

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
70913	0		0		The structure of Section 16.5.4 is confusing. It would be better to organise it based on Table 16.7, i.e. having one subsection on financial instruments, one on regulatory instruments and one on soft instruments.	Noted. Restructuring was considered, but as the section also attracted some praise, we decided to leave it as it is.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
31063	0				Military technologies are missing from Chapter 16. Military research is very large, and includes projects to address emissions, and ought to be included.	Noted. This is a good point but we are not aware of literature addressing this. Moreover, it should be included in the appropriate sectoral chapters.	Daniel Helman	College of Micronesia-FSM	Micronesia, Federated States of
64297	0				Innovation also results in greater transparency and creates additional opportunities for mitigation. In the spirit of the UN Outer Space Treaty, publicly funded satellites (NASA, NOAA, ESA, etc.) provide data on GHG concentration levels that is crucial for the development and enforcement of climate policies. The use of satellite data is mentioned several times in this report, but the analysis of satellite data at scale and the delivery of results to relevant stakeholders in the industrial, financial and public sectors is a distinct area that typically falls to the private sector and academia, and which must also be supported. On that basis, government regulations and incentives are necessary to accelerate the development of new technologies that bring transparency on climate-related issues. ( <a href="https://sentinel.esa.int/documents/247904/3541451/Sentinel-5P-Methane-Product-Readme-File">https://sentinel.esa.int/documents/247904/3541451/Sentinel-5P-Methane-Product-Readme-File</a> ). The taskforce on national greenhouse gas inventories already mentioned the potential for satellite technologies in their 2019 Refinement of 2006 Guidelines (see in particular section 6.10.2 in Volume 1, chapter 6: <a href="https://www.ipcc-nggip.iges.or.jp/public/2019r/f/pdf/1_Volume1/19R_V1_Ch06_QA_QC.pdf">https://www.ipcc-nggip.iges.or.jp/public/2019r/f/pdf/1_Volume1/19R_V1_Ch06_QA_QC.pdf</a> ), highlighting the role satellites can play for verification as an auditable and independent data source.	Noted. The delivery of satellite data is discussed in various chapters, such as chapter 14, but not this chapter which is on technological innovation directly for mitigation.	Christian Lelong	Kayrros	United Kingdom (of Great Britain and Northern Ireland)
74127	0				in general: this chapter contains many abstract professional/technical terms - inevitable due to the complex nature of the subject, but it would help the reader if more examples from practice could be given in layman terms	Taken into account. We have tried to add illustrative examples in the text, such as in the boxes.	Leo Meyer	retired	Netherlands
74129	0				A key message seems to be: Technology and innovation alone cannot solve the climate problem (as is described in FAQ 16.1). This is important since many politicians (not just politicians) see climate change as an issue that can be solved by engineers.	Accepted. We hope that we state this very clearly in the ES and throughout the chapter, and have checked the chapter for this.	Leo Meyer	retired	Netherlands
11899	0				The potential role of biotechnology in agriculture and forestry seems entirely ignored. Emerging technologies like gene editing should be mentioned.	Taken into account. This falls under the "general purpose technologies" which are discussed in section 16.2.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
8997	1	1	1	1	International communities action about climate change and opposing reactions must be free of any politic and must be only environmental.	Noted	Behzad Layeghi	IRIMO	Iran
8999	1	1	1	1	Iran have high potential of clean energies and renewable energies because of its geographical location.	Noted	Behzad Layeghi	IRIMO	Iran
37465	1	1	72	37	A section on the trend in inventive activity in climate change mitigation technologies (CCMT) by the major developed countries need to be added at an appropriate location in Chapter 16 to reflect the following: There has been a steady decline in the inventive activity related to CCMTs by the major developed countries after the period 2011-12 (ie post-Copenhagen). It can be observed that major developed countries that bear much of the historical responsibility for cumulative global emissions and possessing the most capabilities have not been meeting their obligations of investing and driving innovations for low carbon technologies. While Annex 1 countries have consistently called for deep emission cuts by all countries, they appear to be not meeting their fair share in technology development and transfer. Calls for carbon neutrality that are not based on holding developed countries accountable for taking the lead in low carbon innovation and technology transfer is counterproductive to the principles of equity and CBDR-RC.	Noted. In 16.2, we discuss the (sparse) numbers on indicators relevant to innovation investments. Numbers are not available for developing countries. It does show an increase in recent years.	Government of India	Ministry of Environment, Forests and Climate Change	India
37467	1	1	72	37	A section on the trend in inventive activity in climate change mitigation technologies (CCMT) by the major developed countries need to be added at an appropriate location in Chapter 16 to reflect the following: There has been a steady decline in the inventive activity related to CCMTs by the major developed countries after the period 2011-12 (ie post-Copenhagen). It can be observed that major developed countries that bear much of the historical responsibility for cumulative global emissions and possessing the most capabilities have not been meeting their obligations of investing and driving innovations for low carbon technologies. While Annex 1 countries have consistently called for deep emission cuts by all countries, they appear to be not meeting their fair share in technology development and transfer. Calls for carbon neutrality that are not based on holding developed countries accountable for taking the lead in low carbon innovation and technology transfer is counterproductive to the principles of equity and CBDR-RC.	Noted. In 16.2, we discuss the (sparse) numbers on indicators relevant to innovation investments. Numbers are not available for developing countries. It does show an increase in recent years.	Government of India	Ministry of Environment, Forests and Climate Change	India
12331	1	1	99	1	Arguably reflecting the state of most of the literature, the chapter presents few deep insights and does not strike me as particularly helpful for policy-making. Large sections are more an undifferentiated depository of hypotheses and results than an analytical review. There is little information on the relative power of different options and on the time scope of deployment, effects, etc.	Noted. The sections are all based on literature results, rather than hypothesising. A discussion of the different options and their state of play is in the sectoral chapters.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
12333	1	1	99	1	The review of the economic literature on innovations is superficial and does not address relevant aspects such as winner-takes-all, innovation races, etc. Potentially useful terminology such as drastic vs. incremental innovations is not introduced.	Taken into account. E.g., radical innovation is discussed in section 16.2 now more clearly.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
