) Where (regions) should be much more over 1.5C global warming? (3) What kind of emissions will be corresponded to an 1.5C global warming? (4) Will an 1.5C global warming cause the more serious extreme events such as heat waves, floods, droughts, serious cold and heavy snow winter than now? (5) Based on the historical and paleo climate changes, an 1.5 global warming is significant level or not. Those scientific questions are not mentioned or emphasized clearly in SR15, especially in executive summaries. [Zong-Ci Zhao, China]	Accepted. Information has been improved, considering new available literature.
22147					Chapter 2 contains up to date literature on SLCF and the links between air quality and climate change. When reviewing the other chapters that mention SLCF or the links between air quality and climate change, the literature cited is often older and not from the most well respected scientific studies. Cross-chapter integration about the most current and up to date literature on SLCF and the link between air quality and climate would be beneficial. [Megan Melamed, United States of America]	Accepted. Consistency and coherence across the report has been revised. Thank you for the positive feedback on the Chapter 2 assessment
2692					Chapter 1 integrates the concept of social-ecological systems throughout the discussion, but does not appear to define it. The way in which the report on the whole talks about coupled social-ecological systems could be improved - some sections are very good at this, others not so. [Penny Urquhart, South Africa]	An attempt has been made to integrate this approach.
21636					Very informative report. The executive summary of the report and that of each chapter has to be concise and provide a specific subsection on recommendations for policy-makers. In addition, the pictures in certain boxes or intext are unreadable. [Prithiviraj Booneedy, Mauritius]	Accepted. The executive summaries were rewritten and improved. For policy-maker the SPM will be extracted from the executive summary statements. The figures and boxes will be reprocessed prior of publication.
1158					From a Ch5 perspective, the SR is progressing quite well! It is heartening to see issues of sustainable development, equity, poverty and inequality being addressed in each chapter, and the storyline is beginning to emerge throughout the report. [Petra Tschakert, Australia]	Noted. Thank you.
20102					Geoengineering was not included in the agreed outline of SR 1.5. It is therefore alarming to see geoengineering technologies, specifically SRM technologies, mentioned in almost every chapter and given broad consideration throughout the report. Some techniques are either just theoretical, untested or full of risks, like SRM, others have already been shown to have unacceptable negative impacts. [Lili Fuhr, Germany]	Accepted, but this kind of technologies are part of different pathways included in scientific literature, therefore, need to be presented in the report.
22150					The term short-lived climate forcers (SLCF) should be the only term used throughout the report to refer to forcing agents that have a short lifetime in the atmosphere. Throughout the report the terminology varies greatly including misleading terms such as short-lived pollutants or short-lived greenhouse gases. The term short-lived climate forcers is the correct term to use. [Megan Melamed, United States of America]	Rejected. Literature presents both terms. An annex to the report will be made available, to clarify this.
1159					Too much space is dedicated to solar radiation management throughout the SR (about 14 pages!). While we agree that SRM should be featured in the SR, it makes little sense for each chapter to address SRM individually. Lets reconsider condensing all discussion of SRM into one comprehensive cross-chapter box. [Petra Tschakert, Australia]	Accepted. This has been revised.
3720					The term "mid-century" should be defined and used consistently (I see it in ch 2, 3 and 4. The Paris Agreement does not refer to this term, Art 4.1 has a long-term mitigation goal "in the second half of this century". The Paris decision text refers to mid-century, but only for strategies (1/CP.21, para 35). Given that the same decision invited IPCC to produce this special report, it would be worth making clear (glossary and / or ch 1) what exactly is meant by mid-century. Is it 2050, some years around there - and how does that relate to the 2nd half of the 21st century? [Harald Winkler, South Africa]	It means the decades around 2050, which we believe is intuitive.

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20094					<p>Most serious concern undermining the validity, integrity and prudence of the entire SR1.5 is that 1.5 degrees C non-overshoot pathways are not described nor discussed. The objective of the Paris Agreement is to hold temperature increase to well below 2°C and to strive for 1.5°C above pre-industrial levels. The Decision text Preamble explicitly refers to "...aggregate emission pathways consistent with" the objective, whereas it does not refer to pathways overshooting the objective. Clearly, non-overshoot scenarios were considered of utmost importance in preparing the outline of the Special Report and instructions to authors (see e.g. IPCC- XLIV/INF.6.). This requirement should have guided the authors of the Special Report even if such pathways could not be produced by the same limited set of Integrated Assessment Models which produced the 34 highly risky overshoot pathways that are discussed in draft Chapter 2. In contrast, this draft does not seriously consider any emission pathways pursuing a 1.5 degrees C non-overshoot scenario, although only such pathways significantly reduce the risks and impacts of climate change, as mandated by the Paris Agreement.</p> <p>Furthermore, Chapter 1 repeatedly underscores the importance of the Sustainable Development Goals adopted in 2015 as a policy framework to guide international responses to climate change. The high-risk nature of overshoot pathways, including the high risks and uncertainties associated with specific technologies relied on in these scenarios, seriously jeopardizes progress made on sustainable development. They are likely incompatible with sustainable development, including the integrity and protection of ecosystems and human communities.</p> <p>The fact that FOD Chapter 2 only includes pathways involving overshooting 1.5 degrees C with a return to 1.5 degrees not until 2100 amounts to serious negligence. The reason cited for this significant omission is that there is no existing literature on non-overshoot scenarios. However, there are numerous references even in the authors' list of references, which develop many, if not all, of the elements for one or more non-overshoot scenario. There is, furthermore, a lot of additional literature warning against overshooting 1.5 degrees C. The expertise of the authors of the Special Report would clearly have allowed discussing potential policy-relevant 1.5 degrees C non-overshoot pathways from the existing literature, both the peer reviewed and grey literature.</p> <p>Hence, despite the strong guidance deriving from the Paris Agreement and the approved outline for the Special Report, the FOD fails to discuss and present the critical issues that need to be addressed to achieve a non-overshoot pathway. In this particular instance of the Special Report on 1.5°C, the IPCC must be aware of the political implications of its own knowledge production more than ever before, must step up to its responsibility for global responses to climate change and make sure it puts forward viable, safe, climate just and SDG compatible pathways to 1.5 degrees C that guide policy making. [Lili Fuhr, Germany]</p>	Accepted. The SOD now includes a discussion of both overshoot and non-overshoot scenarios in Chapter 2. The LED scenario is consistent with limiting warming to 1.5°C (at a reasonable level of probability) without extensive use of BECCS or CCS.
20101					<p>It is part of the mandate of the IPCC to, inter alia, "formulat[e] realistic response strategies" (AR6 SCOP/Doc. 2, p. 34). The reliance on inherently high-risk, undeveloped technologies with profound and unevenly distributed adverse impacts to "fix" climate change cannot be considered a realistic and responsible response strategy. Realistic and responsible responses to climate change should pay heed to other planetary boundaries (in particular, biodiversity loss, impacts on land-use change, impacts on global freshwater availability, impacts on the nitrogen cycle, see Rockström et al. 2009 in Nature) and make sure the transgression of other planetary boundaries is not exacerbated by climate change responses but rather alleviated by relying on safe, viable and climate just global response strategies. [Lili Fuhr, Germany]</p>	Accepted. Information will be revised accordingly to new literature related to this topic and 1.5°C. Synergies and tradeoffs are highlighted in this report.
3721					<p>The term "net zero" emissions is used in several places. The Paris Agreement does not use the term, but more technical language (!) in Art 4.1, "to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases". A glossary definition and / or discussion in framing might make clear to reader what is meant by 'net zero'. [Harald Winkler, South Africa]</p>	Accepted. A definition will be part of next versions of the report.
3978					<p>In many cases the figures and their axes labels, legends etc are impossible to read because they're either too small or resolution is too low [Stephanie Henson, United Kingdom (of Great Britain and Northern Ireland)]</p>	Accepted. This will be improved after the SOD, once final figures have been decided.
651					<p>Most parts of SR1.5 focused on emissions, impacts and policy, but a few part of SR1.5 provided the CLIMATE CHANGE basic issues of 1.5C global warming (such as observed facts, attribution and projections). Climate change of 1.5 global warming is the most important in the entire report, others are responded to climate change. Suggestion is to give more pages to climate change of 1.5C global warming. [Zong-Ci Zhao, China]</p>	Accepted. Information has been improved, considering new available literature.
6545					<p>I found strong biases towards an « ecologically correct » society: no coal, no nukes, slower population growth, reduced energy supply, behavioural changes... I would have preferred more science. [Jean Louis Bobin, France]</p>	Rejected. The report is based on scientific literature.
10391					<p>These comments (up to section 3.3) are made from the point of view of readability, communications and editorial criteria, not the underlying science. [Jonathan Lynn, Switzerland]</p>	Noted.
10392					<p>They do not comprehensively address copy-editing issues. But further down the road the following, among other things, need to be standardized: [Jonathan Lynn, Switzerland]</p>	Noted.

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9882					I was not able to read the entire report in detail, but it seemed as if the chapters could be better integrated. Chapter 1 refers to the "intrinsic link" between climate change and inequity and injustice, but did very little to define or explain that link. I expected, therefore, to see more in chapter 3 describing inequities in climate change impact. Chapter 5 does describe the potential for increased inequality and poverty, but does not really describe the interactions between poverty and health impacts. [Susan Clayton, United States of America]	Accepted. Coherence between chapters has been improved and topics have been covered according to the limited available literature.
20378					I would like to commend the authors for this first draft. The topic of the report was quite challenging and the authors have made a good job at structuring the report. There is however currently a lack of integration and synthesis between chapters. This is quite obvious between chapters 1 and 2, whereby chapter 2 is not using the vocabulary and concepts defined in chapter 1. I like chapter 1, but it rests on very thin literature, so chapter 2 has used more traditional (maybe less appropriate) concepts. Somehow Chapters 3 and 4 are more consistent, but there are still inconsistencies in some of the definitions, assumptions and conclusions with the other chapters. [Olivier Boucher, France]	Noted.
21133					As sections 1.2.1.1, 1.2.1.2, 1.2.1.3, and 1.2.1.4 clearly show, the text of the Paris Agreement leaves significant flexibility for interpretation of many important technical elements required to accurately define and analyses pathways to achieve the 1.5C and 2C targets. However, one element of the Paris Agreement text is not left to interpretation, and that is that all action to address climate change occur in the 'context of sustainable development and efforts to eradicate poverty.' This language can be found in Article 2 and Article 4.1. It is surprising that this language is not referenced in the summary chapter of the report. [Nathan Borgford-Parnell, Switzerland]	Rejected. FOD already considers sustainable development as a key issue related to 1.5°C, according to the approved outline and will be further improved or emphasized in next drafts.
3986					As the first order draft it covers many of the key points. However I think there is more case studies out there that can help you come to some more definitive conclusions in the final. There seems to be an over stressing of local and regional action as distinct from national. In all the OECD research it emphasises the need for all three levels of government, national, state and local as while much innovation occurs at the local level it generally cannot do over the long term on its own or alternatively the transformation can occur much more quickly with the support of high levels of government - see national urban policy reports 2007 and 2017 by the OECD. [Barbara Norman, Australia]	Accepted. Information about national governance has been added in SOD. Requests for further case studies are beyond our scope.
2197					A very general comment is that the entire report is fundamentally based on results from IAM global scenarios where more or less realistic assumptions have been used. On this basis the report presents WHAT could be done to achieve a 1.5 degree world. The major shortcoming of the report is that the analysis regarding HOW to actually manage the transformations suggested by IAMs is largely lacking. The mitigation pathways section does refer to the scaling-up challenge and refers to other sections of the report, eg. for the consideration of technical challenges. This is dealt with primarily in chapter 4. However, in chapter 4 too much of what has already been presented in the mitigation pathways chapter is repeated and the actual analysis with respect to individual technological options is shallow, largely anecdotal and insufficient. It would be a useful exercise to delete those parts of chapter 4 that only repeat numbers from chapter 2 as it would then be revealed how incomprehensive many sections of chapter 4 really are. [Kenneth Möllersten, Sweden]	Accepted. Efforts have been made to avoid overlaps.
2198					The report does refer to the rapid transformation/scaling-up challenge that the world is facing. However, for some reason the focus lies on the post 2050 phase of mitigation pathways, in particular concerning CDR. If one looks at the figures of chapter 2 mitigation pathways commonly include CDR from as early as from 2030. The report should analyse this challenge in much more detail as it is possible to do that with more precision compared to post 2050. Deployment of CDR will have certain lead times (planning, permits, financing, engineering) and this report will be published only 12 years ahead of 2030. Yet, the CDR levels of 2030 are hardly mentioned, or their realism analysed. If it can be concluded that assuming massive CDR (0.5 Gt/yr) from 2030 is a highly risky assumption then this has implications for the overall realism of the mitigation pathways presented. An even more rapid transformation would be required in other technological areas/later on. It is not addressed what early opportunities for BECCS deployment might be available and that could be promoted to realistically meet the early CDR deployment that pathways modelling results in. [Kenneth Möllersten, Sweden]	Chapter 2 now reports on a much wider variety of scenarios compatible with 1.5°C. Some of these scenarios deploy large amounts of CDR by 2030, while others do not use BECCS at all. The hope is that this provides balance and insight in the various options available to policy makers.
17306					Regarding negative emissions technologies (NETs); the report emphasizes in various places that all scenarios examined contain NETs to some extent and it discusses the scale at which different NETs are deployed in different scenarios. However, to improve the policy-relevance of report regarding NETs it would be very important to discuss which NETs have been fully or partially demonstrated to work in practice; at demonstration scale or deployment scale. Without this information, policy-makers and societies will have a hard time assessing whether they expect the NETs utilized in the scenarios to become available at the scale the scenarios assume. Furthermore, the discussion of potential problems with the deployment of various NETs (land use, social acceptance, cost, side effects etc) are not fully explored, focussing mainly on BECCS but providing less if any details on other technologies such as ocean fertilization, biochar, DAC etc. [Christian Holz, Canada]	Accepted. Information will be revised accordingly to new literature related to this topic and 1.5°C.
15003					The report should have a consistent reference to Article 2 of the Paris Agreement. Which contains a single long-term temperature goal. Parties also committed to aim to pursue efforts toward limiting warming to 1.5 degrees, but they did not adopt a 1.5 degree limit, target, or goal. [Farhan Akhtar, United States of America]	Accepted. Text will be revised.

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19101					<p>This review applies to chapters 1,2,3 & 4, and has been paid to sections relating to importance of clouds on radiation and specifically geoengineering. Modifications should be inserted in appropriate chapters.</p> <p>This report largely omits some scientific discussion of current limitations of the science of climate change and research which is not mainstream. This approach may well be correct but research which argues that climate models per say, are inadequate should be discussed more and those physical processes which are ignored described. For example, the discussion of "Geoengineering" is separated from the fact that mankind is warming the climate from greenhouse gas (e.g. CO2 and CH4) warming, and semi-ignores the feedback effects of the biggest green house, water vapour. Modification of clouds both unintentionally or intentionally is "geoengineering". Since most climate models replicate clouds badly this is a topic that is insufficiently discussed. Tropical storm Harvey, is an example of the effects of abnormally warmer Sea Surface Temperatures in the Gulf of Mexico on the intensity of hurricanes. Although, for example, the work of Holland is quoted, the role of the albedo changes due to clouds and the feedback increase precipitable water in the boundary layer is limited. Tropical storm Irma's intensity is a direct consequence of the SSTs etc. being 2C warmer than normal. This whole area needs more discussion included as regards impacts (see \$2 below). Marine Cloud Brightening (see references at the end) is only discussed briefly. Clouds can easily have as large an effect as greenhouse gas emissions, is fundamental (see references below, Appendices A and B); MCB should have much more discussion and analysis. The few references ignore the sources of the ideas, but just provide the views of those who criticize the original theory. The underlying role of clouds / albedo changes is critical for the planet's energy balance. The report takes a "conservative" approach and belays the whole philosophy of trying to reach an unbiased scientific assessment and genuinely presents the science.</p> <p>One further example of this methodology, which needs attention, is the omission of discussion of the work of Wadhams on ice loss in the Arctic. This is a significant body of research, which is also very important in a 1.5C scenario. Even if this work is erroneous, which I suggest is not, it should be discussed. Omission of reference to these ideas of scientists who propose, this, is not right or proper and is bad science. If I were to review this in a paper I would recommend reject and resubmit.</p> <p>Details of the omission in the specific areas are discussed in more detail below, with some citations provided. There is much excellent work in the report, but in my view these details have to be addressed.</p> <p>1. There is an omission of a lack of discussion of the possible rapid changes of Arctic Ice fields, and consequential changes in a 1.5C world. This needs to be addressed. A few references to the work of Peter Wadhams, some of which are supplied in Appendix A, needs analysis. His views may not be mainstream, but there is a possibility he may be right and certainly NO reason to be ignored in a unbiased assessment. This work is fundamental science.</p> <p>2. It is apparent in the report that considers that SRM - Marine Cloud Brightening - will not work. The justification of this is unclear and approach inappropriate. This analysis is achieved by ignoring the more than dozen papers which show it could work, would be cost effective and has far less damaging side effects than Stratospheric sulphur injection. There are many more papers than those listed in Appendices A and B. Crutzen, (2006), a founder of stratospheric sulphur injection prefers MCB as less damaging and technology easily switched off and is preferable option if SRM (Solar Radiation Management) has to be implemented. The effects of MCB on hurricane weakening and reducing coral bleaching are being currently discussed in the open literature, and ignored in this report. Why does the report not discuss this more? The sceptic would say this is because the report is written by consortia scientists who are chosen in such a way as to preclude those with different views. A collection of some of the references is included in Appendix B. These should be discussed as the original source documents, rather than the those scientists who have reviewed the work. There are far more publications than in this small collection in Appendix B. Critically, physical scientific processes involved are not discussed and need</p>	Accepted. Literature will be revised for next draft.
21152					<p>The IPCC Special Report on 1.5 Degrees (First Order Draft) is excellent. In the SR 1.5 FOD I found, for the first time, properly considered the hydrogen carrier and fuel cell technologies and I'm sure that new literature about these disruptive low-carbon solution will be published shortly and will be assessed and included in SOD. In this perspective in my comments I'll suggest you to consider some specific literature not included in FOD and I look forward to reading and comment the SOD. [Mario Valentino Romeri, Italy]</p>	Thank you.
12453					<p>There are terms in report about the economical condition of countries like:"low and moderate-income countries", "less wealthy countries", "low and middle income countries". I think it is good to consider homogeneity in using such words in Whole report. [Mohammad Rahimi, Iran]</p>	Noted. Language has been streamlined.
19621					<p>Three overall comments. First, the paucity of non-overshoot scenarios seriously jeopardizes the utility and credibility of the report. Second the heavy reliance on NETs with significant land use demands that this implies will leave the report open to rather brutal attacks from both within academia and the NGO community. The authors should do all that they can to remedy this situation before publication. Finally, the significant discussions of SRM are not justified by the agreed outline and directions to authors and will be seen as highly problematic by many and so should be significantly scaled back. [Doreen Stabinsky, United States of America]</p>	This is addressed in the LED scenario in Chapter 2.