86317	1	1	114	24	A very comprehensive chapter on a rather complicated subject matter. Inclusion of a few successful examples can be immensely helpful.	Thank you. We have included successful examples in boxes, in particular those in sections 16.3 and 16.4.	RABIZ FODA	Hydro One Networks Inc.	Canada
20289	1	10			María Josefina Figueroa Meza (Venezuela/Denmark), María Figueroa (Venezuela). It is the same person or two different colleagues?	Taken into account. It is the same person, and she is now only mentioned in one way.	Avelino G. Suarez	Research Centre for the World Economy	Cuba

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3991	1		114		The text is very clear, complete and objective. It brings, in my understanding, fundamentally all the information pertinent to the treated subject. The section is very well written and the authors were very responsible and assertive in dealing with the subject in question. For these reasons I have nothing significant to add as I understand that the topic is being treated very clearly and completely. The authors are to be congratulated for the excellent work.	Thank you.	FABIO RUBENS SOARES	USP - Universidade de São Paulo	Brazil
82975	2	0	2	0	The ordering of the sections appears odd. Wouldn't you want to start with Sections 16.3 and 16.4 which are foundational and do SD links (16.2) towards the end. The chapter felt it repeated itself a bit because of the ordering.	Accept. The section ordering has been changed according to the suggestion.	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
29821	2	1	3	3	Throughout the Chapter there are several Boxes and at least one Cross-Chapter Box that are of high interest for readers. Please consider to expand the table of content by including these boxes and increasing their accessibility and visibility. This is already established practise in other underlying chapters.	Thank you. Our understanding is that this indeed will be done in the final version of the chapter.	Government of Norway	Norwegian Environment Agency	Norway
74013	4	1	5	3	As was presented by us on IPCC/ICC Working Session on Technology and Transport, we would humbly propose to pay more attention to technology innovations as a means to targeting specifically climate/social/economic feedbacks. We proposed adding the executive summary outline point ===== Regular SDG goals - oriented support for the emerging technologies which can intentionally invoke anticipated non-linear effects by targeting specific climate/social/economy feedback could increase mitigation power involving more people and reduce mitigation costs or turn these costs negative. This includes short-term carbon cycle/land use+social/economy feedbacks in AFOLU emission sector and technology projects where minimal inputs SDG goals (Food, Water and Terrestrial ecosystem) imply mitigation target (Climate) via the technologically-induced economy advancements (No Poverty, Health) making them achievable and attractive for a wide market. Active searching among transdisciplinary productivity-targeting projects could increase the combined impact of the most promising technologies supported. ===== and reflecting this point in the document structure. Papers and materials presented/mentioned on IPCC/ICC Working Session on Technology and Transport: Presentation - <a href="http://bit.ly/KrayPitchDeckClimateEmissions">http://bit.ly/KrayPitchDeckClimateEmissions</a> Research report - <a href="https://bit.ly/GRASP_Excurrence">https://bit.ly/GRASP_Excurrence</a>  (references included)	Taken into account. We have significantly rewritten section 16.2 (and moved it to the end of the chapter, it is 16.6 in the FGD) to accommodate this interaction better.	Dmytro Surdu	Kray Technologies	Ukraine
5581	4	1	6	3	I suggest to add a whole paragraph to develop another point which is not mentioned, for example on page 5 after line 14. Some R&D programs request long term view and stability in political views. Several examples may be taken : very high performances solar cells, Hydrogen and fuel cells, IVth generation model of nuclear reactors. In democratic countries, it may happen that changes in governmental policies induce changes in R&D objectives, with a stop and go effect on public support and financing. Examples : France had the leadership in the 1990s on sodium cooled fast breeders, a technology which has been abandoned for political reasons. Realizing the importance of that mistake, the government decided in 2010 to start again an R&D program based on a prototype reactor named Astrid. In 2020, an other government decided to stop the Astrid program, to please the green fraction of the population. The idea to be develop is that a fruitful R&D requests not only appropriate financing, but also stability in the objectives and policies. If you change your mind every 2 weeks, better to stay in bed! The others will do the job.	Accept. This is indeed in the chapter, e.g. in table 16.6 but als in section 16.4. This point is implied in the 'guidance of the search' example of a TIS function in the ES.	Michel SIMON	Retraité/ Pdt d'association	France
70915	4	2	4	5	The focus here is mainly on environment/natural resources/climate in terms of effects. Afterwards, the sustainable development agenda is mentioned. Since SD/the SDGs are broader than environmental effects, it could be beneficial to incorporate that in the first sentences of the summary.	Accept. Social inequalities, as an example, are now mentioned in the first paragraph of the ES. Unfortunately we don't have space to go through all SDGs.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
23637	4	4	4	5	We suggest a clarification and precisions on this sentence. Indeed, the rebound effect lead generally to lower emission reduction than expected but rarely to increased emissions. Furthermore, the 'other side-effects' has to be defined, e.g. co-benefits on other pollutants.	Taken into account. We mention rebounds but not in the headline. There are a couple of examples of net increases of emissions due to that. The comment on "other side-effects" is unclear, but we tried to clarify trade-offs and all.	Government of France	Ministère de la Transition écologique et solidaire	France
59413	4	5	4	5	The definition for the word "so-called" includes "used to express one's view that a name or term is inappropriate." Is that the intent of the authors in this instance? Sentence should be edited to clarify its meaning.	Accept. Word is removed.	Government of United States of America	U.S. Department of State	United States of America
23639	4	8	4	8	The term "demonstration should be defined here"	Taken into account. The word is removed here. It is explained in 16.2.1 on stages of innovation.	Government of France	Ministère de la Transition écologique et solidaire	France
59415	4	8			Authors should reference the source or comprehensively define the term and acronym "research, development and demonstration (RD&D)". Common authoritative terms for technology development include Research and Development (R&D) (OECD Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development Research and various U.S. government publications). Another authoritative term is Research, Development, Test, and Evaluation (RDT&E) which is somewhat unique to the U.S. Department of Defense (DoD) research enterprise and defined in DOD's Financial Management Regulation (DOD 7000.14-R). Given the extensive and prominent use of the term and acronym "research, development, and demonstration (RD&D)", the authors should reference the source or define it comprehensively.	Taken into account. See response to comment 23639.	Government of United States of America	U.S. Department of State	United States of America

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1713	4	9	4	9	"In addition to research, development and demonstration (RD&D), deployment and diffusion of new and improved technologies are necessary to achieve climate and sustainable development goals" This phrase sounds a bit off. Deployment and diffusion of technologies will decrease global warming, but R&D is needed to get some of these technologies ready to deploy, not the other way around.	Taken into account. The phrase has been revised.	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
10041	4	12	5	31	References are made to: 1. Tabel 16.1 A Categorization of SDGs and their linkages to technological change, row Expected Objectives: "Innovation as a systemic inclusive effort, codetermined by institutional, behavioural and societal capability factors" 2. Statement in page 16-5 line 29-31 mentioned: International cooperation in technology development and transfer can play an important role in addressing global climate and Sustainable Development Goals and needs by helping both developed and developing countries to share knowledge and experiences. 3. Statement in page 16-4 line 12-14 mentioned: "..not only technology push and market pull, but also tailoring innovation policies to local development priorities and context and overcoming both market and innovation system failures" 4. Statement in page 16-5 line 21-22 mentioned: "The process of technological change is represented in a stylized way in mitigation pathways generated by climate-energy-economy model..." 5. Statement in page 16-5 line 15-16 mentioned: "Appropriate innovation and transfer of climate supporting general purpose technologies can help achieve both climate and sustainable development goals in a synergistic mode". In accordance with table 16.1 row Expected Objectives, it is written that innovation is 'a systemic inclusive effort, codetermined by institutional, behavioral and societal capability' which in this draft report is related to page 16-5 paragraphs 15-16 which states 'appropriate innovation and transfer of climate supporting general purpose technologies can help achieve both climate and Sustainable Development Goals in a synergistic mode', and also written on page 16-4 that the above technology development is also associated with 'tailoring innovation policies to local development priorities context'. For that, the success of transfer technology from developed countries to the developing countries no longer to the pattern of 'hands on and hands under' but also have to do with the pattern of 'shared knowledge and shared experiences'. Those points above are because all the problems faced related to the local socio-economic-culture characteristics that only could be understood by the local experts. Thus solving the problem must be based on local conditions through the implementation of the innovation results which has been developed in the developed country. Moreover, it is agreed that solving the climate change problem should involve all the multi-stakeholders, besides the fact that developing countries still have big number of low income peoples which are actually much affected due to changes in climate, then one of important things that need to be considered are all efforts of technology based to mitigation and	Accept. The point on local involvement and expertise is well taken and is also addressed in various place in chapter 16, e.g. in section 16.3, Box 16.10 and 16.6. This point is reflected in various places in the FGD version of the ES.	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
59417	4	14	4	15	When the authors make the declarative statement "The overall effectiveness of reported RD&D spending is not available", they owe the reader either a reference to support the statement or an explanation that supports the statement. Request the sentence be referenced or amended to provide a reason, for example: "The overall effectiveness of reported RD&D spending is not available because [give reason]."	Accept. This language is heavily rewritten in the FGD.	Government of United States of America	U.S. Department of State	United States of America
70917	4	14	4	16	After the discussion of different policy options, this mention of nature-based solutions does not fit here (since the next paragraph starts with policies again).	Accept. Sentence is removed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
80319	4	15	4	20	First order draft said: "Appropriate mixes of climate, industrial and trade policies could induce progress of low-carbon technologies, with spill-over across regions leading to global reduction of emissions and attaining sustainable development goals."  Second order draft said: "Appropriate innovation and transfer of climate supporting general purpose technologies can help achieve both climate and sustainable development goals in a synergistic mode. This would entail taking into account, and responding to, adverse, unanticipated externalities of technological transitions (robust evidence, high agreement). Such externalities could include livelihood loss, environmental damages or increased production and consumption of goods and services. {16.2, 1916.3.2.2, Cross-Chapter Box 4 in Chapter 4}"  COMMENT Edit: "Appropriate innovation and transfer of climate supporting general purpose technologies (e.g. carbon removal and solar radiation modification) can help achieve both climate and sustainable development goals in a synergistic mode."  Source: Carnegie Climate Geoengineering Governance Initiative. (2018). Carbon Removal and Solar Geoengineering: Potential implications for delivery of the Sustainable Development Goals. C2G. <a href="https://www.c2g2.net/wp-content/uploads/C2G2-Geoen-SDGs_20180521.pdf">https://www.c2g2.net/wp-content/uploads/C2G2-Geoen-SDGs_20180521.pdf</a>	Reject. The evidence on SRM and many CDR options contributing to SD is not there. In response to comment 70917, we are removing the NBS-sentence too.	Kelly Wanser	SilverLining	United States of America
74133	4	19	4	21	this sentence does not flow and is incomprehensible	Accepted, sentence removed and rewritten.	Leo Meyer	retired	Netherlands
52947	4	20	4	20	Check wording/grammar	Accepted, sentence removed and rewritten.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia

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53027	4	20	4	20	Green Technology should be an inclusive definition under clean technologies.	Taken into account, sentence removed and rewritten.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
59419	4	23	4	24	Grammar: Extraneous comma at the end of the citation {16.3, 16.4.2, 16.4.4, 16.5.}	Accept revised.	Government of United States of America	U.S. Department of State	United States of America
31717	4	23	4	36	L23 & L34& L36: "(low evidence/high agreement)"- please use comma instead of /	Accepted, revised.	Shreya Some	Ahmedabad University	India
74135	4	25	4	28	would it be possible to include some quantitative information here?	Noted, but unfortunately attributing innovation outcomes to particular policy instruments, or even to policy, is very hard. It is clear that both R&D and deployment/diffusion support are essential. This text has been revised to include more of a systemic perspective.	Leo Meyer	retired	Netherlands
70919	4	27	4	34	While this is a correct summary of the empirical evidence based on the set of indicators in Section 16.5, the sentence suggests that direct R&D support is superior to other measures. This is misleading, in particular when considering that the impact of feed-in tariffs on RES cost reduction has been much larger than that of direct R&D support.	Taken into account. Thank you for pointing that out! It is clear that both R&D and deployment/diffusion support are essential. The text has been revised to accommodate this (and restructured as well to improve the storyline).	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