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3995					<p>Dear Sirs,</p> <p>First of all, thank them for the opportunity you have given me to review document SR15-FOD. I would have liked to have more time to read it calmly but I have hardly had two weeks.</p> <p>In a general way, the document follows the guidelines of the past reports, making a very predictable scenario unfortunately for all of us.</p> <p>Without going into details because it is a document prepared by a group of people more suitable than me, I would like to make a reflection.</p> <p>You are posing a global scenario. I understand that for a scientific and political forum is necessary but this type of messages do not usually reach the population.</p> <p>You talk about large regions, major climate changes and general scenarios, but people live in small regions, suffer concrete and different changes from those of their neighbors, and face the problem differently. Many data, many variables and many scenarios, but what about what is happening to our surroundings? We must explain it to the people around us, who see that not only climate change is something that covers 2000 pages and that elaborates some scientists and that is going to affect others. It is something that is happening and that is causing irreparable damage to me and mine. If we are able to do this we will have taken a big step and people will begin to understand the meaning of global.</p> <p>I think it would be good to look for ways to generate working groups from small regions and move the proposed scenario in your report to the day to day and to the reality of people.</p> <p>I live in Galicia and have been studying their agroforestry systems for 20 years. At the moment we are suffering an unprecedented drought. This drought is affecting livestock production, agriculture, water resources, tourism, fishing, shellfish, etc. But the farmer or the farmer addresses the problem differently from the fisherman or the farmer from another region.</p> <p>In recent years I have been lecturing in schools, high school, university and different forums of "normal" people, ordinary citizens, and the system works.</p> <p>In their document they speak of Poverty Eradication but in Galicia one begins to speak of emergent poverty. And this situation begins to be general in Spain and in other countries. Countries considered as the first world.</p> <p>I believe that without forgetting the horizon of global climate change and global measures of action we should try to work more on the particular.</p> <p>Unfortunately chapter 5 Sustainable Development, Poverty Eradication and Reducing Inequalities will not only affect poor countries in the future, I think it is already affecting us all and we are not doing anything.</p> <p>We must explain to the fisherman why he fishes less, the farmer because pests are more common and smaller productions, the local government because tourism can be lost if we lose our natural heritage and our friends and neighbors that indisputable and "inalienable" assets such as water, food and "peace and social welfare" are in danger. Explain that your children will have problems not because the IPCC says but because if we have time to observe we can see it. There should be the strength of the document, from the particular to the global. If we are able to reach people we will have a chance.</p> <p>Good job. Excuse my mistakes in writing but my English is a bit "rusty", and thank you once again for offering me this possibility. I will continue working and trying to convey the spirit of the document and reach as many people as possible.</p> <p>[José Antonio Rodríguez Ahón, Spain]</p>	<p>Thanks for your comments. Information about regions, countries and subnational level is presented when available. Overall, information related to 1.5°C is very limited and the authors have integrated what is available at the moment. More information about current observed changes and scenarios for regions will be part of the 6th Assessment cycle Report (AR6).</p>
9634					<p>The cross-cutting issues of different chapters need to be further clarified, as in Chapter 1 and Chapter 2, Chapter 3, Chapter 4, Chapter 5 and the previous chapters; the full report consistency, including 1.5 ° at global and regional scale.</p> <p>Clarifying differences of the effects of global warming of 1.5 ° and 2.3.4 ° on natural and human system, increasing the assessment content of effects of 1.5 ° pre-industrial level on natural and human system, and using consistent climate change scenarios, such as RCP scenarios; giving uncertain or confidence of project effects of climate change on natural or human system.</p> <p>Attribution of past climate change impacts on natural and social systems and project the effects of future climate change on natural and social systems.</p> <p>clear the differences of Adaptation and mitigation measurements, some measurement for adaptation and mitigation may be cruss-cut for AFOLU or LULUCF. [Jianguo Wu, China]</p>	<p>Accepted. Consistency across the report has been improved (further work will be done for the FGD). Coverage of global and regional effects of 1.5°C global warming is made when available literature allows for it.</p>
21420					<p>Congratulations to all contributors on another stellar contribution to science. [Tadhg O'Mahony, Finland]</p>	<p>Thank you.</p>
691					<p>Most parts of SR1.5 focused on emissions, impacts and policy, but a few part of SR1.5 provided the CLIMATE CHANGE basic issues of 1.5C global warming (such as observed facts, attribution and projections). Climate change of 1.5 global warming is the most important in the entire report, others are responded to climate change. Suggestion is to give more pages to climate change of 1.5C global warming. [Zong-Ci Zhao, China]</p>	<p>Accepted. Information has been improved, considering new available literature.</p>
7865					<p>The report needs to align language to either US or British English because there are the uses of both forms in the same phrases throughout the text, which makes for a lack of elegance. [Yana POPKOSTOVA, France]</p>	<p>Editorial - copyedit to be completed prior to publication</p>
21696					<p>The scenarios consider overshooting temperature, many degree years, in the same way recently Millar et al.. Scenarios that do not exceed 1.5 °C should also be produced and their impacts and pathways analyzed separately. [alberto pedace, Argentina]</p>	<p>The SOD now includes a discussion of both overshoot and non-overshoot scenarios. The Millar et al. scenarios are stylized thought experiments without underlying energy system information.</p>

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9160					the use of case studies could be interesting to illustrate, however, you might be going into difficult discussion on why did you select such or such zone, and might want to find a delicate balance in between geographical areas, if possible. [Timothée OURBAK, France]	Accepted. Depending on new available literature information about different regions has been added in SOD.
20424					It is not clear how the report will be synthesized. In its current form I am concerned that different readers could draw very different conclusions on the feasibility of a 1.5°C pathway by cherry-picking the material they like most in the different chapters. [Olivier Boucher, France]	Thank you for your comment. The key findings of each chapter is summarized in the executive summaries and the overall report will be synthesized with the Summary for Policy-makers.
20425					I've always heard that IPCC reports should not make recommendations on what additional research is needed. This is not the case of this report, but maybe we should change paradigm here, so I'm not saying all recommendations should be removed. [Olivier Boucher, France]	Accepted. IPCC reports are not and can not be prescriptive, but research gaps can be identified.
20647					In the next order draft, consider editing / condensing so that the key messages become more clear for decision makers and other readers: need a very careful treatment of what is known about existing pathways and trade-offs (difficult ethical questions, impacts understood with some certainty on values like food production) with the risks, knowns, and unknowns of alternatives like negative emissions technologies. The overall report runs the risk of presenting decision makers with very complex, difficult questions and not enough treatment of what may appear to be easier, simpler, less known solutions (for example, discussions on negative emissions technologies should draw on literature in ways that allow the knowns, unknowns, and risks to be compared with emissions reductions knowns, unknowns, and risks to avoid "false bargains" in decision making—placing high hopes on untested technology down the road in part because social discourse around trade-offs of political "knowns" like emissions reductions seem too complicated in the present period. [Koko Warner, Germany]	Accepted. Efforts have been made to avoid overlaps and to present the information in a more concise way. The report is a technical report, which will be the basis for the Summary for Policy Makers, which will be developed together with the SOD.
681					Policy-makers and public paid more attention to those scientific basic issues: (1) When (which years) will reach 1.5C global warming relative to 1850-1879 for the various scenarios and pathways? (2) Where (regions) should be much more over 1.5C global warming? (3) What kind of emissions will be corresponded to an 1.5C global warming? (4) Will an 1.5C global warming cause the more serious extreme events such as heat waves, floods, droughts, serious cold and heavy snow winter than now? (5) Based on the historical and paleo climate changes, an 1.5 global warming is significant level or not. Those scientific questions are not mentioned or emphasized clearly in SR15, especially in executive summaries. [Zong-Ci Zhao, China]	Accepted. Information has been improved, considering new available literature.
12462					It is not known how contributing authors have been selected. It appears a number of contributing authors have been repeatedly used in a number of chapters who are mostly represented from non-developing countries. Chapter 2 and Chapter 3 are too elaborated without main substances. Only chapter 5 balance mitigation and adaptation. Other chapters largely missing balancing adaptation and mitigation. Chapter 4 is too descriptive like a 'report model'. Authors need to think assessing the literature rather than putting all basic information like a 'guidebook'. Chapter 4 has too many boxes, do we really need them here. [Dr Noim UDDIN, Australia]	The selection was made considering expertise, regional and gender balance. The team has tried to improve the balance between mitigation and adaptation, considering the available literature. Also, the number of boxes has been reduced.
6833					In addition to my earlier comments on the structure of the report I want to add my concern that chapter 3 seems to leave the discussion of adaptation strategies to chapter 4. I find this not very logical, given that impacts and adaptation options for the various elements of the global system are already in chapter 3. In addition, as I suggested in my other comments on the structure of the report, it would strengthen the logic of the report to discuss the combined adaptation/ mitigation strategies and their relation with pursuing Sustainable Development in chapter 5, which would be moved to come after chapter 3 and leave chapter 4 to solely discuss implementation issues for these combined strategies. So what I recommend is to move the material on adaptation strategies from chapter 4 to chapter 3. [Bert Metz, Netherlands]	Discussion on adaptation has been revised in next draft.
15039					The report has exceeded the length requested by the Panel significantly. At its current length, it will be very difficult for member governments to review and approve the report next year. It will also lessen the impact of the report in the greater community. I urge the authors to reduce redundancies between sections and across chapters and to focus their efforts on peer reviewed socioeconomic and scientific information that is specific to the global warming of 1.5 degrees. Information that is more general about climate change and related policies will be addressed in later reports this cycle. For each section, the authors should ask if the topic or information is it relevant to 1.5 degrees. If it is a topic that is relevant to climate action more broadly but is not specifically related to the impacts at 1.5 degrees and the pathways towards this end, it should be removed. This will mean that many important topics will be removed from this report. This is however, consistent with the request of the UNFCCC and the IPCC panel decision. [Farhan Akhtar, United States of America]	Noted.
21964					The confidence levels are often put after the statement (made up example: Precipitation has increased globally in the past 50 years (low confidence). It would be better to use the defined likelihoods, or to put this up front so that it doesn't negate the previous statement (e.g. It is known (with low confidence) that precipitation has increased....) [Delphine Lobelle, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. Confidence and likelihood language can both be used in the report, depending on the associated evidence and agreement (see Guidance note for Lead Authors of the IPCC AR5 on consistent treatment of uncertainties).
13517					The terms 'aerosol-radiation interaction' and 'aerosol-cloud interaction' should be used instead of 'aerosol direct effect' and 'aerosol indirect effect' (See IPCC WG1 AR5 Section 7.1.3). [Toshihiko Takemura, Japan]	Noted.

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21965					Often a difference is stated without a sign, e.g. the temperature difference was 0.5degreesC, when it would ideally be +0.5degreesC (or -0.5degreesC where required) [Delphine Lobelle, United Kingdom (of Great Britain and Northern Ireland)]	Editorial - copyedit to be completed prior to publication
3534					a glossary with all definitions would be very helpful given the complexity of the topic and the fact that many parameters are operationally defined. [Sylvia Sander, Monaco]	Thank you. A list of acronyms and glossary will be part of the report.
21966					All of the figures are too small to read the details/legends/titles, as well as being very blurry/low resolution [Delphine Lobelle, United Kingdom (of Great Britain and Northern Ireland)]	Editorial - copyedit to be completed prior to publication
21967					There is an obscene amount of repetition. In many cases this is ideal as it would be a struggle to read the whole report, however in Chapter 3 alone the concept of 1.5 vs 2degreesC warming is described multiple times, as is the concept of linearising the climate response over an additional 0.5degreesC warming (just as examples, there are many more). Repetition could be vastly reduced by being consistent with standards, abbreviations, etc. At least one section was word for word identical to another... Overall this means it doesn't feel like a cohesive whole, but rather many separate bits and pieces pushed together. [Delphine Lobelle, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Report has been significantly shortened.
19648					The attention paid to setting out the human rights, ethics and justice aspects of both the impacts of climate change and responses to climate change in chapter 1 needs to be reflected in the rest of the report where treatment of these issues is variable and sometimes only partial. It is particularly important to use human rights, justice and ethics to inform international, national and local response to climate change. It is recommended that authors with speciality in these fields be invited to work with the chapter authors to strengthen chapters 2, 3, 4, and 5 in particular. Human rights provide a framing for examining the social and ethical aspects of both climate impacts and climate responses. Gender differentiated climate impacts, gender equality and the need for and value of gender responsive climate policy should be strengthened throughout the report. [Tara Shine, Ireland]	Accepted. When possible, this will be improved in further drafts of the report.
4297					I think the report would gain by focusing on chapters with quantitative information (mainly chapter 2-5) reducing the length of rather rhetoric and long sub-sections of chapters 1, 4 and 5, where I find extremely difficult at times to extract a clear new message (i.e. not mentioned already in Ch 1) when referring to sustainable development, societal aspects, equity, justice etc. Authors of Ch2 (i.e. those translating ideas into numbers using quantitative models) should read other chapters, and assess/commnet if the information is coherent with data including in 1.5°C scenarios and pathways of Ch2. [Abanades Carlos, Spain]	Thank you for your comments. The chapters have reduced their lengths and their structures and texts were revised to allow more clarity. The information presented, is the information that was available during the preparation of the FOD. Quantitative information made available after the preparation of the FOD, has been added in the SOD. Coherence between the chapters was also revised.
6601					The report seems to over-adhere to one single theoretical perspective, that is that of transition theory. However, most of the examples and case studies provided do not fit to that theory -nor the potential pathways- and even less for the case of climate mitigation or adaptation. This is so because such examples do not follow or show any signs of a typical S-curve, none have a particular end-point or even trajectories which can be quantified or validate such s-shape trajectories in terms of GHG reductions or adaptation progress. In other words, basically what we see on the ground or the evidence stated in the report does not seem to fit that theory. This is a risky decision, as the report runs the risk of being based only on a theoretical framework with little room for empirical validation and improvement (or even rejection, as it happens with many social theories). In this respect, one wonders if the report could complement such single perspective (which is strangely is coupled with normative statements derived from other abstraction such as the use of single-rationality agents used to run General Equilibrium macroeconomic models..) with a more nuanced, empirically grounded, open to multiple future states, with multiple equilibria and in fact less linear (despite following a log line) approach which could be more suited to help understanding the real dynamics of much plural and complex social transformations operating in many different scales and contexts - and do in a way which could be much more supportive to meet the 1.5°C challenge in an iterative social (and sustainability) learning mode. The 2013 World Social Science report Report and the work by Heide Hackmann and colleagues in this respect may help to understand what I mean in this regard. [J. David Tabara, Spain]	Noted, but it is unclear how this could be implemented.
21968					Can a glossary be introduced? There are a very large amount of terms and abbreviations, which are often defined ad hoc, meaning it is necessary to go back in the text until you find the definition of the term you need (if there is one). [Delphine Lobelle, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. A list of acronyms and glossary will be part of the report.
21969					There is a common practice of incorporating a lot of numbers into a sentence (for example see Chapter 3, Pg 17, Lines 36 to 40). These numbers would almost always be better expressed in a table or chart. [Delphine Lobelle, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. When possible, information is presented in tables.
21970					Despite the emphasis on being consistent in the first Chapter of the report, it appears that many ad hoc standards are defined and employed which vary from chapter to chapter [Delphine Lobelle, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Consistency and coherence of the report has been revised.
21971					Often the figure caption is rewritten elsewhere in the text (e.g. Chapter 3, Pg 27, Lines 2-3) [Delphine Lobelle, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Improvements have been made in this regard.

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10196					If chapters 1 and 2 use human induced warming to characterise pathways (which I think is the right choice), for chapter 3 and in other places, we need to be careful about how we describe a 1.5C world. We could be in a future with lots of volcanic activity where human induced warming >> 1.5C but we are not in a 1.5C world. I think this needs to be covered somewhere in Chapter 1 and referred to by Chapter 3 and others [Piers Forster, United Kingdom (of Great Britain and Northern Ireland)]	Definition of a 1.5C warmer world has been clarified to refer to total, not just human-induced, warming.
21972					Values are stated without errors, confidences or uncertainties throughout the report. [Delphine Lobelle, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Improvements have been made in this regard.
1749					Structure: It would be more logical to start with the impacts (Ch1) to be followed with the mitigation pathways (Ch2): also in line with the Paris Decision (para 21) "special report in 2018 on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways". [Tibor Farago, Hungary]	Noted.
9685					Executive Summaries of Chapters 1-4 lack mentions of confidence levels and agreement levels. [Masahiro Sugiyama, Japan]	Accepted. Efforts have been made to add calibrated language.
21973					The word 'preindustrial' is spelt in many different ways e.g. (pre-industrial, Pre-Industrial, pre-Industrial, preindustrial etc.) [Delphine Lobelle, United Kingdom (of Great Britain and Northern Ireland)]	Editorial - copyedit to be completed prior to publication
1750					Context: The IPCC was invited to provide the SR15, however, it is essential for the policymakers to understand what ought to be done for the 1.5°C case beyond the actions for the 2°C case. Thus, throughout the SR it would be important to see this incremental aspect. (Para. 17 of Paris Dec.: "much greater emission reduction efforts will be required .. in order to hold the increase .. to below 2 °C above pre-industrial levels by reducing emissions to 40 Gt or to 1.5 °C .. by reducing to a level to be identified in the special report" (As e.g.: SR15 Ch1 p7 lines 25-26) [Tibor Farago, Hungary]	Thanks for the recommendation. The report presents comparison between 1.5°C and 2°C when information is available.
6868					I think there is a serious problem with the structure of the report. With the current structure the main emphasis is on chapter 2, outlining the strategies to keep warming under 1.5oC, not only covering the "what, where and when" aspects, but also the "how", based mostly on IAM literature. Chapter 4 then starts covering the "what, where and when" issues in section 4.3), but now based on different literatures. It overlaps heavily with ch 2 and reads like an afterthought and it is likely this will not affect the main messages drawn from ch 2. A similar problem rises with ch 5, where mitigation and adaptation are discussed in a sustainable development framework, overlapping with chapter 2's discussion of SSP modelling and chapter 4's discussion on integration of adaptation and mitigation options, again making ch 5 look like an afterthought. In order to improve the logic and ensure that each chapter gets equal attention in conveying the main messages, I suggest the following restructuring: Chapter 2: have all the "what, where and when" discussions on mitigation here, including much of what is now in ch 4.2 and 4.3 (bringing the other literatures and considerations to the relevant sections of ch2, allowing a balanced discussion of the limitations and strengths of IAM findings and supplementing it with other literatures); then move all the "how" material from ch 2 to ch 4. Move the discussion of SD aspects (section 2.5.3) to chapter 5, as that is the place to discuss the relationship with other issues. Chapter 4: focus exclusively on the "how" question, i.e. sections 4.4 and 4.5 and move all of the "what, when and where" material from 4.2 and 4.3 to ch 2, except the considerations on combining adaptation and mitigation that should go to chapter 5, as that is already doing that. Chapter 5: move the chapter to sit before the current chapter 4, because it then can deal effectively with integration of adaptation and mitigation in a SD context (on the "what, where and when" issues), allowing chapter 4 (when moved to the end) to discuss all relevant "how" issues for getting below 1.5 degrees in an SD context. This restructuring will allow to draw the key messages on mitigation strategies from ch2, on adaptation strategies from ch3, on the changes that an integrated strategy of adaptation and mitigation in an SD context will require from the old chapter 5 (now 4) and then the key messages on how to get it done from the old chapter 4 (now 5). [Bert Metz, Netherlands]	Rejected. Thanks for the suggestions, but the report follows the approved outline, therefore the structure has not been changed, but work has been done to avoid overlaps between chapters.
21974					In chapter 3, there are many figures with low quality and not visible fonts and legends. Probably enhance quality of the images, change colour of non-visible lines, larger fonts and legends. See Table XX (pp. 60-61), Figure 3.12 (p. 32), Box 3.2 (p.34), Figure 3.17 (p.53, also see extra parenthesis line 12), Figure 3.2 (p.18), Figure 3.8 (p.24), Figure 3.9 (p.26), Figure 3.11 (p. 30). [Delphine Lobelle, United Kingdom (of Great Britain and Northern Ireland)]	Figures have been improved.
1751					UNFCCC and Paris Agreement: The IPCC was invited to provide SR15 in accordance with Art 21 of the 'Paris Decision'. The most important 'guiding' provisions of the Paris Agreement (PA) are included in its Art 2, Art 4, nevertheless, the relevant items of the UNFCCC are overlooked in spite of the fact that it is the legal basis also for the PA. I mention two items (others might also be essential for SR15): objective (Art 2 of the Convention) when the damages are considered (harmful impacts to be avoided); the notion of the climate change which is clearly related to the anthropogenic one in accordance with the definitions (Art. 1), which is different from the more general approach by the IPCC. [Tibor Farago, Hungary]	Rejected. Report follows approved outline, which follows the invitation of the COP21.
1752					Authors: I could identify only one expert among the CLAs, LAs and CAs from the UN-EE region (~25 countries) in the entire draft SR (i.e., among the 86 Authors selected from 560 nominations); it contradicts to the principles of IPCC operations and also reinforces the rather low level of public awareness of this hazard and low level of involvement of this regions' experts in this cooperation. [Tibor Farago, Hungary]	Thanks for your observation. The selection was made based on the nominations received, considering expertise, regional and gender balance.

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7384					The executive summaries for different chapters are structured in very different ways in the current draft. Please consider to streamline, with headline statements in bold and also include level of uncertainty where appropriate. In addition it is crucial that the referencing to the corresponding sections are done in a consistent manner throughout the report, and especially in the executive summaries. Since there are so many cross chapteral topics in the report you should also consider to include, especially in Chapter 1 (framing and context), references to other relevant chapters where appropriate. [Øyvind Christophersen, Norway]	Accepted. This has been improved for the SOD.
7385					Please make sure that near term forcers are named the same way throughout the report for consistency. As it is now different names are used (e.g. short lived forces or short lived pollutants). [Øyvind Christophersen, Norway]	Accepted. This has been improved for the SOD and a editorial process will follow after the approval of the report. Chapter 2 now consistently uses "short-lived climate forcers". Short-lived climate pollutants are a subset of short-lived climate forcers, namely only the warming ones.
20185					Use of the acronym DAC/Direct Air Capture will only have a meaning if the removed CO2 ends up in a sink e.g. a geological storage. That's why I would prefer to use the term DACS like is being in Chapter 4. [Ton Wildenborg, Netherlands]	Noted.
7386					Please consider writing the executive summaries in a less technical language, with conclusions that are clear and conclusive. Preferably conclusions in the executive summary should be highlighted (e.g. in bold) and presented as "take-home-messages". For easy access, the take-home-message could be stated at the start of each paragraph in the executive summary [Øyvind Christophersen, Norway]	Accepted. In SOD, all executive summaries present the takeaway sentences in bold.
20186					I would prefer to use the term 'CO2' rather than 'C' or 'carbon' in terms like 'carbon emission' or 'zero carbon technologies', e.g. on page 29, lines 53 and 54 [Ton Wildenborg, Netherlands]	Noted, although it is important to reflect the diversity of usages in the literature.
7387					Please consider to make clearer and more consistent throughout the report what is new since AR5. [Øyvind Christophersen, Norway]	Accepted. This has been improved in the SOD, considering the new available literature.
7388					Please be consistent throughout the report when referring to different scenarios, e.g. SSPs, RCPs or 1.5C vs 2C. We understand that this is a very demanding task but think that you could significantly improve readability by being as consistent and precise as possible. [Øyvind Christophersen, Norway]	Accepted. This have been improved.
9949					It would be interesting to have a list of acronyms. There are a lot of acronyms and sometimes it's difficult to remember what an acronym means. [Olga Alcaraz, Spain]	Accepted. A list of acronyms and glossary will be part of the report.
9186					I read Chapters 1 and 2. There is so much text, and rather heavy text. So many paragraphs I read the first sentence, and then just skipped to the next paragraph. Not all text will be for everyone, but by far the biggest challenge will be to simply delete paragraphs that are not absolutely essential. With every reduction in length, the report will get better. [Glen Peters, Norway]	Noted.
7142					In Paris, policy makers agreed an upper and lower limit of global warming. For IPCC, this means a focus on assessing 2/1.5 °C worlds while continuing to assess 4, 6 and 8 °C warmer worlds. The report illustrates the efforts made by IPCC and the scientific community to respond to this new reality as well as to assess two relatively close levels of global warming. The report is very important because it may constitute a model for future special reports that may be aligned with the global stocktake and the ambition cycle, should the option of ten-year assessment cycles be adopted by the Panel [Iulain Florin VLADU, Germany]	Noted.
7143					The report defines worlds 1.5 °C warmer by combining elements agreed in Paris with scientific aspects in a coherent scientific assessment framework. However, in doing so, it introduces new concepts, such temperature overshooting, CO2 forcing equivalent, overshoot intensity, shared socio-economic pathways and policy assumptions, several types of cumulative carbon budgets and avoided risks and impacts, which will complicate the understanding of the findings of the report. When possible, the introduction of new concepts should be avoided. For the new concepts that are needed, the report should provide simple "explainers" (e.g., FAQ, visuals) and IPCC should discuss these concepts with Parties before the report becomes available [Iulain Florin VLADU, Germany]	Accepted, but the report is a scientific report which makes use of scientific terms. The Summary for Policy Makers (SPM), which presents the key messages or takeaway messages for policy-makers will be developed based on the SOD. The SPM is revised and approved by governments.
7144					Stringent near-term targets by 2020 or 2030 imply higher near-term mitigation costs, carbon prices and investments, but lower long-term mitigation costs, carbon prices and investment. When comparing near term costs versus long-term benefits could the avoided costs of impacts at greater levels of warming be included? To the extent possible, the findings on avoided costs of impacts from greater levels of warming, including on the time frame of these costs, should be summarized in Chapter 3 [Iulain Florin VLADU, Germany]	Accepted. Authors have made efforts to add this kind of information, according to the limited literature available.
2025					Recently, the polarization of temperature changes has intensified, and regional differences have also increased gradually. When the global warming gets to a certain extent, 1.5 degrees' average temperature increase impact harder on the global ecosystem now than that in the past. The influence is obvious in the ecological fragile areas especially. This report should give more insight into the spatial differences of climate change. [Tao Yang, China]	Accepted. The report presents the available information at the time it was prepared. There is limited regional literature.
11497					This report, compared with previous reports, has achieved an important integration of physical, ecological and social aspects. This is a very valuable contribution, perhaps the most valuable contribution both to advancing knowledge about climate change and to advancing the organization of the academy towards transdisciplinary approaches that are currently very necessary [Meimalin Moreno, Venezuela]	Thank you.

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9200					Why do boxes have authors and sections do not? I know certain authors focus on certain sections, and it would actually be very smart (I think) for the IPCC to say who writes which section (ie, who are the primary authors). [Glen Peters, Norway]	Rejected. Only cross-chapter boxes indicate their authors as they could be located in any part of the report. The IPCC reports are prepared by interdisciplinary teams which contribute to different sections.
14330					My biggest concern is that while there has been a substantial increase in the focus on social science, very little focus is placed on the role of education to inform, inspire, engage and prepare society to reduce climate risks. Here and there in various chapters there are mentions of some literature, but clearly you have no experts in educational research in any of your panels. This is a massive oversight. As is eluded to, a 1.5C pathway (whether called SSP or as promoted in Chapter 5 CRDP) requires high levels of education in every level of society in order to reduce risks and maximize resilience. But then education is hardly mentioned except in passing, and often "knowledge" seems to be confused with "beliefs" or "opinions", especially in Chapter 4. The original UNFCCC called for nations to inform and engage their publics so they can be involved with developing adequate responses to climate change-- that hasn't happened, even with repeated efforts to revitalize Article 6, rename it Action for Climate Empowerment, and lump it under Article 12 capacity-building of the Paris Agreement. This draft report continues the attitude that education for climate action is not a priority. Linking SDG 13 (climate action) with SDG 4 and weaving together with other relevant SDGs should be a no-brainer, but missing from here. Also missing from the mix: Lutz, W., Mutarak, R., & Striessnig, E. (2014). Universal education is key to enhanced climate adaptation. Science, 346(6213), 1061-1062. They make the case that education should be funded as a climate finance priority, not just big engineering projects. But somewhere in this report examples of education that is relevant, localized and informs, engages, demonstrates and inspires youth in particular and communities in general should be reported. Such examples do exist but they remain on the fringe because they are ignored by the climate community at large. [Mark McCaffrey, Hungary]	Accepted. Report is based on information available in relation with 1.5°C. Information will be revised according to new available literature
3838					The example boxes are very illustrating and helpful! [Mats Winroth, Sweden]	Thank you.
3839					There are many paragraphs that have only one sentence. They need to be expanded or merged with other one-sentence paragraphs. [Woonsup Choi, United States of America]	Accepted. This has been improved for the SOD.
13402					Be consistent in terminology when it comes to NETs and CDR. The two are used throughout. Better to choose one and stick with it. Same goes for "bio-energy" and "bioenergy". [Helene Muri, Norway]	Rejected. Literature presents both terms. An annex to the report will be made available, to clarify this. The spelling of bioenergy will be harmonized throughout.
20854					The difference between 'scenario' and 'pathway' is explained twice in Ch1 (Ch1, p.13, line 28-31 and Box 1.1), and once more in Ch2 (Ch2, p.7, line 23-29). However, the words are used inconsistently: e.g. temperature scenarios (Ch2, p.7, line 48-49) and temperature pathways (Ch1) are both used, as well as prospective/adaptive scenarios (Box 1.1) and prospective/adaptive pathways (Ch1, p.15). [Heleen de Coninck, Netherlands]	Accepted. Ch 2 has removed the redundancy with ch 1 and essentially now just gives a minimal definition and points back to ch 1. Language has been tightened as far as possible consistent with the broad range of usages in the literature.
20822					It is good to see that the report recognises (in chapters 4 and 5) the potential for the 1.5 degree target to deliver significant co-benefits, and the corresponding need to minimise adverse side-effects (e.g. from large scale biofuel cultivation). Consideration of these wider impacts is crucial for making choices between alternative mitigation options and pathways. However, I feel that this message should be emphasised more strongly in the framing (chapter 1) and in the summaries to chapters 4 and 5. For example, a growing body of evidence suggests that these co-benefits could substantially offset or even outweigh the cost of climate action, yet this message does not come through clearly. [Alison Smith, United Kingdom (of Great Britain and Northern Ireland)]	Issues of synergies and tradeoffs are emphasised throughout, and in the SPM.
13698					Spelling of particular terms inconsistent throughout chapter and report (e.g. WGII vs WG2; Pre-industrial vs Preindustrial). [Elvira Poloczanska, Germany]	Editorial - copyedit to be completed prior to publication
13700					Alternating use of full name and acronym (e.g. greenhouse gas vs GHG, urban heat island vs UHI, GMST); should be consistent [Elvira Poloczanska, Germany]	Editorial - copyedit to be completed prior to publication
13701					all assessments of confidence and likelihood should be in italics [Elvira Poloczanska, Germany]	Editorial - copyedit to be completed prior to publication

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1674					<p>This report is a superb and I would say masterful attack on the problem. Unparalleled comprehensiveness aside, explicit consideration of poverty eradication, equity and ethics issues provides precisely the right framework for what climate policy needs to look like. Too often in other studies the future energy needs of the global poor have been ignored or assumed away. It is exceptionally well-written on top of this and communicates well.</p> <p>In contrast to the report's comprehensiveness, my ability to comment is narrowly limited. My comments throughout focus on a single issue: the role of energy efficiency in realizing the 1.5 C goal. Should the team take these comments on board, I offer that it will make your case even stronger and the urgency of action greater, but their implications will be disconcerting to some. Specifically, I believe (in my opinion: high likelihood, high relevance) the scenario projections systematically overstate the reductions in energy use attainable via energy efficiency programs, making the 1.5 C goal significantly more of a reach than indicated in the report. On the other hand, the same mechanisms that underpin this claim open greater room for enabling the socio-economic advancement of the global poor, making the tradeoff among Sustainable Development Goals more manageable. Bad news, good news.</p> <p>The comments are of a technical energy-economics nature relating to the Integrated Assessment Model methodologies and their treatment of resource use efficiency. Details passim. [Sections 2.3, 2.4, 2.6, 4.2, 4.4, 5.4] [HARRY SAUNDERS, United States of America]</p>	Thank you. Information on energy efficiency will be revised in next drafts, according to available literature.
1675					<p>Up-front Caution and Disclaimer</p> <p>In telling the story that follows, I rely heavily on citations of my own work. It is the most concise way I know to present the case but carries the risk of understating the numerous contributions made by colleagues and other researchers on the topic; it also risks being self-promoting, and to be frank it arguably is. To help overcome this, I include an augmented reference list (partial – there are now perhaps hundreds of peer-reviewed articles on the topic of efficiency rebound) that allows a much more thorough evaluation of the claims made here (some of which references I provided in an AR5 external expert submission and are repeated here).</p> <p>Also, I am not asking that the self-citing references necessarily be included in SR 1.5 – that call clearly and rightfully belongs with you and your teams – and I would be happy to simply see reported a solid recognition that the considerations I raise create at minimum an added risk to achieving the 1.5C goal, yet also bring benefits along other Sustainable Development Goal dimensions. [HARRY SAUNDERS, United States of America]</p>	Noted: many of these innovations are reflected in the LED scenario that is highlighted as one of the "archetype" scenario in the SPM. Information on energy efficiency will be revised in next drafts, according to available literature.
2465					<p>The point is to educate people/policy makers and get them on board. Starting out with the scientific evidence for climate change may not achieve this, the same with the passive writing. People/humans caused climate change; climate change impacts people.</p> <p>Provide a table of all abbreviations/acronyms; they are hard to keep up with</p> <p>Population management needs to be addressed</p> <p>Need to begin and conclude each chapter with specific impacts on humans—in the end, that is all what people really care about.</p> <p>Appendix: how-do manual for individuals/families/communities? [Lisa Lucero, United States of America]</p>	Accepted. Firstly, according to the outline, CH3 provides information on human and natural systems. Second the SPM will be written for policy makers and a wider audience. A list of abbreviations and acronyms will be provided with the final version of the report. Also, we now include a box on key terms in the SPM. Finally, increased material on population has been included.
9132					Generally, through the report, issues relating to limits to adaptation are lacking. The report should explore the following concepts in relation to 1.5°C and 2°C: permanence, irreversibility, non-economic losses, timescales of risks and recovery, existential risks, and limits to risk management. [Susanna De Beauville-Scott, Saint Lucia]	Accepted. Information about this will be revised and completed for next drafts considering available literature.
2494					One final comments; I don't know if this is necessary, but you may want to at least acknowledge the 'unintended consequences.' History is replete with them....Signing off. Thanks to you all for your hard effort. [Lisa Lucero, United States of America]	Comment is not clear, so it was not possible to give an answer ("unintended consequences" of?)