52949	4	31	4	33	The negligible outcomes or negative outcomes were a result of companies shifting their attention optimizing their business processes to maximize profits/sales rather than focusing on innovation. Additional sales were invested in marketing/advertising, not in R&D. In a way, these instruments distorted 'markets'.	Reject. In the literature, we have not found evidence for this and therefore this is not included in chapter 16. Hence, it is not in the ES.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
1715	4	31	4	34	"Indirect policy instruments such as feed-in tariffs, auctions, emissions trading schemes, taxes and renewable portfolio standards have generally been associated with positive or negligible innovation outcomes, although in some cases specific designs have resulted in some negative distributional outcomes (medium evidence/medium agreement)." This sentence is very general and basically says that the evidence for indirect policy instruments is mixed. The sentence could be simplified. Otherwise, to be more informative, one sentence per policy instrument can help the reader get an idea of which of the policies are associated with what outcomes.	Taken into account. Discussing every individual policy instrument would become too long for the ES, unfortunately. We have instead tried to address this helpful comment by putting the policy instruments in a systemic perspective. This also addresses comment 70919.	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
12339	4	34	4	34	negative è undesirable	Reject. Negative is more factual than the fairly prescriptive undesirable.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
70921	4	34	4	35	A "sustained and comprehensive effort" in what and by whom? Direct or indirect policy instruments or both?	Accepted, but the text has been rewritten in the meantime.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
28031	4	37	4	37	It is also critical to collect evidence from developing countries, including using data from UNFCCC related technology bodies.	Accepted. Text has been added about this, and it has a prominent place in the Gaps in Knowledge parts of the ES and the chapter.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
70923	4	39	4	40	Not sure what "both on the supply and the demand side" refers to here. The three developments in line 39 seem to refer to the market in general so this specification could probably be left out (sentence stopping after "mitigation").	Accepted. This unclear language has been removed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
1717	4	39	4	41	"Recent years have seen lower cost, improved performance, and faster deployment rates of many technologies that can contribute to climate change mitigation on both the supply and the demand side (high confidence). These often have been driven by governments through a range of policy instruments, as well as by private-sector responses." These two sentences seem out of place in this paragraph. I propose moving it to before 39.	Accepted, and the text has been revised to also accommodate comment 70923 and improve the storyline.	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
28033	4	40	4	40	Bearing in mind the importance of adaptation technologies, add after "climate change", "adaptation and".	Rejected, as chapter 16 does not say much about adaptation, in particular the sections that this paragraph draws on are focussed on mitigation.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
70925	4	40	4	40	What does "these" refer to? The three developments in line 39 or the technologies in general?	Accepted, "these" is indeed unclear. We have revised the text of the ES significantly so this has disappeared.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
74137	4	41	4	46	would it be possible to include some quantitative information here?	Noted, as in comment 74135, this attribution is at the moment not yet possible, or leads to meaninglessly large ranges.	Leo Meyer	retired	Netherlands
12341	4	42	4	42	"as well as by private-sector responses". The formulation is unfortunate as the responses are driven by the policies. Suggestion: Delete "responses".	Noted, this was the intended meaning so responses should stay. However, the language has been significantly revised in any case, so this sentence has disappeared.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
37299	4		4		Few acronyms are explained. Acronym should be explained at the first glance.	Noted. The only acronym on this page is RD&D, which is explained in line 8.	Arun kumar Nayak	Bhabha Atomic Research Centre Trombay Mumbai	India
9549	4				Executive summary: I would include the need to overcome governance of digitalisation challenges and the role of digitalisation and technologies to improve, in a innovative way, the traceability of products, services, practices.	Accepted partially: the governance aspect is now mentioned in both the chapter and also the ES. The traceability of products etc is not mentioned in the cross-chapter box, probably for lack of literature on this.	Blanca Casares Guillén	EfecTo TP	Spain

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74131	4				It would help if some numbers /quantitative info could be given in the ExSum , illustrating the headline statements	Noted, see response to 74135. We would love to do this too but the literature is predominantly qualitative.	Leo Meyer	retired	Netherlands
9249	5	1	5	1	The title of the chart in the abstract is IEA countries, while the abstract and Box 16.4 are both expressed as OECD countries. IEA countries include countries other than OECD, and a unified approach is recommended.	Accepted. Thank you for pointing out this inconsistency, OECD has been removed from the ES.	Yongxiang Zhang	National Climate Center	China
12343	5	1	5	14	The paragraph is chaotic as it jumps from one to the other topic and should be reorganized along the main streams of idea:	Noted. Most of the comment seems to have gone missing. We have however rewritten this paragraph, and hope the flow has improved.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
51839	5	5			"The overall effectiveness of reported RD&D spending is not available" this seems to contradict the conclusion on the previous page "Direct policy instruments have had a positive impact on innovation outcomes"	Accepted. We have tried to repair this by putting this information together in a set of paragraphs discussing system approaches.	Florin Vladu	UNFCCC Secretariat	Germany
1719	5	9	5	14	Move "Since the mid-1970s public investments in OECD countries in energy RD&D have seen large swings, with a peak after the oil crisis of the 1970s at USD2019 21.3 billion and of USD 22.2 billion in 2009 as part of government efforts following the financial crisis." to before ". Over time, the portfolio of energy technologies which are funded has changed. In 2019, around 80% of all public energy R&D spending was on low-carbon technologies – energy efficiency, CCUS, renewables, nuclear, hydrogen, energy storage and cross-cutting issues such as smart grids". To talk first about total spending changes, and then the components of it.	Noted, this would indeed improve the flow of this paragraph. In the end we decided to not report these numbers in the ES, given their uncertainties and the fact that they represent only part of the world.	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
37301	5	13	5	13	Check the following reported values, "USD2019 21.3 billion"	Noted, done, this number was correct but also removed.	Arun kumar Nayak	Bhabha Atomic Research Centre Trombay Mumbai	India