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4835					Shell welcomes the effort behind this publication to examine plausible pathways to limit warming of the climate system to 1.5°C. Our own comments, set out below and in the context of the Chapter 2 statement that to hold warming below 1.5°C by 2100 with at least 66% or 50% likelihood the carbon budget (i.e., the cumulative amount of CO2 emissions emitted from 2016 to 2100) is 280 (150-360) GtCO2 and 330 (250-490) GtCO2 respectively, come from our considerable expertise in the implementation of CCS projects and the development of energy scenarios. Recently the company has published a detailed look at the system requirements for net-zero emissions in our 2016 supplement 'A Better Life With a Healthy Planet: Pathways to Net Zero Emissions.' Our own work has shown that while a 1.5°C goal is highly desirable, it is also extraordinarily difficult to achieve. We have done extensive analysis on energy system deployment and find that there is no historical precedent for the rates of deployment required for net-zero emissions at a global level in just 30 years. However, the NZE task is achievable within the bounds of this century, even given the current rates of change as the starting point, which although rapid in some areas are significantly lower than required overall. We refer you to a 2009 Nature paper, which puts forward a model for deployment rates. Nature, Vol 462, 3 December 2009, pages 569-570, No quick switch to low-carbon energy, Kramer and Haigh. [Wilfried Maas, Netherlands]	Noted, and the technical, social and institutional challenges of achieving 1.5°C are emphasised in this report.
6327					The FOD regrettably makes no or very inconsistent use of uncertainty language in most places. This is problematic because it means the opportunity has been lost to get feedback through the FOD review on the initial uncertainty and confidence assessment of key findings by the authors. I urge the leadership of the report to place a very high priority on getting an approach to uncertainty assessment and communication agreed and implemented, and iterated within and across chapters, before the SOD, so that the SOD will provide a solid and constructive basis for reviewers to respond to the uncertainty assessment in all the chapters. [Andy Reisinger, New Zealand]	The application of uncertainty language has been streamlined and harmonised throughout.
11091					The report contains multiple inaccuracies and misleading or incomplete statements throughout its discussion of SRM. For example, it makes contradictory or misleading statements regarding the effect of SRM on the carbon cycle, its uneven regional cooling effects, different particles that might be used, and SRM's capacity for regional adjustment of RF. [Joshua Horton, United States of America]	Accepted. Consistency and treatment of SRM throughout the report has been revised.
11103					In our view, in its discussion of solar geoengineering, the draft presents an inaccurate depiction of the potential benefits, costs, and risks of SRM in a world experiencing substantial climate change. Specifically, the text downplays the potential benefits of SRM, underemphasizes the costs of climate change in the absence of SRM, and is unclear about the basis of its risk-risk comparison. [Joshua Horton, United States of America]	Accepted. Consistency and treatment of SRM throughout the report has been revised.
20576					Biofuelwatch signed onto a letter delivered to the IPCC on September 7th 2017 by the Heinrich Boll Foundation. The letter was delivered because we find that the structure for this review process does not provide adequate latitude for addressing the serious fundamental concerns with the FOD. We reiterate here some points made in that letter: "Earlier IPCC documents pertaining to this Special Report contain numerous references to the need to analyze pathways "with warming kept to 1.5 degree C" or which "limit warming to 1.5 degrees C". Clearly, non-overshoot scenarios were considered of utmost importance in preparing the outline of the Special Report and instructions to authors (see e.g. IPCC-XLIV/INF.6.). This requirement should have guided the authors of the Special Report even if such pathways could not be produced by the same limited set of Integrated Assessment Models, which had produced the 34 highly risky overshoot pathways, as discussed in draft Chapter 2. In contrast, this draft does not seriously consider any emission pathways pursuing a 1.5 degrees C non-overshoot scenario, although only such pathways significantly reduce the risks and impacts of climate change, as mandated by the Paris Agreement." Overshoot is highly unlikely to be later addressed, will have serious socioeconomic consequences, will trigger feedbacks that will make future warming uncontrollable, and undermines efforts to achieve the SDGs. IPCC must evaluate non-overshoot models! [Rachel Smolker, United States of America]	Chapter 2 has been revised to consider non-overshoot scenarios in response to several reviewer comments. Note that the LED scenario highlighted in the SPM has a reasonable (50-66%, depending on the analysis method and assumptions) chance of avoiding overshooting 1.5C.
20577					Also from the Sept 6th letter: the lack of transparency, and insufficient treatment of cost-benefit calculations incorporated into the IAMS on which the report is fundamentally based is unacceptable, and serves only to obfuscate and misguide policymakers who struggle to grasp the implications of models and scenarios. The importance of realistic incorporation of avoided damages has recently been clearly demonstrated in the wake of destruction from hurricanes Harvey, Irma and Maria. Texas, Puerto Rico and the Caribbean Islands are faced with many billions in damages and reconstruction costs. These events and costs for reconstruction will only escalate as warming progresses and realistic treatment of such consequences should be clearly embedded in any economic analyses. Also as stated in the letter, the near to midterm time frame is far more critical as guidance to addressing mitigation in the coming 5 year timeframe. [Rachel Smolker, United States of America]	Clarification - The CBA-IAM literature on the social costs of carbon (including avoided impacts) is assessed in Chapter 3 to the extent it pertains to the subject of 1.5°C warming. Furthermore, the impacts of mitigation (cost, benefits, co-impacts, trade-offs) on sustainable development are explicitly treated in Ch5.
20578					Also from the Sept 6th letter: "From the perspective of policy makers, the discount rate determines to a large extent what is perceived to be cost effective mitigation. A 5% discount rate is, arguably, even high for a private investor discount rate these days, but it is certainly inappropriate for this Special Report. Cost-effective mitigation is a societal imperative not a matter of private profit and loss. [Rachel Smolker, United States of America]	Taken into account - where available also scenarios with lower discount rates have been assessed. However, the available literature is limited in this area.

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14187					CCS has yet to be proven on a really large scale as a way of preventing GHGs, but there is reason to be hopeful. If CCS is able to scale up the way this document is proposing and the fugitive emissions from the pipeline infrastructure can be taken care of (which I am personally skeptical of, but allow that this is far outside my field of expertise) then that makes natural gas a relatively low GHG option as well. Focusing the conversation on 'low carbon emission' rather than 'renewable' allows CCS to be under that umbrella. [Jason Donev, Canada]	Implementation challenges to CCS and CDR in general are discussed in chapter 4.
14188					We absolutely must look carefully at nuclear power's capability to address climate change. The difficulties with nuclear power are tiny compared with the difficulties of climate change. The fear that exists around nuclear is not commensurate with any actual danger associated with its use. The complete lack of fatalities or meaningful environmental problems due to the radiation release from Fukushima are an excellent indicator that even under 'worst case scenarios' nuclear power is not that bad. The magnitude of the problem of dealing with nuclear waste is several orders of magnitude smaller than the problem of dealing with carbon dioxide. [Jason Donev, Canada]	Noted: these issues are addressed in chapter 4, but full review of technologies is beyond our scope.
11107					Overall, the report's treatment of SRM is biased—there seems to be a presumption that it is risky a priori, and the text downplays the scale and scope of the potential benefits while exaggerating the costs compared to unmitigated climate change. We recommend that a balanced survey of the benefits, costs, and risks be made, and that a clear summary be added. As a basis for this summary, we suggest that the list of key risks (and the physical hazards that drive them) presented in the IPCC AR5 WG2 report be used. Keith and Irvine (2016) use such a framework to suggest that SRM may have the potential to reduce most of these key risks in most places. Irvine et al. 2017, however, highlights the key climate impacts research gaps that preclude making a truly robust assessment of its potential benefits and risks. [David W. Keith and Peter J. Irvine, "Solar Geoengineering Could Substantially Reduce Climate Risks—A Research Hypothesis for the Next Decade," Earth's Future 4 (2016): 549-559; Peter J. Irvine et al., "Towards a Comprehensive Climate Impacts Assessment of Solar Geoengineering," Earth's Future 5 (2017): 93-106] [Joshua Horton, United States of America]	Accepted. Consistency and treatment of SRM throughout the report has been revised.
20579					We are troubled by the inclusion of climate geoengineering options in this report which seems inappropriate given the many serious risks and also technical barriers that are likely to limit the feasibility and effectiveness and only exacerbate environmental and socioeconomic woes. For example, Direct Air Capture, Enhanced Weathering or Ocean Liming all would require very large energy inputs, a barrier that renders them ineffective and is unlikely to be overcome. SRM is extremely problematic. Among other concerns raised in numerous reviews and reports on the topic, please note a very recent paper reports that chemical reactions in the troposphere could result in an increased persistence of methane. https://www.atmos-chem-phys.net/17/11209/2017/ Legal restrictions on ocean iron fertilization are in place and cannot simply be ignored. None of these geoengineering options are viable, nor do they appear to have realistic potential to become viable or be effective. Serious, thorough investigation of geoengineering options was not part of the mandate for this report and the current inadequate treatment is highly problematic. [Rachel Smolker, United States of America]	Accepted. The feasibility of CDRs and SRM was included and the reference added.
20580					While the report does offer the concerns about land use change implications of very large scale BECCS, as well as implications for food production and biodiversity (for example chapter 4, section 4.3.6.1), those concerns are moot if the IAMS continue to incorporate BECCs as a viable means of delivering negative emissions. We presume that the ongoing focus on BECCS, in spite of indications it cannot deliver, is related to the fact that it is the only CDR method proposed that not only (as claimed) delivers energy, but also reduces atmospheric CO2. This "win win" concept while very highly appealing, appears fundamentally flawed and we regret that the IPCC IAMS continue to convey BECCS as a real technology. Biofuelwatch published a groundbreaking review of BECCS, which was updated in 2015. That report included a review of peer reviewed literature, and industry reports among other. It concludes that BECCS is unlikely to ever become technologically feasible due to complexities of the emissions capture, energy demands and other technical hurdles. REF: http://www.biofuelwatch.org.uk/2015/beccs-report/ [Rachel Smolker, United States of America]	Noted, but it is important for SR1.5 to reflect the range of views about the feasibility of large-scale BECCS.

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14185					On the whole, I'm impressed with this work, it is much needed and well done. It took a great deal of effort to bring together such disparate expertise and fold all of these ideas, perspective and research into one coherent document. Bravo! I appreciate the labour and commitment that this took and am grateful for the hard work. The only big holes that I see is the lack of an author who is familiar with what is going with nuclear power and an author who is familiar with hydropower. It is difficult to grab everyone that is needed, and on the whole the committee did an excellent job. However, I would strongly urge the project to consider asking for the contributions of an expert on nuclear power who could address questions around the central question of: can nuclear power meaningfully contribute towards limiting the warming of the world to 1.5oC? Regardless of one's opinion on nuclear power, this question is deeply important, since we are using nuclear power right now, and will be for the coming decades, and the use of nuclear power will absolutely have an impact on the central question of limiting global warming and climate change. Likewise, finding an expert on hydropower to contribute would strengthen this document considerably. There are a number of places throughout the document where the text skirts around hydro and nuclear power's contribution in ways that need to be address. A list of papers that should be reviewed around these issues is in a subsequent comment. [Jason Donev, Canada]	Noted: these issues are addressed in chapter 4, but full review of technologies is beyond our scope.
10947					I propose a study to verify whether decoupling has been exhibited by any nation when using consumption-based emissions for wealthy nations who have increased their imports in order to decarbonize their domestic economy (in actuality, I argue that this is not decarbonization since the shadow casted by these nations extends far beyond their borders. I also propose using extraction-based accounting to measure economic decoupling or lack thereof for fossil fuel exporting nations whose economy is highly dependent on revenues from these exports. [Daniel Horen Greenford, Canada]	Noted - although the IPCC does not undertake primary research. This was a topic in AR5 WGIII, and will be revisited in AR6 but is not within the scope of the SR1.5
725					The formatting of the table of contents for each chapter is different, this is something which I presume will be dealt with later [Moshe Kinn, United Kingdom (of Great Britain and Northern Ireland)]	Editorial - copyedit to be completed prior to publication
13144			3	7	The report provides very interesting and relevant knowledge. Thank you very much. [Christiane Textor, Germany]	Noted with appreciation.
13145			3	7	Headline statements / key messages across the report should be provided as part of the SPM in the SOD. These should be written in a way that is accessible to non-experts, and they should be usable for communication in a stand alone version. [Christiane Textor, Germany]	Accepted. The key messages/ headlines were rewritten and improved. These are intended to be part of the SPM.
13146			3	7	It would be interesting to get information about the risks/benefits related to 1.5C pathways in comparison to 2C, including mitigation, adaptation, impacts, avoided impacts, positive and negative side effects for other SDG. [Christiane Textor, Germany]	These are intended to be covered in the relevant chapters (2 for mitigation, 3 for impacts, 5 for other SDGs). Costs and benefits are discussed, but a direct comparison is complicated because many are incommensurable.
14186					While the report is quite comprehensive and thorough in its perspective, one deep problem with the document is how the discussion around energy is framed. The important aspect that we're looking for in our primary energy portfolio is 'low-carbon'. Renewable energy has become a 'buzz word', employed by a variety of people as a catch-all for 'good energy'. Most literally, renewable energy is energy that can renew itself. The difficulty is that this term means different things to different people, and doesn't cover all of our energy options. For example, while hydropower is in fact renewable, it's often not discussed when discussing renewable energy. Likewise, there's nothing renewable about nuclear power, but given the vast abundance of fissile and fertile material on Earth we run no risk of running out. Nuclear and hydropower can both be run with very little life-cycle GHG emissions, in fact as low or lower than wind, solar or geothermal. While 'renewable' is a popular term in a number of circles, framing the energy solutions in terms of 'renewable energy' sidesteps the real concern which is GHG emissions. For example, part of the difficulty with discussing renewable energy is that implies that the real difficulty is that we're going to run out, nothing could be further from the truth! The real difficulty with fossil fuels is that we are not running out in any immediate sense of the word. Fracking and other unconventional methods of getting fossil fuels out of the ground means that we now have access to frighteningly abundant amounts of fossil hydrocarbons which can be burned, emit CO2 and damage the environment. On the other side of the coin we have biofuels. A number of places in the world are harvesting biofuels in an unsustainable way. Biofuels are absolutely renewable, but unless grown and maintained in a sustainable way they will become problematic. The growing of biofuels will specifically be an issue as climate change makes crops harvests less dependable. [Jason Donev, Canada]	Thanks for your observation. Information about renewable energies (including biofuels and its impacts) will be revised in next drafts.

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14189					The first mention of nuclear power in the text isn't until page 33 of the second chapter, although it does appear in both tables and graphics for scenarios. Nuclear power has prevented a tremendous amount of CO2 from being emitted over its history, but is rarely credited with that contribution to fighting climate change. In the absence of nuclear power, the world would be in an even more dire situation with climate change than it is! The most disconcerting is the treatment of nuclear power, technology that has existed for decades, and is improving, on an even footing with unproven technology like CCS. While CCS has been deployed in limited amounts, it has not yet been scaled up to make anything approaching a significant contribution to fighting climate change. While we certainly should continue to investigate using CCS, we shouldn't rely on it the way we can rely on technology that has worked for a long time. Nuclear technology should also be improved, but those improvements are minor modifications to existing technology, as opposed to a large launch of not yet reliable technology like CCS. [Jason Donev, Canada]	Noted: these issues are addressed in chapter 4, but full review of technologies is beyond our scope.
14190					Likewise, chapter 2 presents substantial growth in both wind and solar for generating electricity. Insufficient attention is paid to the problem of intermittency. Electricity must be used immediately after it has been produced. The need for some sort of grid-scale energy storage is both not trivial and inadequately addressed. This oversight dramatically erodes the credibility of the report on our electricity future, and is a significant reason why wind and solar can't stand on their own. At the moment, most grids use peaking natural gas plants (which have a poor carbon efficiency) to 'back up' wind and solar power. In the absence of a shift towards 'supply side electricity' (we only use it when it is available) the proposed shift towards is rather unfeasible. See list of papers to consider in subsequent comment. [Jason Donev, Canada]	Electricity storage is taken into account in chapter 4.
14191					I would suggest that it would be fruitful to look at the extensively at the papers by Clack et al and Heard et al. These papers were cited in chapter 4, but not chapter 2 (where the information is also relevant). This paper explores why rapid changes to the primary energy supplying the grid using only wind, water and solar have extensive problems. The casual treatment of 'there's a controversy' doesn't do justice to the arguments presented in these papers. Clack, C. T. M., and Coauthors, 2017: Evaluation of a proposal for reliable low-cost grid power with 100% wind, water, and solar. Proc. Natl. Acad. Sci. U. S. A., 114, 6722–6727, doi:10.1073/pnas.1610381114. http://www.ncbi.nlm.nih.gov/pubmed/28630353 (Accessed July 22, 2017). Heard, B. P., B. W. Brook, T. M. L. Wigley, and C. J. A. Bradshaw, 2017: Burden of proof: A comprehensive review of the feasibility of 100% renewable-electricity systems. Renew. Sustain. Energy Rev., 76, 1122–1133, doi:10.1016/j.rser.2017.03.114. http://dx.doi.org/10.1016/j.rser.2017.03.114 . [Jason Donev, Canada]	These issues are addressed in chapter 4, and they cannot be assessed twice. The reference Clack et al 2017 was included in chapter 2.
13147			3	7	It would be interesting to get information about the costs/savings related to 1.5C pathways in comparison to 2C, including mitigation, adaptation, impacts, avoided impacts, positive and negative side effects for other SDG. [Christiane Textor, Germany]	Costs and benefits are discussed, but a direct comparison is complicated because many are incommensurable. Costs in ch 2, savings (or more generally impact costs) in Chapters 3, 4 and 5.
13148			3	7	Information about the role, risks, costs, benefits, feasibility of the CDR technologies embedded in the scenarios in chapter 2 is needed and should be considered across the report, including statements about the unknowns and potential risks. [Christiane Textor, Germany]	Accepted. The sections about CDR were revised. Knowledge gaps and risks are indeed highlighted.
13149			3	7	It would be very useful to provide a systematic analysis about what works and under which conditions. This would be more useful than generalizing or abstract statements, that currently dominate many Executive Summaries. [Christiane Textor, Germany]	Accepted. An effort has been made to make ES statements more specific in subsequent drafts.
13150			3	7	FAQ should be contained in each of the chapters. They should be written in a way that is accessible to non-experts. [Christiane Textor, Germany]	These will be included in each chapter
13151			3	7	The Executive Summaries of chapters 4 and 5 provide similar and sometimes quite general statements, e.g. on synergies between adaptation and mitigation, which sometimes seem a bit trivial. In addition, sometimes the statements remind of those in the WG2 report of AR5. Please amend. [Christiane Textor, Germany]	An effort has been made to make ES statements more specific in subsequent drafts.