53021	5	15	5	15	"Transfer Technology/ innovation and transfer of climate supporting general purpose technologies" Elaborate the mechanism and the cost of transfer tech and how that could affect developing countries' economies.	Accepted, we have changed this (not mentioning GPTs anymore so prominently and focussing on digitalisation instead) and have emphasised the impacts on developing countries.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
1721	5	16	5	16	Simplify. Remove "in a synergistic mode".	Accepted. The paragraph has been strongly modified, and this phrase has also disappeared.	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
74139	5	16	5	19	please provide examples of these mysterious 'externalities'	Accepted, this has been done in the FGD version of the ES, in the first paragraph and also associated with digitalisation.	Leo Meyer	retired	Netherlands
59421	5	16			"in a synergistic mode" is jargon that lacks clarity. Request authors consider re-writing sentence for clarity.	Accepted, see response to 1721.	Government of United States of America	U.S. Department of State	United States of America
9739	5	21	5	28	That is true. In particular technological change is mostly represented as exogenous and further that in most IAM models the cost associated with technical change (adoption of technology) is not reflected.	Thank you.	Mustafa Babiker	Saudi Aramco	Saudi Arabia
12345	5	21	5	28	The paragraph is unconvincing. Arguably it attempts to capture the following: At the aggregate level (pathway, macro-models) innovation is typically treated as a smooth trend with very stylised explanations of the policies and other factors that shape it. Thus, most models do not include detailed representations of innovation policies and practices to support the climate and SD transitions. {16.3.4, Box 16.1} At the micro level, however, innovation proves to be an extremely complex phenomena with social, economic, environmental, financial, institutional, infrastructural, capacity, and behavioural dimensions (high confidence). Understanding and modelling various aspects of technology development and diffusion processes has been and is likely to remain useful for capturing the interactions between innovation, emissions, and decarbonisation pathways.	Reject. The suggested text does not reflect the underlying literature, as summarised in Box 16.1. The paragraph is however shortened to one sentence only in the FGD ES.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
59423	5	22			The use of the term "in reality" is surplusage. Authors should consider deleting it from the sentence for clarity.	Rejected; it is not superfluous as it was highlighting the contrast between the modelled world and the real world. But, this paragraph is shortened to a single sentence anyway so the term is omitted.	Government of United States of America	U.S. Department of State	United States of America
28035	5	37	5	37	After "especially in", add "developing countries, including".	Reject, we did mean especially LDCs and SIDS. In some other countries that are qualified as developing countries by the UNFCCC this is less of an issue (although with others yes). But the exceptional position of SIDS and LDCs is clear.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
52951	5	37	5	37	Abbreviation of 'SIDS' does not appear in the chapter yet - small island developing states. It appears later in the chapter.	Accepted, revised.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
30607	5	38	5	40	It states that the current implementation of technology development and transfer is insufficient, but in order to make this statement, it is necessary to define what level of implementation is sufficient and to show the current level of implementation against that level quantitatively. However, the body text does not provide such verification. The discussion should be based on previous studies and quantitative evaluation.	Taken into account. This point is very important and warrants a much longer discussion than the response to a comment on the ES. When we started putting together the chapter, it was our intention to make an assessment in a more quantitative way. It turned out that for various reasons this is impossible. This already starts with the question of when it would be enough. The quantitative models on this fall short on answering this question. It has also, in the past, proven very difficult to establish how much technology cooperation is actually taking place. Therefore, we relied on qualitative work, which is in high agreement that several countries are missing any substantial technology and innovation cooperation, and that it's needed, hence the conclusion that there is a gap.	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
63435	5	38	5	41	The authors state that current arrangements for technology development and transfers are insufficient and that enhancing financial support may contribute to improvements. These conclusions are based on research from 2016 (Brook et al. 2016) and 2015 (de Coninck and Puig 2015; Ockwell et al. 2015) which were both published prior to the complete negotiation and implementation of the Technology Framework and its additional measures. In addition, any discussion of gap of funding should also provide a more quantitative assessment of what the current situation is, studies pointing to what it should be, and what is not being supported as a result.	Noted. See also response to comment 30607. The literature emerging on technology and innovation cooperation is very sparse. The concrete actions that have emerged from the technology framework in the Paris Agreement have not gone beyond the existing actions in the Technology Mechanism. Hence, the conclusions of the earlier literature still hold.	Government of Canada	Environment and Climate Change Canada	Canada
59425	5	38	5	45	This formulation seems quite favorably biased towards developing countries. It could have a serious negative impact on technology negotiations, which is not the purview of IPCC.	Taken into account. The formulation has been adjusted. We however also reflect what the literature has stated on this.	Government of United States of America	U.S. Department of State	United States of America
12347	5	39	5	39	"are" is	Accepted, text revised.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
12349	5	40	5	43	Please check these two sentences	Accepted, text does not run well. It has been revised.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
74141	5	40			add 'to' before contribute'	Accepted, text does not run well. It has been revised.	Leo Meyer	retired	Netherlands
1723	5	41	5	43	"Emerging ideas such as sectoral agreements, climate-related innovation builders in developing countries and enhanced capacity building." Missing a verb	Accepted, text does not run well. It has been revised.	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
28037	5	41	5	43	The sentence needs to be rephrased.	Accepted, text does not run well. It has been revised.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
15711	5	41	5	43	The sentence may be changed into: Emerging ideas "for international technology transfer and cooperation include" sectoral arrangements ----.	Accepted, text does not run well. It has been revised (but changed anyway).	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16733	5	41	5	43	The sentence may be changed into: Emerging ideas "for international technology transfer and cooperation include" sectoral arrangements ----.	Accepted, text does not run well. It has been revised (but changed anyway).	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
74143	5	41	5	43	the sentence does not flow, verb and object is missing, hence meaning is unclear	Accepted, text does not run well. It has been revised.	Leo Meyer	retired	Netherlands