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14192					<p>Additionally, here are some papers worth reviewing that cover important aspects of limiting our GHG emissions to prevent warming beyond 1.5oC:</p> <p>Pacala, Stephen, and Robert Socolow. "Stabilization wedges: solving the climate problem for the next 50 years with current technologies." <i>Science</i> 305, no. 5686 (2004): 968-972.</p> <p>Hong, Sanghyun, Corey JA Bradshaw, and Barry W. Brook. "Global zero-carbon energy pathways using viable mixes of nuclear and renewables." <i>Applied Energy</i> 143 (2015): 451-459.</p> <p>Williams, James H., Andrew DeBenedictis, Rebecca Ghanadan, Amber Mahone, Jack Moore, William R. Morrow, Snuller Price, and Margaret S. Torn. "The technology path to deep greenhouse gas emissions cuts by 2050: the pivotal role of electricity." <i>science</i> 335, no. 6064 (2012): 53-59.</p> <p>Brook, Barry W. "Could nuclear fission energy, etc., solve the greenhouse problem? The affirmative case." <i>Energy Policy</i> 42 (2012): 4-8.</p> <p>Ben Heard, Corey J. A. Bradshaw & Barry W. Brook (2015) Beyond wind: furthering development of clean energy in South Australia, <i>Transactions of the Royal Society of South Australia</i>, 139:1, 57-82</p> <p>Agustin Alonso, Barry W. Brook, Daniel A. Meneley, Jozef Misak, Tom Blees, and Jan B. van Erp, "Why nuclear energy is essential to reduce anthropogenic greenhouse gas emission rates" <i>EPJ Nuclear Sci. Technol.</i> Volume 1, 2015, article 3. DOI: 10.1051/epjn/e2015-50027-y</p> <p>Berger, A., Blees, T., Bréon, F.-M., Brook, B.W., Hansen, P., Grover, R.B., Guet, C., Liu, W., Livet, F., Nifenecker, H., Petit, M., Pierre, G., Prévot, H., Richet, S., Safa, H., Salvatores, M., Schneeberger, M. and Zhou, S. (2017) 'How much can nuclear energy do about global warming?' <i>Int. J. Global Energy Issues</i>, Vol. 40, Nos. 1/2, pp.43–78.</p> <p>Berger, A., Blees, T., Breon, F.-M., Brook, B.W., Deffrennes, M., Durand, B., Hansen, P., Huffer, E., Grover, R.B., Guet, C., Liu, W., Livet, F., Nifenecker, H., Petit, M., Pierre, G., Prévot, H., Richet, S., Safa, H., Salvatores, M., Schneeberger, M., Worman, B. and Zhou, S. (2017) 'Nuclear energy and bio energy carbon capture and storage, keys for obtaining 1.5°C mean surface temperature limit', <i>Int. J. Global Energy Issues</i>, Vol. 40, Nos. 3/4, pp.240–254.</p> <p>Sanghyun Hong, Corey J.A. Bradshaw, Barry W. Brook "Global zero-carbon energy pathways using viable mixes of nuclear and renewables" <i>Applied Energy</i> 143 (2015) 451–459.</p> <p>Staffan A .Qvist, Barry W. Brook "Environmental and health impacts of a policy to phase out nuclear power in Sweden" <i>Energy Policy</i>84(2015)1–10</p> <p>Qvist S., Brook B. W. (2015) "Potential for Worldwide Displacement of Fossil-Fuel Electricity by Nuclear Energy in Three Decades Based on Extrapolation of Regional Deployment Data." <i>PLoS ONE</i> 10(5): e0124074. doi:10.1371/journal.pone.0124074</p> <p>Barry W. Brook, Jan B. van Erp, Daniel A. Meneley, Thomas A. Blees: "The case for a near-term commercial demonstration of the Integral Fast Reactor" <i>Sustainable Materials and Technologies</i> 3 (2015) 2–6. [Jason Donev, Canada]</p>	Accepted. The literature was reviewed and some papers were taken into account where appropriate.
14193					<p>Some further papers:</p> <p>B. W. Brook, C. J. A. Bradshaw "Key role for nuclear energy in global biodiversity conservation" (2014) DOI: 10.1111/cobi.12433</p> <p>Michael Buchdahl Roth, Paulina Jaramillo "Going nuclear for climate mitigation: An analysis of the cost effectiveness of preserving existing U.S. nuclear power plants as a carbon avoidance strategy" <i>Energy</i> Volume 131, 15 July 2017, Pages 67-77</p> <p>William C. Sailor, David Bodansky, Chaim Braun, Steve Fetter, Bob van der Zwaan "A Nuclear Solution to Climate Change?" <i>Science</i> 19 May 2000: Vol. 288, Issue 5469, pp. 1177-1178 DOI: 10.1126/science.288.5469.1177</p> <p>Junji Cao, Armond Cohen, James Hansen, Richard Lester, Per Peterson, Hongjie Xu: "China-U.S. cooperation to advance nuclear power" <i>Science</i> 05 Aug 2016: Vol. 353, Issue 6299, pp. 547-548 DOI: 10.1126/science.aaf7131</p> <p>Pushker A. Kharecha" and James E. Hansen "Prevented Mortality and Greenhouse Gas Emissions from Historical and Projected Nuclear Power" <i>Environ. Sci. Technol.</i>, 2013, 47 (9), pp 4889–4895 DOI: 10.1021/es3051197 Publication Date (Web): March 15, 2013 [Jason Donev, Canada]</p>	Thank you. The literature was reviewed and only literature on 1.5°C warming was included, but it could be taken into account in AR6.

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7578					<p>Dear colleagues,</p> <p>At the beginning I want to thanks you the confidence in my expertise, perhaps this is focus in other way that present report and it will not be interesting for your report.</p> <p>In spite of this I want to offer you my opinion, mainly centered in agro forest sector.</p> <p>Present report is well writhed and presented, because information is wide, deep, valuable and contrasted, besides all the literature is published and consequently it has been previously evaluated.</p> <p>In this way, I cannot offer you relevant comments related to the form, size and presentations, these points are more than correct.</p> <p>I have read chapter 2 with a high level of detail and there aren't important mistakes and / or typographic errors. So, I cannot offer a detailed revision according excel file</p> <p>My opinion and information is focus on the nucleus of the report, because the feeling that I have receive is that all the report is developed to show as our world, our societies will arrive to develop mitigation pathways compatible with 1.5°C in the context of sustainable development.</p> <p>I have not found any discussion about the real world differences at society structure level, edapho climatic conditions; real and potential water availability, legislative development.....and the real connections among them.</p> <p>Perhaps, in some moments along the report, these are cited, but in my opinion are not take in consideration sufficiently.</p> <p>Really when you read the report, it seems that time is elastic and it's running too slow, consequently 2050, in my opinion tomorrow, in the report it will be long, long time in the future.</p> <p>When I evaluated this report I have thought about Club de Roma issued a new warning in 1972, according to the document on Limits of Growth (Meadows 1972) if the current increase in world population, industrialization, pollution, food production and exploitation of natural resources remained unchanged, would reach the absolute limits of growth on Earth over the next hundred years.</p> <p>The most alarmist predictions of the Club of Rome have not been fulfilled. It was certainly a mission impossible to introduce the extraordinary complexity of world development into an econometric model. Among other errors and / or inaccuracies in the report the limits to Growth there were not sufficiently valued that technology which is capable of displacing ecological limits by expanding the potential of renewable resources, reducing resource consumption by improving its efficiency, reducing its pollution burden, establishing recycling strategies, etc. On the other hand, the report carried out a very simple modeling of population growth, since it did not sufficiently consider that economic development, based on a certain level of standard of living, acts as a moderator of the growth rate of the population. [Robert Savé, Spain]</p>	Noted, stressing that on the timescales relevant to 1.5C, population trends can be taken as given (important, but also largely policy-insensitive).
13152			3	7	<p>Uncertainty statements should be added to all Executive Summaries, and scientific jargon should be avoided as much as possible. While generalisation is needed to a certain degree, some of the statements are so general that they become trivial. [Christiane Textor, Germany]</p>	ES will be improved as suggested
7579					<p>But at the same time the dynamics of development were related to new vectors of tension, not predicted or predicted with less intensity by the referred study, which still are and will be important and consequently can promote serious dysfunctions in the models, but above all in the projections, these are:</p> <ul style="list-style-type: none"> • Unstoppable progress in globalization. - Improvement of conventional communications but above all the development of information and communication technologies brought the world and people together, something that led Thomas Friedman to say that the earth was flat (Friedman 2005). Globalization has transformed the world. This tendency has reduced commercial frontiers, standardization processes have become more accentuated and companies are adapting their strategies from a broader perspective of the competitive environment, in locating many services. Economies of agglomeration have lost weight in favor of the residential attractions and with this open new trends in urban development. • Interconnection of the energy vector with the feed vector.- As agriculture plays a relevant role in energy production, the integration of price trends is almost absolute. As a result, demand pressure on agricultural supply increases and volatile food markets become particularly attractive for speculation. • Extraordinary development of the so-called emerging countries. - Logical demands in quantity and food quality, with more protein diets from meat consumption, much more demanding in natural resources. • Climate change. - The evidence on climate change is already eloquent, it has ceased to be a topic of the future to be an active element of accentuation of tensions already in the present. The latest commodity price crises, with serious political and social consequences, have been triggered by factors directly or indirectly associated with climate change. • Biodiversity.- Evidence of the rapid deterioration of biodiversity makes conservation not only a major environmental objective, but also becomes an issue of economic concern (for example, the possible reduction effect of pollinators and / or predators natural or scientific) by losing biological resources that can store solutions to the most diverse problems of diverse nature (new materials, biological defenses, etc.). • Inequality. - Sustained and growing economic and social inequality takes center stage as a time bomb in the stability of the system. [Robert Savé, Spain] 	Thank you for your comments. The IPCC special report focuses on the impacts of global warming of 1.5 °C. The addressed subjects are not specific related to 1.5°C warming but could be interesting for the AR6.

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7580					<p>Which promotes four important challenges:</p> <ol style="list-style-type: none"> 1. Progressive shortage of fossil fuels and other mineral resources. The ease with which these resources have been exploited so far is disappearing and therefore price increases and supply tensions are foreseeable 2. The food, that is, the security of the food supply, which is the first cause that motivates this report, because without food there isn't people and development. 3. The environment in general from an ecological perspective that goes beyond the conservationist (keep actively taking into account the presence and human performance now and in the future) 4. Inequality as the major indicator of the failure of the current system <p>For these reasons, when along the text appear the idea, among others, to use biomass in order to reduce the fuel dependence, the question is where, when, during how much time.....</p> <p>Really, it's a good idea and interesting sostenible and few contaminant source of energy, but under Mediterranean conditions, in semiarid areas and in dry tropical forest..... the use of wood is restricted to real forest growth rate (Gracia 2010 SICCC; Kapelle 2006) (ACCUA 2012 http://www.creaf.uab.cat/accua/) and energy crops in these areas are a simple speculative crop, without clear real incidence on occupied soil surface and economical profit.</p> <p>The main important factor to use these sources of energy are water, mainly in these cited areas of the world (they are a very important surface of the earth, besides these areas sustain a great number of population), which is a real limiting factor for plant productivity (see TICC 2016, Reguant and Savé 2016.....), which in turn is a limiting factor to have more water availability. [Robert Savé, Spain]</p>	<p>Noted: these opportunities are addressed in chapter 4 to the extent they are relevant to 1.5C. Geophysical limitation in association with CDR options are now clarified in chap 2.</p>
7581					<p>In these moments, if we take as example the rivers basins of Catalonia (small area of Mediterranean Spanish coastal), it's know that according climate change projections and the forest growth in upper areas of basins, water availability is close to 25 % lower than in 80s of last century (see Life MEDACC http://medacc-life.eu/; TICC).</p> <p>The Segre, Ter and Muga basins (northeastern Spain) are extensively regulated, through a dense network of dams constructed during the second half of the 20th century. These of river regulation promoted an important impact on the evolution of hydroclimatological extreme events across the basin during the past six decades (1950-2013). We assessed whether the occurrence of floods and hydrological droughts has changed, and whether these changes have differed spatially between the headwaters and lower areas of the basin. Data development employed a set of hydroclimatological indices in order to quantify the evolution of the amount as well as the frequency of quantiles of high precipitation and flood events. Changes in these variables were assessed by means of the nonparametric Mann-Kendall Tau coefficient.</p> <p>Results reveal a general reduction in the occurrence of extreme precipitation events in these basins from 1950 to 2013, which corresponded to a general reduction in high flows measured at various gauged stations across the basin. While this study demonstrates spatial differences in the decrease of streamflow between the headwaters and the lower parts of the basin, mainly associated with changes in river regulation, there was no reduction in the frequency of the extraordinary floods. Changes in water management practices in the basin have significantly impacted the frequency, duration, and severity of hydrological droughts downstream of the main dams, as a consequence of the intense water regulation to meet water demands for irrigation and livestock farms. Nonetheless, the hydrological response of the headwaters to these droughts differed markedly from that of the lower areas of the basin, which is attributable to great forest growth without real management, which promotes high evapotranspiration and consequently less water (approximately 20%) for river streamflow (http://www.irta.cat/es-ES/RIT/Noticies/Paginas/Efectes-embassaments-Segre.aspx).</p> <p>Thus, at least in Mediterranean Basin, in Mediterranean ecosystem, which is very similar to semiarid ecosystems and dry neotropical forest ecosystem (Kappelle, M. 2006; Ecology and conservation of neotropical montane oak forest; ecol. Studies 185; Springer Verlag), the use of forest and crop biomass (life http://vineyards4heat.eu/) is restricted to water availability, that's depends of typical bimodal [Robert Savé, Spain]</p>	<p>Noted: these opportunities are addressed in chapter 4 to the extent they are relevant to 1.5C.</p>

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7582					<p>Mediterranean climate and derived weather events, climate change, new water uses and needs....consequently, production is and will be negatively affected for this low water sources availability.</p> <p>However, it has been evaluated in many situations as a simple cause-effect relationship and this is more complicated due to different space time interactions among different components of ecosystems, which promotes synergic and / or contrary effects. Also, it must be taken in consideration the great importance of regionalization of climate change projections and effects, because in some cases in local areas suffer additive stresses, as drought in Mediterranean Basin and in arid and semiarid areas of the world:</p> <p>http://canvi-climatic.espais.iec.cat/files/2013/07/12_Projeccions_SICC.pdf http://static-m.meteo.cat/wordpressweb/wp-content/uploads/2014/11/18130754_note-study-climatology-hail-n74.pdf http://www3.amb.cat/repositori/PSAMB/Canvi_clima.pdf http://premsa.gencat.cat/pres_fsvp/AppJava/notapremsavw/295100/ca/agost-sec-major-part-catalunya.do</p> <p>So, Mediterranean ecosystem is characterized by a double stress, cold / drought (Terradas and Savé 1992) and to powerful climatic phenomena such as the North Atlantic Oscillation (NAO), oscillates from the Western Mediterranean (WeMO) and Arctic oscillation (AO) (Lopez - Bustins et al., 2008).</p> <p>At the regional level, at a reduced geographical scale, the forecasts of the Third Report on Climate Change in Catalonia (http://cads.gencat.cat/ca/detalls/detallarticle/Tercer-informe-sobre-el-canvi-climatic- Catalunya-00003, TICCC, 2016) are fully aligned with the Report of the International Panel of Experts on Climate Change (IPCC, 2014) and the Meteorological Service of Catalonia (SMC, 2015) are that the average temperature can increase up to 0.8 °C for the period 2012 to 2021, on those registered in the period 1971-2000, or 1.4 °C for the period from 2031 to 2050.</p> <p>As for rainfall, the expected reductions in the same comparative periods are 2.4 and 6.8%. This decrease in precipitation should be added to the seasonality and variability expected to increase with variations ranging from -31.4% to + 22.3%, or inter annual variability from -22.3% to + 5.8%. There is no mention of meso geographic variability, which could aggravate these predictions. [Robert Savé, Spain]</p>	<p>Noted: these opportunities are addressed in chapter 4 to the extent they are relevant to 1.5C. This information could be useful for the next AR6 report.</p>
7583					<p>This increase in temperature will generate a water deficit at the atmospheric level, which will increase the rate of evaporation (approximations of the IRTA place it at 25% higher than the current one, by the end of the 21st century; http://www.emporda.info/comarca/2012/03/23/sequera-podria-comprometre-recursos-hidrics/161632.html;</p> <p>http://www.regio7.cat/cerdanya-alt-urgell/2016/09/02/sequera-reduce-caudal-del-segre/377116.html; http://www.irta.cat/ca-es/RIT/Noticies/pagines/Efectes-embassaments-Segre.aspx) and therefore under conditions of water availability, an increase in transpiration And in drought situations, an aggravation of water deficits in plant tissues.</p> <p>In addition, global change promotes the combination of many of them in the same space and time, which can promote synergistic effects on vegetation in crops (Terradas 2010). It is also known that global climate change accompanied by an annual increase in the variability of the agricultural sector will increase the difficulties and risks in this sector (Reguant 2011). Mediterranean Ecosystem was defined during 70s of last century for Mitrakos, Money, Montenegro, Fuentes (Kruger et al. 1983; Rundel et al. 1998; Roda et al. 1999), which characterized for some soil and environmental conditions, that promotes important adaptations of vegetation as sclerophyllous traits.</p> <p>Under Mediterranean and in semiarid environmental conditions, more than 440 mm of annual rainfall are required for oaks forests to persist.</p> <p>Summer drought and winter cold are thus important abiotic factors limiting the distribution of oak species and fosters the development of shrub and secondary tree communities, mostly pine. In both cases, drought stress is involved</p> <p>Olive groves have been, are and will be an important option in Mediterranean, semiarid and arid areas of the world in order to provide food, ecosystemic services, landscape, culture and population stabilization,....similarly, this crop avoid fire risk, erosion....and desertization. [Robert Savé, Spain]</p>	<p>Noted: these opportunities are addressed in chapter 4 to the extent they are relevant to 1.5C.</p>

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7584					<p>So, when it's evaluate the sink capacity of some woody crops as olive groves, vineyards and fruit trees under Mediterranean (Funes et al., 2015; Vayreda et al 2016), it's founded that under these environmental and cultural conditions this crop is a real carbon sink by means of management in woody parts of plants and soil. So, in Catalonia (North East of Iberic Peninsula) carbon stock in an olive grove is close to 92 Mg or tons /ha in woody part of plants, besides, to this amount about 40 tons of the carbon in the soil can be added (Rodriguez Martin et al.2016;).</p> <p>Table 1. Equations used in aboveground (ABGB) and belowground (BGB) biomass estimation for Olive. TBA is trunk basal area (cm2). TBA data are based on non-destructive measures. Olive ABGB is estimated using a relationship between TBA-ABGB published in literatura (Villalobos et al. 2005). BGB was estimated from ABGB using a ratio (Root:shoot ratio) from literature (Nardino et al. 2013).</p> <p>Carbon capture (Mg C/ha/any)a according edge of crop</p> <p>Plantation frame and tree density b</p> <p>Olive tree</p> <p>0-4 years</p> <p>5-11 years</p> <p>12-50 years</p> <p>>50 years</p> <p>100-200 trees/ha</p> <p>0.26</p> <p>0.47</p> <p>0.22</p> <p>0.1</p> <p>Table 2.- a Slope of equation biomass vs edge b plantation frame and trees density. [Robert Savé, Spain]</p>	<p>Noted: these opportunities are addressed in chapter 4 to the extent they are relevant to 1.5C. Geophysical limitation in association with CDR options are now clarified in chap 2.</p>
7585					<p>In woody crops the values of carbon stock in wood are between the 107 Mg C/ha of an Abies alba forest and the 28 Mg C/ha of a Pinus halepensis community.</p> <p>So:</p> <p>Similarly, soil carbon stock, can be an important limiting factor under these conditions, because they have a reduced capacity to soil water storage</p> <p>This important carbon sink can be developed according 4x1000 strategy and conservation agricultural practices..... in this way, olive groves, vineyards, fruit trees are not the solution, but they are one of the real solutions against climate change in Mediterranean and semiarid conditions (Savé et al 2016).</p> <p>These lines only want to contribute to develop a new, broader framework, taking into account countries where water is a major limiting factor and where the population is subjected to multiple tensions such as wars (Mediterranean basin, Maghreb, Middle East, Central America), tourism, social inequality post economic crisis of 2008.....</p> <p>In other words I pretend to take in consideration that time in some places runs more than social development and therefore the options too simple to mitigate climate change, can be good but unreal.</p> <p>We are talking about 2050, in other words in the next generation, perhaps it's important to introduce in present report some comments related to education, formation at all levels,, because people will be the main important key for change.</p> <p>I want that my mail contribute positively to the report and I remain at your disposal.</p> <p>My best wishes.</p> <p>Robert</p> <p>Dr. Robert Savé M. [Robert Savé, Spain]</p>	<p>Noted: these opportunities are addressed in chapter 4 to the extent they are relevant to 1.5C. Geophysical limitation in association with CDR options are now clarified in chap 2.</p>
21156					<p>there are many references to "afforestation" as measure that could remove CO2 from the atmosphere. Propose that instread, refer to "afforestation, reforestation and other ecosystem restoration", to be more inclusive, noting that reforestation has more synrgiesand fewer tradeoffs with other SDGs, and that ecosystems beyond forests have significant potential. (see Epple, C., García Rangel, S., Jenkins, M., & Guth, M. (2016). Managing ecosystems in the context of climate change mitigation: A review of current knowledge and recommendations to support ecosystem-based mitigation actions that look beyond terrestrial forests. Technical Series No.86. Secretariat of the Convention on Biological Diversity, Montreal, 55 pages.) available at: https://www.cbd.int/doc/publications/cbd-ts-86-en.pdf [David Cooper, Canada]</p>	<p>Accepted. In chapter 4 the section about afforestation and reforestation has been revised and ecosystem restorations has been taken into account within the chapter.</p>