52953	5	41	5	43	Reword sentence.	Accepted, text does not run well. It has been revised.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
51841	5	43	5	45	This statement seems to be limited to the role of IPRs for the diffusion of climate technologies. Since this chapter focuses on innovation, technology development and transfer, a broader perspective on the role of IPRs for innovation, technology development and transfer would be justified e.g. the role of IPRs in spurring innovation.	Accepted. The IPR paragraph has been revised to reflect this.	Florin Vladu	UNFCCC Secretariat	Germany
28039	5	44	5	44	After "but", add "developing" countries.	Reject, it's not needed.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
52955	5	44	5	45	Diffusion of technologies in developed countries is not always easy. Developed countries can also face problems in deploying technologies given the already available infrastructure. Needs to be clarified	Reject, the point is about the role of IPR in the diffusion of climate mitigation technologies, and there is not so much of an issue in developed countries on that.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
70927	6	1	6	2	Page 4 and Section 16.5.4 say that there is robust evidence on the positive impact of public R&D investments on innovation in energy and climate technologies. So please be more specific here about the gaps.	Accept, text has been revised to clarify this.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
59427	7	2	7	3	As a declarative statement, this sentence requires a reference especially in this case where the declaration is not further supported in the narrative.	Accepted. This sentence has disappeared from the introduction in the FGD because of a restructuring of 16.1. The new first paragraph is extensively referenced.	Government of United States of America	U.S. Department of State	United States of America

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
1725	7	4	7	6	Simplify "To set the ground for further discussions Chapter 16 covers the major aspects of these topics in relation to the multiple dimensions of sustainable development in sections 16.2 and 16.3." to "Sections 16.2 and 16.3 cover the major aspects of these topics in relation to the multiple dimensions of sustainable development."	Accepted- text revised. Section 16.2 Technological Changes and Sustainable Developments and Section 16.3 Fundamental Elements, Drivers and Incentives of Technology Innovation Processes will be moved to Section 16.6 and 16.2 respectively in the FGD version of chapter 16. The "reader" to the chapter has been expanded, strongly revising this sentence.	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
31687	7	9			Incorrect intext citations: P7L9-13; P8L40; P16L27; P26L29,.....	Accepted.	Shreya Some	Ahmedabad University	India
1727	7	10	7	12	Change "and (Stavins et al. 2014) in their chapter on international cooperation concluded that technology-related policies could lower mitigation costs and increase the likelihood that countries commit to reducing GHG emissions" to "and (Stavins et al. 2014) concluded that technology-related policies could lower mitigation costs and increase the likelihood that countries commit to reducing GHG emissions in their chapter on international cooperation"	Accepted. However, the sentence has been removed, as well as the reference, in a restructuring of 16.1	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
1729	7	13	7	13	Move "in the SR1.5" to the end of the sentence	Accepted. However, this reference is removed from the introduction based on the new layout for chapter 16.	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
12351	7	16	7	17	"the benefits and trade-offs" è "the synergies and trade-offs" or "the benefits and drawbacks"	Accepted. Changed to "benefits and drawbacks", whereas section 16.6 discusses synergies and trade-offs.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
12353	7	21	7	23	The sentence is confused and arguably incorrect. Suggestion: "Across the Chapter, innovations are understood as novel combinations of inventions, existing knowledge, resources, etc. together with corresponding attempts at commercialization. That is, innovation is essentially the process through which new ideas are generated and put into commercial practice, thus affecting how we live and work (Schumpeter 1934, Scotchmer 1991; Arthur 2009). Innovations may cover new forms of commercial, business, financial, and even societal or political organisation. In that context, the chapter defines technology as the full range of knowledge, devices, methods, processes, and practices that can be used "to fulfil certain human purposes in a specifiable and reproducible way" (Brooks 1980).	Taken into account. This suggestion reflects a much more comprehensive definition of innovation. Based on the definition of innovation in encyclopedia, innovation is the practical implemenation of new ideas that create new goods, technologies, services or novel combination of those. It is also often viewed as taking place through the provision of more-effective products, processes, services, technologies, art works or business models that innovators make available to markets, governments and society. Innovation is related to, but not the same as, invention. Innovation is more apt to involve the practical implementation of an invention (i.e. new / improved ability) to make a meaningful impact in a market or society. Innovation often manifests itself via the engineering process when the problem is solved in term of a technical or scientific nature. Taking into account the ideas suggested by the reviewer, the definition of innovation together with the scope of its coverage are therefore changed to following: -Innovations are defined as new ideas or combination of new, or existing knowledge, resource, and/or invention being implemented to bring value to the organizations by means of creating more-effective products, services, processes, technologies, policies, and business models that are applicable to commercial, business, financial and even societal or political organizations. In the context of the role of technological innovation, technology is defined as the full range of knowledge, devices, methods, processes, and practices that can be used "to fulfill certain human	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
70929	7	21	7	28	The following paragraphs and chapters very much focus on technological innovations (as shown also in sentence 1 of this chapter). While the definitions of innovation and technology separately have merits, a definition of "technological innovations" would fit even better here (since the chapter is not concerned with e.g. social innovations and to a very small extent with process or methods innovations). This way, the foundational definition by Schumpeter could also be supplemented with more recent sources on technological innovations.	Accepted (with additional explanation). Technological innovation will be defined and supplemented with a few most recent sources or successful cases on technological innovations such as technological innovations for mitigation of CO2 (Shuhong, 2021) (Cheng, 2021)(Anis, 2020). In addition to technological innovation, social innovation will be emphasized to some extent in the latest version of this chapter to demonstrate examples of transformative impact to the society linked to technological innovation. Social innovation implies the transformation of new institutions, new practices and new models of using technology in favour of a low carbon society with particularly relevance when is focusing on soft technologies. This creates a positive societal impact and is characterized by collaboration that crosses traditional roles and boundaries, between citizens, civil society, the state and the private sectors (Reynolds et al 2017).	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