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21199					Report does not examine importance of biodiversity in underpinning ecosystem resilience (and therefore adaption) and contribution to mitigation, including role of keystone species. Therefore does not consider implications of biodiversity loss for climate mitigation and adaptation and SD. see, for example: martin 7 Watson 2016, Intact ecosystems provide best defence against climate change, N. Climate. 6 122-124; and refs therein; Poorter L, et al. 2016. Biomass resilience of Neotropical secondary forests. Nature 530:211-214.; Murdiyarso et al n. climate 5 1089-1092;Bello et al 2015, Sci. Adv. 1501105. Trumper, K., Bertzky, M., Dickson, B., van der Heijden, G., Jenkins, M., Manning, P. June 2009. The Natural Fix? The role of ecosystems in climate mitigation. A UNEP rapid response assessment. United Nations Environment Programme, UNEPWCMC, Cambridge, UK. [David Cooper, Canada]	Accepted. The importance of biodiversity in a 1.5 °C warming world was strengthened in the report. More consideration about biodiversity and ecosystem resilience can be part of AR6 as well as the mentioned literature.
726					It is acknowledged in a few places in this report that there is a need for many options of mitigation to all work in parallel for the 1.5 degree scenario to be successful. What is called the 'The Solar Hydrogen Economy' has been given almost no coverage in this report, and is something that weakens the power of this report to empower people. For the point given on page 2-38 line 54, that hydrogen is "relatively expensive" I point to the failure in the UK of CCS due to cost (as well as other reasons like nimbysism), yet CCS and all its derivatives are given ample discussion this this report. For the point that 'hydrogen is not a ready technology', page 4-29 line 1, I say that so is CCS as stated on page 4-34 lines 1-16, and in other places. Therefore the IPCC should please put more effort into highlighting and promoting the solar hydrogen economy. See Nature. (2004). Leapfrogging the power grid. Nature, 427(6976), 661-661, which states "It's time to further boost hydrogen research" [Moshe Kinn, United Kingdom (of Great Britain and Northern Ireland)]	Noted, although the report reflects the current state of the literature, and post-AR5 publications on the hydrogen economy are relatively few.
727					Based on Section 3.7.3, global SRM is looked at as having dangers and region SRM is looked at as providing winners and losers and therefore both overall seem, from this report, as not being usable for mitigation purposes. All would agree that sea levels are rising and according to Section 3.7.4.2 have the potential to rise another 50 meters. Sea level rise is a present problem that needs to be dealt with now. Sea level rise is due to rising levels of ice melt on glaciers and at the pole regions. This report repeats three time that SRM is not a mitigation option, yet if it can be used locally over the sea ice or glaciers to reduce summer melting that would be a mitigation option for all the dangers caused by sea level rise. I do not suggest uncontrolled use of SAI but somewhere I read about an option to cover ice to reflect mid-summer sun. Also if localises SAI could be used and thus reduce summer ice melt, this would be a very worthwhile mitigation option and should therefore be looked at with some urgency. I am not aware of the correlation between the amount of ice-mass and global temperatures, but wouldn't an increase in global ice-mass stabilise if not reduce over time global temperature? Finding ways to reduce and regress ice-mass melting is something that need to be urgently looked into. [Moshe Kinn, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Consistency and treatment of SRM throughout the chapter has been revised.
728					This report has represented a balanced approach to the problem of climate change and possible mitigation solutions. However, in all the major mitigation options, including many carbon capture and solar radiation management options, the report leaves the reader at a loss as to what actual mitigation options should be used. For each potential option, reasons why not to use it are given. So what does the IPCC want the report to achieve? The problems of how climate change will affect every part of the globe, are very well articulated but what about solutions? Since much of manmade GHG emissions are produced by engineered 'machines' and 'processes', there is a need for more emphasis on research and development of the technology, and a huge increase of electrical, mechanical, chemical, aeronautical etc. engineers within this research. I wrote a paper that showed the lack of engineering focus within the Disaster Risk Reduction and Management literature, Kinn, M., & Abbot, C. (2014). To what extent is electricity central to resilience and disaster management of the built environment? Procedia Economics and Finance, 18, 238-246. doi:http://dx.doi.org/10.1016/S2212-5671(14)00936-8. After reading this report, I think that were I to redo that piece of work and look at climate science I would find engineers and engineering very much lacking within that fraternity. Therefore, the IPCC must seek to emphasise the need for engineers to be heavily involved in climate change mitigation solutions. [Moshe Kinn, United Kingdom (of Great Britain and Northern Ireland)]	Noted. The IPCC Report is an assessment report on what knowledge about a 1.5°C warming is available. It is not policy prescriptive. In AR6 will be a chapter about Innovation, technology development and transfer where engineering capabilities are addressed.
12112	1				Applies to the five Chapter Executive Summaries which are the items the majority of people will read. We know IPCC will do everything possible to see that the Executive Summaries and subsequent Policymaker Summary and Press Releases do not contain material omissions or misrepresentations, which are likely to mislead a reasonable person. To that end, below are checklists of "facts material to a reasonable person" the content (not wording) of which we conclude must be included in IPCC Summaries and Press Releases. [Michael Wadleigh, United States of America]	Accepted. The executive summaries have been improved.
12113	1				Important note on Asymmetry: Of scientists' nationalities credited on this IPCC Report, 7 scientists are from Low Developed -, 16 from Medium Developed -, 17 from High Developed -, and an overwhelming 97 are from Very High Developed Nations (classification from 2016 UNDP Human Development Index) [Michael Wadleigh, United States of America]	Thanks for your observation. The selection was made based on the nominations received, considering expertise, regional and gender balance.
12114	1				Very High Developed - the wealthiest, healthiest and best educated - are just 18% of population but have caused an overwhelming 68% of cumulative emissions. Low Developed - the poorest, least healthy and educated - are 13% of the population but have caused a miniscule 1% of cumulative emissions (data: Development Classification UNDP HDR 2016, Population, UN Population Division World Population Prospects 2017 revision, Cumulative emissions World Resource Institute CAIT Climate Data Explorer 2015, Global carbon Project 2016) [Michael Wadleigh, United States of America]	Thanks for your observation. The selection was made based on the nominations received, considering expertise, regional and gender balance.

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12115	1				"Asymmetry in the contributions to the problem... and asymmetry in the power to decide solutions": the rich / Very High Developed (18% causing 68%) are never mentioned in the Summaries or the 600 page Report, all emphasis is on the poor / developing (13% causing 1%). [Michael Wadleigh, United States of America]	Rejected: the emphasis regarding impacts is on the poor and vulnerable, but this is not the case regarding mitigation.
12116	1				The asymmetry in responsibility and power is reversely reflected in the Report which mentions "equity" synonyms and antonyms more than 500 times, "development" nearly 1,000 times, "less developed", "poor" and synonyms nearly 600 times, however "developed", "rich", "OECD", "Industrialized" "Kyoto Annex I" and synonyms are nearly absent, mentioned only 14 times. [Michael Wadleigh, United States of America]	Rejected: this emphasis on equity is a novel and positive aspect of this report, requested by governments at the scoping meeting.
12117	1				This is important because there cannot be omissions or misrepresentations of the rich / Very High Developed asymmetric "contributions to the problem" or it is unlikely that there will be "solutions" to climate change / sustainable development. [Michael Wadleigh, United States of America]	Noted.
12118	1				See Climate Change Checklist: points 11-36 [Michael Wadleigh, United States of America]	Noted.
12119	1				See ClosedMass Check list: points 38-39 [Michael Wadleigh, United States of America]	Noted.
12120	1				See Sustainable Development Checklist points 41-67 [Michael Wadleigh, United States of America]	Noted.
12145	1				Closed Mass checklist: points 37-39 [Michael Wadleigh, United States of America]	Noted.
12149	1				Sustainable Development checklist: points 41-67 [Michael Wadleigh, United States of America]	Noted.
10002	1		167		There is a problem with the resolution of the figures such as Figure 3.1, Figure 3.2, Figure 3.6, Figure 3.10. The whole report should be considered in this sense. [Nazan AN, Turkey]	Editorial - copyedit to be completed prior to publication
10015	1		167		There is a problem in the most of the figures' headings and captions such as Figure 3.4, Figure 3.6. The whole report should be considered in this sense. [Nazan AN, Turkey]	Editorial - copyedit to be completed prior to publication
16377	1				In choosing to be looking at the difference in conditions at 1.5 C and 2 C, I was under the impression that these value would be considered as peak temperatures to stay below rather than new sustainable levels, which seems to be how this report is treating these numbers. In that this is a report from the scientific community, it seems to me to make sure the report makes clear that these are politically chosen values and not one scientists have chosen--what scientists need to be doing is to report what would be the consequences of any particular value, and at 1.5 C there would be very serious impacts occurring and initiated. In particular, 1.5 C will likely lead to a multi-meter rise in sea level and more (based on glacial cycling, the equilibrium sea level sensitivity is something like 15-20 meters per degree C), to significant loss of species (not just locally, but globally), to quite significant changes in storm tracks, to quite significant ocean acidification and loss of coral reefs and low-lying island nations, and lots more. To me it is simply unacceptable to have a scientific assessment about potential trajectories not indicating what the consequences will be at 1.5 C, much less 2 C, and to be indicating that it will take going back to less than about 0.5 C to really moderate the impacts than are disrupting nations and on a path to very significant sea level rise. [Michael MacCracken, United States of America]	Impacts have been more comprehensively assessed in subsequent drafts. The framing of the report included the definitions and explanation of 1.5°C/ 2°C warming were explained in CH1. The impacts on human and natural systems were discussed in Ch3 based on reviewed scientific literature.
2940	1		2		This report suffers from being far, far too long. I am sure that a more succinct report would be better received by the community. [Jim Haywood, United Kingdom (of Great Britain and Northern Ireland)]	Noted, but also note many requests for more information.
2941	1		2		Chapter 1: 62 pages [Jim Haywood, United Kingdom (of Great Britain and Northern Ireland)]	Noted, but also note many requests for more information.
2942	1		2		Chapter 2: 100 pages [Jim Haywood, United Kingdom (of Great Britain and Northern Ireland)]	Noted, but also note many requests for more information.
2943	1		2		Chapter 3: 165 pages (with an annex of 63 pages!) [Jim Haywood, United Kingdom (of Great Britain and Northern Ireland)]	Noted, but also note many requests for more information.
2944	1		2		Chapter 4: 134 pages [Jim Haywood, United Kingdom (of Great Britain and Northern Ireland)]	Noted, but also note many requests for more information.
2945	1		2		Chapter 5: 92 pages [Jim Haywood, United Kingdom (of Great Britain and Northern Ireland)]	Noted, but also note many requests for more information.
2946	1		2		Surely it would be better to provide a more focussed report. While I can just about cope with chapters <100pages, 165 pages with 63pages of annex for Chapter 3 is just too excessive. There is a significant amount of overlap between the chapters with chapters trying to do a bit of everything. For example, chapter 3 is supposed to be impacts on the natural and human systems. It then wades into a summary of observed and modelled changes to the physical system. The first 50 pages should therefore be moved somewhere more relevant – a cut down version could be included in the framing Chapter 1 as this is supposed to be scene setting for the rest of the report. [Jim Haywood, United Kingdom (of Great Britain and Northern Ireland)]	Noted, but also note many requests for more information.
10029	1		47		Intermediate sentences must be audited for the whole chapter. Transitions can not provide integrity in some parts. [Nazan AN, Turkey]	Accepted. This have been improved in the SOD, and will be further improved in the FGR.
9502	1	1			Entire volume of this report should be cut at least into half. Make it focus sharply into 1.5 issues only. So many general descriptions so far confirmed by past IPCC are to be boldly deleted The relative balance of page allocation seems appropriate. Chapter 5 need not to be big one, as this report focuses on 1.5 .degree matter. [Shuzo Nishioka, Japan]	Noted, but also note many requests for more information.
9533	1	1			Entire volume of this report should be cut at least into half. Make it focus sharply into 1.5 issues only. So many general descriptions so far confirmed by past IPCC are to be boldly deleted The relative balance of page allocation seems appropriate. Chapter 5 need not to be big one, as this report focuses on 1.5 .degree matter. [Shuzo Nishioka, Japan]	Noted, but also note many requests for more information.
9559	1	1			Entire volume of this report should be cut at least into half. Make it focus sharply into 1.5 issues only. So many general descriptions so far confirmed by past IPCC are to be boldly deleted The relative balance of page allocation seems appropriate. Chapter 5 need not to be big one, as this report focuses on 1.5 .degree matter. [Shuzo Nishioka, Japan]	Noted, but also note many requests for more information.

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10948	1	1			It is vital that the conceptual framing set up in Chapter 1 is used and carried through to subsequent chapters. This is not yet being done. The most obvious example is the use of classes of pathway (stabilization, continued warming and overshoot)- its set up nicely in Chapter 1 but not followed through in Chapter 2 which so far deals only with overshoot [Skea Jim, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The framing in Chapter 1 has been adjusted so that it better frames the assessment of Chapter 2
12898	1	1	1	1	Could-you provide a definition of global warming of 1.5°C (from top of atmosphere, SST, etc.) at the beginning of Chapter 1? Impact on global and regional climate? [Mustapha Meftah, France]	Accepted. Definitions of 1.5°C and 2°C global warming were provided in CH1.
10000	1	1	165	7	Resolution of the figures are very low [Mustafa Tufan Turp, Turkey]	Editorial - copyedit to be completed prior to publication
10001	1	1	165	7	The transition between the passages should be modified with linking sentences [Mustafa Tufan Turp, Turkey]	Noted.
21333	1	1	2	1	Introduction [Mary Booth, United States of America]	This seems to be a headline of further comments.
21334	1	1	2	1	The following comments on the IPCC "1.5" report focus on a general critique of report, in particular its treatment of bioenergy and BECCS in the FOD. Citation recommendations follow general comments. Copying and pasting out of this document into Word should allow reproduction of paragraph and heading structure. THESE COMMENTS NEED TO BE READ IN ORDER - they will not make sense if they are segmented by chapter, except for the line comments (through line 13, below). [Mary Booth, United States of America]	Thank you. This seems to be an introduction for further comments.
21335	1	1	2	1	Line comments on style and content Report is too jargony – use simple plain English [Mary Booth, United States of America]	Accepted. The style of language was improved.
21347	1	1	2	1	The report should include non-overshoot models. Most models include substantial deployment of bioenergy with CCS (BECCS) as a means of accomplishing "negative emissions" after overshoot. All the models considered in this version of the report exhibit overshoot and then later drawdown of CO2 to achieve 1.5 degrees. However, the dangers associated with this approach are unknown, and BECCS is largely an unproven, and probably an unscalable, technology. Relying on BECCS is dangerous and irresponsible. [Mary Booth, United States of America]	It is unclear which models are meant with "non-overshoot models". However, based on the available literature the SOD now discusses pathways which do not significantly overshoot 1.5°C or which do not use BECCS.
21349	1	1	2	1	The report does not adequately discuss what BECCS untenability means for achieving 1.5. It says the pathways to 1.5 considered in this report rely on BECCS, and it says (weakly) that BECCS isn't realistic. However it does not put these two statements together anywhere to state clearly that the overwhelming dependence on BECCS means that achieving 1.5 degrees is likely impossible under these modeling scenarios. This lack of realism is frightening and inexcusable. Other pathways to achieving 1.5 must be found, but this will not happen as long as BECCS is treated as a realistic option. [Mary Booth, United States of America]	The SOD now provides a discussion of scenarios with varying levels of BECCS, including some which do not deploy this measure altogether. The LED scenario is consistent with limiting warming to 1.5°C (at a reasonable level of probability) without extensive use of BECCS or CCS.
21350	1	1	2	1	Report needs one long detailed section highlighting problems with BECCS and bioenergy. This is the single most important thing we offer in this review, so please pay attention: Bioenergy and BECCS are apparently central to all models for 1.5 C, and thus deserve a thorough airing in the report where all the information is compiled in ONE SECTION. The treatment of bioenergy/BECCS stands in contrast to the treatment of Solar Radiation Management (SRM). SRM is not a real mitigation option, but gets more discussion than BECCS. Chapter 4 contains subheadings on SRM, at 4.3.7 "Governance and institutional feasibility" and, "Economics and cost" and "Social acceptability and ethics." However, there is no such section devoted to bioenergy/BECCS. It is essential that there be one section in the report where the assumptions about bioenergy and BECCS are laid out and critiqued. The assessment should include all the bits and pieces of information scattered throughout the rest of the report, and additional information, as outlined below. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21351	1	1	2	1	Report must not rely on AR5 for assessment of bioenergy feasibility [Mary Booth, United States of America]	Noted - we combine AR5 with more recent literature.
21354	1	1	2	1	Need to compile planned uses for biomass in one section. Bioenergy is frequently referred to in generic terms as providing a significant amount of energy input. However, the report needs to be more specific about how biomass is to be used – for liquid biofuels used for transport and heating, or solid biomass burned for electricity generation or thermal energy, either with or without BECCS. It is impossible to tell how realistic projections are if they are not compiled in one place. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21360	1	1	2	1	Is the carbon penalty of CCS taken into account? . Discussions of BECCS appear to relate the amount of energy generated from bioenergy to a fixed amount of CO2 production that is then stored using CCS. However, these assessments do not appear to take into consideration the "carbon penalty" of BECCS – that is, the extra fuel that must be burned to generate energy to run CCS equipment, which generates extra CO2 that must be stored (Supekar and J Skerlos 2015). [Mary Booth, United States of America]	When integrated scenarios are considered, such system-wide effects are typically considered, as the increase in one activity (e.g. CCS) affects the overall energy demand and potentially emissions