1731	7	23	7	25	"This considers innovation as inventing and discovering new ideas by building on prior knowledge and realising them at large scale affecting how we live and work (Scotchmer 1991; Arthur 2009)" Remove "involving", add "as"	Accepted. All round definition of innovation will be provided in the latest version of the introduction. The core idea of the mentioned sentence will be well incorporated into the new definition of innovation.	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
12355	7	31	7	31	"and how public" & "and the way public"	Noted	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
70931	7	31	7	31	Public policy does not only intervene ("top-down" view) but is intertwined with innovation and technological change in a more complex manner. E.g. "which role public policy plays"	Accepted. This thought is incorporated in the new version of 16.1.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
1733	7	34	7	34	"and on distribution of wealth": either "and on the distribution of wealth" or "wealth distribution "	Accepted. "and on distribution of wealth" does not occur in the chapter anymore (because of rewrites)	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
82977	7	34	7	34	we get off to a really negative start with rebound. Its why I'd prefer a re-ordering.	Taken into account. Through discussions with the chapter writing team, a new structure for the introduction is provided in this latest version of chapter 16. The intention of this new introduction is to present several important statements and facts, supported by references, in order to highlight that technological innovation should be coupled by sustainability and innovation policies together with regional and international cooperation in order to achieve sustainable development goals. As the reviewer has pointed out, public policy is intertwined with innovation, technological changes and other factors in a complex manner. Hence, innovation and technological changes in a sustainable development context requires addressing the overall social, environmental, and economic consequences. All the sections are reorganised in the latest version of chapter 16 to provide a comprehensive spectrum of the subject matter.	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
4887	7	34	7	36	Should note that rebound, while it "...can prevent achieving the full potential of technological changes in relation to energy savings..." these effects are partly offset by increases in economic welfare. (Making the tradeoff different for developing countries, and whether "rebound suppressing" policies are a proper tool), as noted in IPCC SR1.5*.  * findings of AR1.5: "...high rebound can help in providing faster access to affordable energy (SDG 7.1) where the goal is to reduce energy poverty and unmet energy demand (see Chapter 2, Section 2.4.3)" and goes on to say "...and to address policy-related trade-offs and welfare enhancing benefits (robust evidence, high agreement) (Chakravarty et al., 2013; Chakravarty and Roy, 2016; Gillingham et al., 2016), (Chakravarty et al., 2013)."	Taken into account. This is incorporated, and the text has been revised such that only the environmental downsides of rebounds are emphasised. We do note that even though rebound effects will be anticipated, these will be partly offset by increases in economic welfare in tandem with technological innovation; there is a feedback. We don't want to go too deeply in the matter of rebounds, as (as the ER notes) they have been addressed in earlier reports.	Harry Saunders	Carnegie Institution for Science, Global Ecology Group, Stanford, USA	United States of America



Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
59429	7	41	7	42	This statement seems incomplete. What has emerged from the literature that contrasts with the earlier, linear models?	Noted. While the innovation process is often stylized as a linear process in the earlier models, innovation is now predominantly seen as a systemic process in that it is a result of actions by, and interactions among, a large set of actors, whose activities are shaped by, and shape, the context in which they operate and the user group with which they are engaging.	Government of United States of America	U.S. Department of State	United States of America
1735	8	7	8	7	Change "In Section 16.6, the chapter" to "Section 16.6"	Noted.	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
1737	8	16	8	16	Is "Table 16.1 A categorisation of SDGs and their linkages to technological change based on (Fu et al., 2019)" based on Fu et al 2019 Table 1? I think that removing the arrows original arrows between "essential needs" towards "governance" and "objectives" towards "governance" loses too much of the original idea of "joint action and systemic consideration" that's behind the original figure.	Accepted. The table is actually removed in the FGD version of the chapter.	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
70933	8	22	8	22	"By most accounts" is quite vague. Leave out or further qualify whose accounts these are (researchers, policymakers, ...?).	Accepted. Phrasing is removed (and section is heavily modified).	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
12357	8	23	8	25	Please check the sentence	Noted. Sentence has been revised.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
52957	8	23	8	25	Sentence not clear. Need rewording	Noted. Sentence has been revised.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
70937	8	23	8	25	"Some literature" quite vague / informal. Qualify further, e.g. literature by sustainability scholars / systems scholars, or similar	Accepted. Sentence has been revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70935	8	23	8	25	Something is wrong with the last part of this sentence.	Noted. Sentence has been revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70939	8	26	8	26	What is meant by "this"? Clarify if this means the systems approach or sth. else	Accepted. Phrasing has been removed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
4061	8	29			Give a space between: intelligence(Milojevic	Accepted. Phrasing has been removed.	Hugo Mantilla-Meluk	Universidad del Quindío	Colombia
7597	8	30	8	32	I do not understand this sentence, since a proper analysis of synergies and trade-offs can only be done using a holistic perspective.	Noted. Synergies and trade-offs analysis can be done without a holistic perspective by, e.g., not taking all societal challenges or environmental aspects into account. We revised the sentence and added a reference.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
1769	8	30	8	32	Big data and AI are technology can solve many pressing challenges, accelerate SDGs and socio-economic efficiency. You can cite this article. Arfanuzzaman, M. 2021. Big data for smart cities and inclusive growth. In: Bears, R. C. The Palgrave Encyclopedia of Urban and Regional Futures	Noted. The reference to AI is not so strong in the new version of the section so this reference was in the end not included. The document was also not readily available and the abstract seemed to miss balance in assessing the impact of big data.	Md Arfan Uzzaman	FAO	Bangladesh