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21357	1	1	2	1	Lifecycle emissions associated with use of agricultural residues can negate "carbon benefits" This report and all others by the IPCC utilize modeling that appears to assume a carbon benefit from collecting and burning agricultural residues (Creutzig, Ravindranath et al. 2015). However, it is not possible to simply collect agricultural residues and burn them in power plants – they must be processed first. There are significant emissions from collecting, processing, storing, and transporting biomass fuels made from residues that significantly offset any carbon benefits from burning a fuel that is assumed to "decompose anyway" (Whitman, Yanni et al. 2011). Further, there is solid evidence that collecting soil residues can lead to depletion of soil carbon (Liska, Yang et al. 2014), an effect that can outweigh all others (Whitman, Yanni et al. 2011). There are also N2O emissions from fertilizer and the need to add additional fertilizer if N is taken off fields as residues; additionally, carbon depletion in soils with residue removal makes soils less able to retain N. Finally, it is well-known in the biomass industry (Melin 2008) that storing raw biomass fuels and processed fuel pellets can lead to large methane emissions from both biogenic (Research 2002) and abiotic processes (Kuang, Tumuluru et al. 2008, Röder, Whittaker et al. 2015). These lifecycle emissions must be discussed in a transparent fashion. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21361	1	1	2	1	CCS with bioenergy is less effective than CCS with coal. Burning biomass emits more CO2 at the stack than coal, per unit energy (Domke, Becker et al. 2012, Walker, Cardellicchio et al. 2013, Laganière, Paré et al. 2017). Generating a given amount of energy from biomass will generate 40 – 60% more CO2 than generating it from coal; the differential with natural gas is even greater. This has significant implications for the ability to deploy CCS with bioenergy, but it is not clear whether the models take this into account. It seems unlikely that the additional CO2 per unit energy is factored in, since most of the models seem to treat bioenergy as having zero emissions. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21362	1	1	2	1	CCS may not work with conventional bioenergy generation. CCS requires purifying the CO2 stream for injection (Supekar and J Skerlos 2015). Bioenergy plants emit tremendous amounts of steam because fuels tend to be wet, as well as pollutants like particulate matter and nitrogen oxides. It is not clear that BECCS can be made to work with conventional plants. The one plant where it has been used is an ethanol manufacturing facility where the CO2 stream differs from the smokestack emissions of a conventional plant burning biomass for electricity generation. It is also obvious that CO2 emissions from actually combusting ethanol in vehicles cannot be captured and stored. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21368	1	1	2	1	Citations [Mary Booth, United States of America]	This seems to be a headline of further comments.
21369	1	1	2	1	Citations. Abt, K. L., et al. (2014). Effect of Policies on Pellet Production and Forests in the U.S. South: A Technical Document Supporting the Forest Service Update of the 2010 RPA Assessment. General Technical Report SRS-202, United States Forest Service, Southern Research Station. Current policies in the European Union (EU) requiring renewable and low greenhouse gas-emitting energy are affecting wood products manufacturing and forests in the United States. These policies have led to increased U.S. pellet production and export to the EU, which has in turn affected U.S. forests and other wood products manufacturing. At this time, the primary exporting region in the United States is the South, and the primary importing countries in the EU are the United Kingdom, Belgium, and the Netherlands. The policies and some Member State subsidies are expected to continue in place until at least 2020, with the potential to continue beyond that date. Key drivers of U.S. pellet feedstock supply include both the age structure of current timber inventory and the policies that define sustainability. Also influencing the effect of increased demand for timber for pellets are the price-inelastic supply and demand. A simulation of the market responses to increases in both pellet and other bioenergy demand in the U.S. South suggests that prices will increase for timber as harvest increases, and will in turn lead to long-term changes in inventory and forest land area. [Mary Booth, United States of America]	These issues are highlighted in chapter 4

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21370	1	1	2	1	Creutzig, F., et al. (2015). "Bioenergy and climate change mitigation: an assessment." GCB Bioenergy 7(5): 916-944. Bioenergy deployment offers significant potential for climate change mitigation, but also carries considerable risks. In this review, we bring together perspectives of various communities involved in the research and regulation of bioenergy deployment in the context of climate change mitigation: Land-use and energy experts, land-use and integrated assessment modelers, human geographers, ecosystem researchers, climate scientists and two different strands of life-cycle assessment experts. We summarize technological options, outline the state-of-the-art knowledge on various climate effects, provide an update on estimates of technical resource potential and comprehensively identify sustainability effects. Cellulosic feedstocks, increased end-use efficiency, improved land carbon-stock management and residue use, and, when fully developed, BECCS appear as the most promising options, depending on development costs, implementation, learning, and risk management. Combined heat and power, efficient biomass cookstoves and small-scale power generation for rural areas can help to promote energy access and sustainable development, along with reduced emissions. We estimate the sustainable technical potential as up to 100 EJ: high agreement; 100–300 EJ: medium agreement; above 300 EJ: low agreement. Stabilization scenarios indicate that bioenergy may supply from 10 to 245 EJ yr ⁻¹ to global primary energy supply by 2050. Models indicate that, if technological and governance preconditions are met, large-scale deployment (>200 EJ), together with BECCS, could help to keep global warming below 2° degrees of preindustrial levels; but such high deployment of land-intensive bioenergy feedstocks could also lead to detrimental climate effects, negatively impact ecosystems, biodiversity and livelihoods. The integration of bioenergy systems into agriculture and forest landscapes can improve land and water use efficiency and help address concerns about environmental impacts. We conclude that the high variability in pathways, uncertainties in technological development and ambiguity in political decision render forecasts on deployment levels and climate effects very difficult. However, uncertainty about projections should not preclude pursuing beneficial bioenergy options [Mary Booth, United States of America]	Reference included.
21372	1	1	2	1	Hudiburg, T. W., et al. (2011). "Regional carbon dioxide implications of forest bioenergy production." Nature Clim. Change 1(8): 419-423. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21371	1	1	2	1	Domke, G. M., et al. (2012). "Carbon emissions associated with the procurement and utilization of forest harvest residues for energy, northern Minnesota, USA." Biomass and Bioenergy 36: 141-150. Interest in the use of forest-derived biomass for energy has prompted comparisons to fossil fuels and led to controversy over the atmospheric consequences of its utilization. Much of the debate has centered on the carbon storage implications of utilizing whole trees for energy and the time frame necessary to offset the carbon emissions associated with fixed-life bioenergy facilities. Forest harvest residues may provide a cost-effective, carbon friendly alternative; however, robust empirical estimates of the carbon consequences of utilizing this feedstock are needed to inform policy and management related to forest-based bioenergy. This study used a modeling approach to assess the availability of harvest residues in northern Minnesota and compared the estimated carbon emissions from in-forest decomposition with emissions from processing, transport, and utilization of residues in a proposed 26 MW bioenergy facility. Model results suggest that the combined emissions from the proposed facility would be 42 percent greater – a net difference of 2,888,751 Mg of CO ₂ – than in-forest decomposition emissions over a 25-year period. The disparity in carbon emissions with and without the proposed facility decreases with increasing time, ultimately reducing to solely emissions from harvesting and transport 190+ years after establishment. These findings have important implications for the development of renewable energy standards including incentives aimed at increasing the use of forest-derived biomass. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21373	1	1	2	1	Kittler, B., et al. (2015). Environmental Implications of Increased Reliance of the EU on Biomass from the South East US. Denmark, European Commission [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21374	1	1	2	1	Kuang, X., et al. (2008). Characterization and Kinetics Study of Off-Gas Emissions from Stored Wood Pellets. The full potential health impact from the emissions of biomass fuels, including wood pellets, during storage and transportation has not been documented in the open literature. The purpose of this study is to provide data on the concentration of CO(2), CO and CH(4) from wood pellets stored in sealed vessels and to develop a kinetic model for predicting the transient emission rate factors at different storage temperatures. Five 45-l metal containers (305 mm diameter by 610 mm long) equipped with heating and temperature control devices were used to study the temperature effect on the off-gas emissions from wood pellets. Concurrently, ten 2-l aluminum canisters (100 mm diameter by 250 mm long) were used to study the off-gas emissions from different types of biomass materials. Concentrations of CO(2), CO and CH(4) were measured by a gas chromatograph as a function of storage time and storage temperature. The results showed that the concentrations of CO, CO(2) and CH(4) in the sealed space of the reactor increased over time, fast at the beginning but leveling off after a few days. A first-order reaction kinetics fitted the data well. The maximum concentration and the time it takes for the buildup of gas concentrations can be predicted using kinetic equations. [Mary Booth, United States of America]	These issues are highlighted in chapter 4

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21375	1	1	2	1	Laganière, J., et al. (2017). "Range and uncertainties in estimating delays in greenhouse gas mitigation potential of forest bioenergy sourced from Canadian forests." GCB Bioenergy 9(2): 358-369. Accurately assessing the delay before the substitution of fossil fuel by forest bioenergy starts having a net beneficial impact on atmospheric CO2 is becoming important as the cost of delaying GHG emission reductions is increasingly being recognized. We documented the time to carbon (C) parity of forest bioenergy sourced from different feedstocks (harvest residues, salvaged trees, and green trees), typical of forest biomass production in Canada, used to replace three fossil fuel types (coal, oil, and natural gas) in heating or power generation. The time to C parity is defined as the time needed for the newly established bioenergy system to reach the cumulative C emissions of a fossil fuel, counterfactual system. Furthermore, we estimated an uncertainty period derived from the difference in C parity time between predefined best- and worst-case scenarios, in which parameter values related to the supply chain and forest dynamics varied. The results indicate short-to-long ranking of C parity times for residues < salvaged trees < green trees and for substituting the less energy-dense fossil fuels (coal < oil < natural gas). A sensitivity analysis indicated that silviculture and enhanced conversion efficiency, when occurring only in the bioenergy system, help reduce time to C parity. The uncertainty around the estimate of C parity time is generally small and inconsequential in the case of harvest residues but is generally large for the other feedstocks, indicating that meeting specific C parity time using feedstock other than residues is possible, but would require very specific conditions. Overall, the use of single parity time values to evaluate the performance of a particular feedstock in mitigating GHG emissions should be questioned given the importance of uncertainty as an inherent component of any bioenergy project. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21378	1	1	2	1	Melin, S. (2008). Safety in handling wood pellets. Delta Research Corporation. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21383	1	1	2	1	Stephenson, A. L. and D. J. C. MacKay (2014). Life Cycle Impacts of Biomass Electricity in 2020 London, UK, UK Department of Energy and Climate Change: 154. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21387	1	1	2	1	Whitman, T., et al. (2011). "Life cycle assessment of corn stover production for cellulosic ethanol in Quebec." Canadian Journal of Soil Science 91(6): 997-1012. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21376	1	1	2	1	Liska, A. J., et al. (2014). "Biofuels from crop residue can reduce soil carbon and increase CO2 emissions." Nature Climate Change 4 (May 2014): 398-401. Removal of corn residue for biofuels can decrease soil organic carbon (SOC; refs 1, 2) and increase CO2 emissions3 because residue C in biofuels is oxidized to CO2 at a faster rate than when added to soil4, 5. Net CO2 emissions from residue removal are not adequately characterized in biofuel life cycle assessment (LCA; refs 6, 7, 8). Here we used a model to estimate CO2 emissions from corn residue removal across the US Corn Belt at 580 million geospatial cells. To test the SOC model9, 10, 11, we compared estimated daily CO2 emissions from corn residue and soil with CO2 emissions measured using eddy covariance12, 13, 14, with 12% average error over nine years. The model estimated residue removal of 6 Mg per ha?1 yr?1 over five to ten years could decrease regional net SOC by an average of 0.47–0.66 Mg C ha?1 yr?1. These emissions add an average of 50–70 g CO2 per megajoule of biofuel (range 30–90) and are insensitive to the fraction of residue removed. Unless lost C is replaced15, 16, life cycle emissions will probably exceed the US legislative mandate of 60% reduction in greenhouse gas (GHG) emissions compared with gasoline. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21377	1	1	2	1	McKechnie, J., et al. (2011). "Forest Bioenergy or Forest Carbon? Assessing Trade-Offs in Greenhouse Gas Mitigation with Wood-Based Fuels." Environmental Science & Technology 45(2): 789-795. The potential of forest-based bioenergy to reduce greenhouse gas (GHG) emissions when displacing fossil-based energy must be balanced with forest carbon implications related to biomass harvest. We integrate life cycle assessment (LCA) and forest carbon analysis to assess total GHG emissions of forest bioenergy over time. Application of the method to case studies of wood pellet and ethanol production from forest biomass reveals a substantial reduction in forest carbon due to bioenergy production. For all cases, harvest-related forest carbon reductions and associated GHG emissions initially exceed avoided fossil fuel-related emissions, temporarily increasing overall emissions. In the long term, electricity generation from pellets reduces overall emissions relative to coal, although forest carbon losses delay net GHG mitigation by 16?38 years, depending on biomass source (harvest residues/standing trees). Ethanol produced from standing trees increases overall emissions throughout 100 years of continuous production: ethanol from residues achieves reductions after a 74 year delay. Forest carbon more significantly affects bioenergy emissions when biomass is sourced from standing trees compared to residues and when less GHG-intensive fuels are displaced. In all cases, forest carbon dynamics are significant. Although study results are not generalizable to all forests, we suggest the integrated LCA/forest carbon approach be undertaken for bioenergy studies. [Mary Booth, United States of America]	These issues are highlighted in chapter 4

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21379	1	1	2	1	Mitchell, S. R., et al. (2012). "Carbon debt and carbon sequestration parity in forest bioenergy production." GCB Bioenergy 4(6): 818-827. The capacity for forests to aid in climate change mitigation efforts is substantial but will ultimately depend on their management. If forests remain unharvested, they can further mitigate the increases in atmospheric CO2 that result from fossil fuel combustion and deforestation. Alternatively, they can be harvested for bioenergy production and serve as a substitute for fossil fuels, though such a practice could reduce terrestrial C storage and thereby increase atmospheric CO2 concentrations in the near-term. Here, we used an ecosystem simulation model to ascertain the effectiveness of using forest bioenergy as a substitute for fossil fuels, drawing from a broad range of land-use histories, harvesting regimes, ecosystem characteristics, and bioenergy conversion efficiencies. Results demonstrate that the times required for bioenergy substitutions to repay the C Debt incurred from biomass harvest are usually much shorter (< 100 years) than the time required for bioenergy production to substitute the amount of C that would be stored if the forest were left unharvested entirely, a point we refer to as C Sequestration Parity. The effectiveness of substituting woody bioenergy for fossil fuels is highly dependent on the factors that determine bioenergy conversion efficiency, such as the C emissions released during the harvest, transport, and firing of woody biomass. Consideration of the frequency and intensity of biomass harvests should also be given; performing total harvests (clear-cutting) at high-frequency may produce more bioenergy than less intensive harvesting regimes but may decrease C storage and thereby prolong the time required to achieve C Sequestration Parity. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21380	1	1	2	1	PCFplus Research (2002). Methane and Nitrous Oxide Emissions from Biomass Waste Stockpiles – Final Report. PCFplus Research. Washington DC. Large wood residue stockpiles may represent a potential source of the greenhouse gases nitrous oxide (N2O), and - if anaerobic digestion occurs inside the stockpiles -methane (CH4). If these gases are indeed emitted, a project which would mitigate the generation and stockpiling of wood residues could be allowed to claim greenhouse gas emission reductions. At present not much is known about the extent of methane and nitrous oxide emissions from wood stockpiles. Therefore an assignment has been commissioned by The World Bank (PCFplus research) to build a general methodology for assessing methane and nitrous oxide emissions from wood residue stockpiles, and using it for assessing the likelihood of estimated methane emissions in one such project in Bulgaria. The assignment consists of a literature survey on methane and nitrous oxide emissions from wood stockpiles, followed by field methane emission measurements on wood stockpiles in Bulgaria, and the development of a spreadsheet model for predicting future methane emissions. As expected only a few articles about methane emissions from wood residue stockpiles were found. Therefore also literature on methane emissions from landfills was included in the survey, of which a large number of publications exists. Methane emissions from landfills show a large temporal and spatial variability, implying that methane emissions at different spots on one landfill can vary up to a factor 1000, and that emissions can vary significantly dependent on the time of day, the season, barometric pressure and precipitation. Seasonal variation is caused by biological oxidation of methane in the top layer of a landfill, and is more pronounced at higher ambient temperatures. It is expected that the same mechanisms and variations in methane emissions from landfills will also take place in wood stockpiles. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21381	1	1	2	1	Röder, M., et al. (2015). "How certain are greenhouse gas reductions from bioenergy? Life cycle assessment and uncertainty analysis of wood pellet-to-electricity supply chains from forest residues." Biomass and Bioenergy 79: 50-63. Climate change and energy policies often encourage bioenergy as a sustainable greenhouse gas (GHG) reduction option. Recent research has raised concerns about the climate change impacts of bioenergy as heterogeneous pathways of producing and converting biomass, indirect impacts, uncertainties within the bioenergy supply chains and evaluation methods generate large variation in emission profiles. This research examines the combustion of wood pellets from forest residues to generate electricity and considers uncertainties related to GHG emissions arising at different points within the supply chain. Different supply chain pathways were investigated by using life cycle assessment (LCA) to analyse the emissions and sensitivity analysis was used to identify the most significant factors influencing the overall GHG balance. The calculations showed in the best case results in GHG reductions of 83% compared to coal-fired electricity generation. When parameters such as different drying fuels, storage emission, dry matter losses and feedstock market changes were included the bioenergy emission profiles showed strong variation with up to 73% higher GHG emissions compared to coal. The impact of methane emissions during storage has shown to be particularly significant regarding uncertainty and increases in emissions. Investigation and management of losses and emissions during storage is therefore key to ensuring significant GHG reductions from biomass. [Mary Booth, United States of America]	These issues are highlighted in chapter 4

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21382	1	1	2	1	Schulze, E.-D., et al. (2012). "Large-scale bioenergy from additional harvest of forest biomass is neither sustainable nor greenhouse gas neutral." GCB Bioenergy 4(6): 611-616. Owing to the peculiarities of forest net primary production humans would appropriate ca. 60% of the global increment of woody biomass if forest biomass were to produce 20% of current global primary energy supply. We argue that such an increase in biomass harvest would result in younger forests, lower biomass pools, depleted soil nutrient stocks and a loss of other ecosystem functions. The proposed strategy is likely to miss its main objective, i.e. to reduce greenhouse gas (GHG) emissions, because it would result in a reduction of biomass pools that may take decades to centuries to be paid back by fossil fuel substitution, if paid back at all. Eventually, depleted soil fertility will make the production unsustainable and require fertilization, which in turn increases GHG emissions due to N2O emissions. Hence, large-scale production of bioenergy from forest biomass is neither sustainable nor GHG neutral. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21384	1	1	2	1	Supekar, S. and S. J Skerlos (2015). Reassessing the Efficiency Penalty from Carbon Capture in Coal-Fired Power Plants. This paper examines thermal efficiency penalties, and greenhouse gas as well as other pollutant emissions associated with pulverized coal (PC) power plants equipped with post-combustion CO2 capture for carbon sequestration. We find that depending on the source of heat used to meet the steam requirements in the capture unit, retrofitting a PC power plant that maintains its gross power output (compared to a PC power plant without a capture unit) can cause a drop in plant thermal efficiency of 11.3 - 22.9 %-points. This estimate for efficiency penalty is significantly higher than literature values, and corresponds to an increase of about 5.3 - 7.7 US\$/kWh in the levelized cost of electricity (COE) over the 8.4 US\$/kWh COE value for PC plants without CCS. The results follow from the inclusion of mass and energy feedbacks in PC power plants with CO2 capture into previous analyses, as well as including potential quality considerations for safe and reliable transportation and sequestration of CO2. We conclude that PC power plants with CO2 capture are likely to remain less competitive than natural gas combined cycle (without CO2 capture) and on-shore wind power plants, both from a levelized and marginal COE point of view. [Mary Booth, United States of America]	These issues are highlighted in chapter 4
21385	1	1	2	1	Vaughan, N. E. and C. Gough (2016). "Expert assessment concludes negative emissions scenarios may not deliver." Environmental Research Letters 11(9): 095003. Many integrated assessment models (IAMs) rely on the availability and extensive use of biomass energy with carbon capture and storage (BECCS) to deliver emissions scenarios consistent with limiting climate change to below 2 °C average temperature rise. BECCS has the potential to remove carbon dioxide (CO2) from the atmosphere, delivering 'negative emissions'. The deployment of BECCS at the scale assumed in IAM scenarios is highly uncertain: biomass energy is commonly used but not at such a scale, and CCS technologies have been demonstrated but not commercially established. Here we present the results of an expert elicitation process that explores the explicit and implicit assumptions underpinning the feasibility of BECCS in IAM scenarios. Our results show that the assumptions are considered realistic regarding technical aspects of CCS but unrealistic regarding the extent of bioenergy deployment, and development of adequate societal support and governance structures for BECCS. The results highlight concerns about the assumed magnitude of carbon dioxide removal achieved across a full BECCS supply chain, with the greatest uncertainty in bioenergy production. Unrealistically optimistic assumptions regarding the future availability of BECCS in IAM scenarios could lead to the overshoot of critical warming limits and have significant impacts on near-term mitigation options. [Mary Booth, United States of America]	Reference included.
21386	1	1	2	1	Walker, T., et al. (2013). "Carbon Accounting for Woody Biomass from Massachusetts (USA) Managed Forests: A Framework for Determining the Temporal Impacts of Wood Biomass Energy on Atmospheric Greenhouse Gas Levels." Journal of Sustainable Forestry 32(1-2): 130-158. Policies based on assumed carbon neutrality fail to address the timing and magnitude of the net greenhouse gas (GHG) changes from using wood for energy. We present a 'debt-then-dividend' framework for evaluating the temporal GHG impacts of burning wood for energy. We also present a case study conducted in Massachusetts, USA to demonstrate the framework. Four key inputs are required to calculate the specific shape of the debt-then-dividend curve for a given region or individual biomass facility. First, the biomass feedstock source: the GHG implications of feedstocks differ depending on what would have happened to the material in the absence of biomass energy generation. Second, the form of energy generated: energy technologies have different generation efficiencies and thus different life cycle GHG emissions profiles. Third, the fossil fuel displaced: coal, oil, and natural gas each have different emissions per unit of energy produced. Fourth, the management of the forest: forest management decisions affect recovery rates of carbon from the atmosphere. This framework has broad application for informing the development of renewable energy and climate policies. Most importantly, this debt-then-dividend framework explicitly recognizes that GHG benefits of wood biomass energy will be specific to the forest and technology context of the region or biomass energy projects. [Mary Booth, United States of America]	These issues are highlighted in chapter 4

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21388	1	1	2	1	<p>Wiltshire, A. J. and T. Davies-Barnard (2015). Planetary limits to BECCS negative emissions 1104872 / AVOID 2 WPD.2a Report 1 . Key Findings ? This study focuses on the planetary limits to BECCS from first generation annual bioenergy (BE) crops coupled with Carbon Capture and Storage (CCS). ? Most but not all IPCC WG3 emission scenarios stabilising climate at low levels, such as 2°C, require large scale deployment of BECCS. ? Land-use emissions embedded in BECCS scenarios can be large and need to be included in emission pathways. In one scenario, the expected BECCS associated temperature offset of 1.34°C by the end of the century is reduced to 0.15°C due to land-use emissions. ? Gross negative emissions from BECCS are unlikely to exceed 640GtC (2346 GtCO2) over the 21st century. When land-use change is included the net maximum contribution is 130 GtC (476 GtCO2). These numbers are derived from the HadGEM2-ES Earth System Model and include the impact of climate on yields. Gross values account for yield only, whilst net values include carbon losses from associated deforestation. The highest gross emissions come from a scenario assuming rapid expansion of bioenergy crops from 2020 in the highly productive tropics covering 18% of the land surface in 2100. The highest net emission comes from a scenario assuming available abandoned agricultural land is put into production reaching a maximum of 5% of land cover in 2100. ? In the scenario with the least mitigation benefit an additional 100 GtC (366 GtCO2) is emitted to the atmosphere due to the combined effect of emissions from clearing forests in regions with marginal yields vulnerable to climate change. In this scenario, the land use emissions exceed the potential carbon sequestration from BECCS over the 21st Century. ? The contribution of negative emissions from BECCS is unlikely to exceed cooling of 0.7°C by 2100, given technological and social constraints. The biophysical effect of deforestation on the decadal-centennial timescale dominates the cooling from negative emissions. More realistic values are around 0.25°C from redeploying agricultural land to bioenergy. ? In the scenarios considered here, yields increase under climate change, with important regional variation. We find no global threshold under which BECCS production decreases. ? The median gross BECCS requirement compatible with a 2°C climate target is 166 GtC (608 GtCO2) within the IPCC scenario database. The highest net estimate presented here is 130GtC (476 GtCO2) implying that deploying enough BECCS within land-use constraints may be highly challenging. ? In the absence of limits on CCS the largest constraint on BECCS, as found in this study, is the amount of land allocated to bioenergy crops and the rate of deployment. Competition for land for food production is a key uncertainty. Other major constraints on the amount of BECCS achievable are the harvest and sequestration efficiencies. ? The most productive areas globally are the tropics. Expansion of bioenergy crop into those areas has a higher marginal gain. ? Biophysical cooling associated with deforestation for biofuels may have benefits to stabilising climate at low levels. Biophysical effects may also include reduced precipitation and other non-temperature linked negative impacts. Other modelling studies have also found warming associated with tropical deforestation. ? Uncertainties are large, particularly with regard to the impacts of climate on crop productivity with literature values spanning a possible increase to decrease [Mary Booth, United States of America]</p>	Accepted. Literature will be revised for next draft.
16378	2				<p>The report dose not really seem to face up to the fact that present commitments to emissions reductions are likely to lead to a warming in excess of 3 C and perhaps even 3.5 C when one fully considers the loss of the sulfate cooling offset, natural carbon feedbacks as permafrost thaws and forests are transformed and die off, and more. The commitments made in the Paris process are not nearly enough to be the world on a path that would have an overshoot as modest as is generally suggested in this report. It is really important that the report make this point and that the longer the world waits to act, the harder it will be and the longer it will take to get on a path that takes the temperature increase back down to below 2 C and 1.5 C, much less to the point we need to get to in order to moderate the much increased rates of sea level rise, biodiversity loss, etc. that will be occurring at the overshoot levels and even at 1.5 or 2 C levels. I just do not get the sense that the authors are being straightforward with those who called for this report--namely the leaders of the island nations--about how large the commitment is becoming to sea level rise and what this will mean for the existence of many of these nations. [Michael MacCracken, United States of America]</p>	Noted. This Special Report was designed to assess impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways. In CH1 a FAQ was included with the title "How close are we to 1.5°C?" were it was stated what happens if the current warming rate continues. A full assessment of the implications of current commitments must be left to AR6.

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16379	3				I think the coverage of the potential for Carbon Dioxide Removal and for Solar Radiation Management, so for geoengineering, is inadequate and very poorly done. The issue to be assessed with respect to these possible geoengineering approaches needs to be whether the world might be better off with elevated GHG concentrations without geoengineering or with geoengineering. All geoengineering researchers agree that geoengineering is not a substitute for mitigation and favor all the mitigation that can be achieved. The key question then is whether and when various types of geoengineering approaches might be phased up (and hopefully later phased down and out) to supplement (so not replace) mitigation and adaptation in order to reduce the intensity and extent of various types of impacts and the overall sustainability of the Earth's natural systems and society. By no means is geoengineering going to be perfect or do everything, but might it reduce the overall impacts. More research is certainly needed, but virtually all of the approaches mimic natural processes going on so are unlikely to introduce strange new conditions and, by being coupled to aggressive mitigation, need only be invoked in moderation compared to the types of application considered so far in the limited research studies that have been done. So, with geoengineering, conditions would hopefully be sustained roughly as they are, so a familiar range of conditions to which there has been much adaptation over recent decades, as opposed to the very different conditions projected for future decades under overshoot conditions (so strange that we really can't have too much confidence in what will happen other than effects will be quite large, indeed much larger than with geoengineering). I just do not think the whole question has been approached in the appropriate framing in this report. [Michael MacCracken, United States of America]	Sections on CDR and SRM, including the SRM box, have been extensive rewritten in response to reviewers' comments.
16380	4				I think consideration has to be given to the uncertainty framing being used in this report. The traditional IPCC framing seeking two-standard deviation identification of changes is fine for the scientific community, but is simply not the framing of findings that is needed by decision makers or by business leaders. Decision makers tend to focus on the relative likelihood of possible outcomes and so are interested in having plausible mid-range estimates. On the other hand, business leaders are supposed to be undertaking (and are called on by governments to do) due-diligence testing--that is testing their resilience to plausible outcomes, including ones of low probability, even if on the high side. For the type of risk analyses that these studies require, the information needed is plausible worst case estimates. In this report there tend to be some rather optimistic projections of what might occur, such as suggesting that the Arctic summer ice might persist well beyond what extrapolations of observed trends are suggesting, that the pace of sea level rise will be much less than the accelerating pace of mass loss from the Greenland and Antarctic ice sheets indicates may occur, that seems to underplay the devastation and impacts that can result from extreme events, and that really does not envision ongoing loss of low-lying islands and island nations. I would urge that the report devote some opening attention to the issue of how ranges and likelihoods are framed that reaches beyond the IPCC tradition and considers the needs of likely audiences for this report, including both the national negotiators, business leaders, and more. Both mid-range estimates and plausible ranges are needed by the various audiences, etc. [Michael MacCracken, United States of America]	A range of uncertainty estimates are used, including "likely" ranges which correspond to one-standard-deviation. The report needs to use the IPCC guidance on calibrated language. The Summary for Policy Makers, which present the key findings of this report, will be prepared together with the Second Order Draft.
4739	4	1	5	49	Before look through the executive summary, I try to imagine what I would like to acquire from it as a policy maker. With happiness, I saw most of them, which include: 1. the warming facts and observable impacts of warming to date; 2. Benefits from 1.5? instead of 2? warming; 3. Gaps to 1.5? warming; 4. How to make 1.5? reality? What are Challenges? 5. Is 1.5? enough for sustainable development? There are only two paragraphs, I think, need to be revised. Please see the following two comments. [Ma Lijuan, China]	Noted.
4740	4	12	4	18	The topic sentence did not well summarize the whole paragraph. [Ma Lijuan, China]	It is not clear to which chapter this comments is referring.
9155	4	13	4	14	a general comment: some chapters are already having confidence level attached to sentences, other chapters don't. This should be harmonized as it would clarify some sentences, e.g the one mentioned here (page 4 lines 13-14) which is unclear without confidence level and not knowing what we are referring to (the previous phrase?). [Timothée OURBAK, France]	Accepted. This have been improved in SOD.
4741	4	35	4	42	It possibly makes much more sense to reveal what benefits humans will get from 1.5? instead of 2? warming, but not tell the policy makers what humans will suffer from 1.5? warming. [Ma Lijuan, China]	Thank you, but both points of view are important: the benefits of a 1.5°C warmer world in comparison of 2°C warmer world and the consequences of 1.5°C warming.

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16486	5				I think the convention used by this report to name pathways by the ultimate temperature stabilization level that they are designed to reach is very misleading and just has to be changed. In my view, the degree of impacts to be expected will be primarily a result of the maximum change in global average temperature is reached (and perhaps how long warming is at this level) and that not using this maximum change as the naming convention for the pathway is a serious mistake and very misleading. Suggesting that the primary issue is the long-term stabilization level will lead to all sorts of variations in impacts among pathways with the same name and no easy way for this to be apparent. It is just not the case that there is considerable hysteresis with the climate—consider, for example, the situation for biodiversity (once lost, bringing the temperature down does not bring back extinct species), for the loss of mass of land on ice (given that as the Greenland Ice Sheet loses ice and the lowered surface is at a warmer temperature, taking the temperature does not re-elevate the surface and ice age history makes clear loss occurs much more rapidly than accumulation), landscapes (landscapes are lost relatively quickly when temperatures rise, the vegetation dries and then burns, whereas re-establishment of a landscape can take centuries and weedy and low-grade species generally come back first and greatly slow a re-establishment of a former condition), and on and on. It seems to me absolutely essential to be naming pathways by their peak value. It might well be there should be a double name, so peak and sustainable goal, but the highest priority should be given to the peak level. And, as indicated in another general comment, we should not be aiming for having the new long-range goal for temperature be 1.5 to 2 C—those should be ceilings as there are quite significant impacts at this level—and the long-term objective should be to get back to 0.5 C or so. [Michael MacCracken, United States of America]	This is a fair point, but this is the convention used in the literature, that have typically developed scenarios aiming to reach 1.5C in 2100, not limited below 1.5C throughout the century. The implications of this are better spelled out in subsequent drafts.
21143	14	3			add cite - Xu and Ramantahn 2017, Well below 2C: Mitigation strategies for avoiding dangerous to catastrophic climate changes, PNAS doi/10.1073/pnas.1618481114 [Nathan Borgford-Parnell, Switzerland]	Accepted. Reference is added.
1804	14	39	14	41	"In this report, consistency with the Paris Agreement temperature goal is interpreted as implying temperatures peaking well below 2°C. Overshoot pathways are referred to in this report as 1.5°C-consistent" This is not valid! According to the Paris Agreement: "pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels", therefore the overshoot option is not there! Yet it can be studied theoretically within the report, but pls do not re-interpret that Agreement. I propose the following modified version for that sentence: Whilst the Paris Agreement calls for pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, the temporal overshoot options will also be considered in this report. [Tibor Farago, Hungary]	Multiple interpretations of the Paris LTTG appear to be possible: the report uses categories that reflect, as far as possible, the available literature.
2089	3	6	3	15	NB. Is adoption of Systems Thinking approaches ever justified in the report? Whilst not personally opposed to this view it could be viewed as inappropriate in some domains/disciplines, e.g. social science? That is, does the adoption of an analytical framework used by climatologists etc easily transfer to other 'disciplines'? Can it be justified by members of THOSE disciplines? If not the approach should be reconsidered/reinterpreted to ensure it is less prone to criticism and achieved 'buy in' from those other disciplines!!! [Timothy Barker, United Kingdom (of Great Britain and Northern Ireland)]	Noted: the Anthropocene box might be considered one example of Systems Thinking in this report.
1154	33	22	33	22	More effort needs to be placed in differentiating between historical flood trends and model-derived flood projections, as these lines of evidence are potentially showing significant inconsistencies that are at present unexplained. It is likely that some of these issues relate to flood processes not being adequately captured by the models, such that the models oversimplify the relationship between extreme rainfall (for which there is increasing evidence about increases) and flood runoff (for which the evidence base is much more mixed). Furthermore, the range of flood processes, that include intensification of extreme precipitation at multiple timescales (e.g. less than hourly for flash floods, through to multi-month rainfall in large basins such as the Mississippi or Murray Darling basins), or from changes to snow melt timing or glacial melt, or changes to storm surge and sea levels for coastal and estuarine regions, need to be considered. The list of historical studies given in this paragraph is also incomplete; see for example Table 1 of Paper 1 below. I believe the text in this paragraph needs major re-working, as it appears to be leading to an over-simplified synthesis of key messages presented in other aspects of the report, such as the executive summary of Chapter 3 and also in Chapter 1. The general message (which is reflected in various IPCC reports) that there remains significant uncertainty about flood trends, including uncertainty about the direction of change, should be more properly represented here. [PAPER 1: Do, H., Westra, S. & Leonard, M., 2017, a global scale investigation of trends in annual maximum streamflow, Journal of Hydrology, doi: 10.1016/j.jhydrol.2017.06.015. PAPER 2: Johnson, F., White, C.J., van Dijk, A., Ekstrom, M., Evans, J.P., Jakob, D., Kiem, A.S., Leonard, M., Rouillard, A. & Westra, S., 2016, Natural hazards in Australia: Floods, Climatic Change, 139(1), pp 21-35. PAPER 3: Hodgkins, G.A., Whitfield, P.H., Burn, D.H., Hannaford, J., Renard, B., Stahl, K., Fleig, A.K., Madsen, H., Mediero, L., Korhonen, J., Murphy, C. & Wilson, D., 2017, Climate-driven variability in the occurrence of major floods across North America and Europe, Journal of Hydrology, 704-717] [Seth Westra, Australia]	Accepted. The section about flooding has been revised in the suggested manner.
7979	36		55		A convincing argumentation concerning the realism and feasibility of the renewable energy technologies (mainly: biomass, wind and solar, including CSR technologies), with the contribution of nuclear power, has been developped for France in the frame of the Association "Sauvons Le Climat". This kind of work can be (and must be) adapted and extrapolated to the world energy system. [Jean Marie Seiler, France]	Noted, although this material is not specific to 1.5C and the IPCC cannot undertake primary research.

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15287	39	8	39	8	copy edit: please insert hyphen in "peer-reviewed" [Pauline Midgley, Germany]	Editorial - copyedit to be completed prior to publication
11009	4	49	4	51	This is a non sequitur: that there is no literature on substituting SRM for mitigation has no implication at all for how sparingly SRM would be likely to be used. [Michael Thompson, United States of America]	Accepted. The section was revised.
2570	8	21			add some information on"" [Xiaojun WANG, China]	It is not clear to which chapter this comments is referring.
2583	8	21			add some information on"" [Xiaojun WANG, China]	It is not clear to which chapter this comments is referring.
2544	8	21			add some information on"" [Xiaojun WANG, China]	It is not clear to which chapter this comments is referring.