1739	8	33	8	35	"A more holistic framework could envisage the SDGs as outcomes of stakeholder engagement and learning processes directed at achieving a balance between human development and environmental protection". I could be reading it wrong, but this phrase leaves room to interpret that some human development will need to be sacrificed for environmental protection. But conceptually, sustainable development is the goal of achieving human development in a way that maintains the environment for today and future generations. I think the reader needs reminding that we're talking about the studies mentioned in the previous paragraph on the feasibility of SDGs, which divide goal of sustainable development into parts, and not all these parts are necessarily achieved at the same time: "A more holistic framework could envisage the SDGs as outcomes of stakeholder engagement and learning processes directed at achieving a balance between human development SDGs and environmental protection SDGs".	Partially accepted: we take the point about the sentence giving the impression that human development needs to be sacrificed for environmental protection, and resolved the issue by adding "to the extent that the two can be separated".	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
12359	8	33	8	39	The way it is formulated, this paragraph is almost non-sensical. Here an attempt at reformulation. "From a holistic perspective and following (Fu et al. 2019), one can regard sustainable development as the outcome of a society cooperating to achieve a balance between human development and environmental protection. In that context, Fu et al (2019) consolidates the 17 SDGs in three categories: 1) essential needs which must be satisfied to ensure human survival; 2) expected objectives, that allow to live prosperous and happy lives; and 3) governance, which encompasses the effective regulation of competitive relationships and the establishment of equitable rules and systems that guarantee meeting at least a minimum number of essential needs while maximizing the expected objectives. These categories can be linked to specific disciplines, see Table 16.1."	Noted, and thank you for the suggestion. We have decided to give less emphasis to the Fu et al paper as it is more contemplative and we wanted to be more actionable. We have revised the paragraph (hopefully not non-sensical now).	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
70941	8	35	8	39	Not sure how this relates to the sentence before. Maybe move 33-35 to the end of the former paragraph and introduce 35-39 with an additional sentence that bridges the paragraphs from the systems perspective to the SDG-technological change connection.	Noted, the text has been strongly revised. We did feel that the sentence in 33-35 needed its own new paragraph.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70943	8	39	8	40	I think this approach requires some discussion. Especially under the strains of the already apparent impacts of climate change, the SDGs under "essential needs" could very well or have already become a matter of social science and ethics as well as a topic for transdisciplinary efforts and studies (e.g. community energy projects). Such grey areas in the classification should be addressed.	Accepted. This is a good point. We have removed the table and some of the conclusions.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
10869	8	40	8	40	This is a nice table. Why not make it still nicer by adding a column stipulating the numbers of relevant SDG?	Noted. We added those in the text. (and removed the table)	Philippe Waldteufel	CNRS	France
70945	8	40	12	16	Overall, Table 16.1 seems to serve as the structure for the subchapter. Make this clearer by referring back to it (or follow a different structure which is clearly distinct from the table and explain what its role is in the chapter).	Noted. We in the end decided to change the structure of the section and also remove the table.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70947	9	1	9	1	Ocean in its singular form under Resources&oceans.	Noted. Table was removed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
9003	9	3	9	3	the big challenge is providing food and water resources for arid and semi-arid areas and mid latitude and developing national approaches for preventing evacuation of water and food resources and preventing sever dependence of these areas to water and food.	Noted. More attention to water and food (and agriculture) was included in the new version of this section, in particular through a box.	Behzad Layeghi	IRIMO	Iran
7719	9	3			The big challenge is providing food and water resources for arid and semi-arid areas and mid latitude and developing national approaches for preventing evacuation of water and food resources and preventing sever dependence of these areas to water and food.	Noted. More attention to water and food (and agriculture) was included in the new version of this section, in particular through a box.	Leila Rashidian	Meteorological	Iran
10871	9	4	9	6	A full implementation of SDG#5 and specifically of target 5.6 would strongly contribute to solve this contradiction by removing the adjective "growing" in this statement.	Noted. The sentence was revised or removed as a whole.	Philippe Waldteufel	CNRS	France
28733	9	4			Technology is important. Lifestyle is also very important. The description is too biased towards green technologies. Digital technologies are also vital in increasing production (( & energy/resource) efficiency and reducing waste. This should be corrected.	Noted. This is a chapter on innovation and technology development and transfer. This section discusses the relation between those and SD. We agree that behaviour and lifestyle are also important and often work together with technology; the one cannot be without the other. We discuss this in many places, in particular in the FGD 16.3 and also in chapter 5.	louis lubango Mitondo	United Nations	Ethiopia
70949	9	6	9	6	Ocean in its singular form for SDG14 (Life under Water).	Accept, correction to be done	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
31689	9	6	9		Instead of "SDGs 15 (land) and 14 (oceans)" kindly write: SDGs 15 (Life on land) and 14 (Life below water)	Accept, correction to be done	Shreya Some	Ahmedabad University	India
12363	9	8	9	8	Delete "and"	Reject. The "and" belongs there.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
28731	9	8	9		If reasoning ....resource waste....resource use efficiency is adopted, then energy waste....energy efficiency should also be added because the two are used in the literature on the issue.	Reject. This is included in "resource use efficiency".	louis lubango Mitondo	United Nations	Ethiopia
12365	9	12	9	12	"food, water energy nexus, is" è food-water-energy nexus is	Reject, the way it is placed in the paragraph/sentence requires this phrasing.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
10873	9	13	9	14	This seems to have been the idea, although Bolisetty et al are almost uniquely concerned with water purification. At the same time, one must admit that there attempt to define a compact index accounting for the role of technology in the context of sustainability did not get any recognition so far.	Taken into account. Eventually the reference was removed.	Philippe Waldteufel	CNRS	France
74145	9	15	9	21	these are appealing nice examples - suggest to take some of them up in the ExSum	Noted. We will see if it fits the word count and the flow.	Leo Meyer	retired	Netherlands
11901	9	15	9	21	It is interesting that concrete innovations are mentioned like this: "Novel irrigation technologies are helping food producers augment and improve water supplies, raise water productivity, and improve effectiveness of water demand management and irrigation system maintenance (Reinders 2020); new technologies such as nanoparticles that can significantly enhance the efficiency of agricultural inputs (Singh et al. 2020); agrivoltaics that co-develop land for agriculture and solar with water conservation benefits (Barron-Gafford et al. 2019; Schindele et al. 2020; Lytle et al. 2020)". It is missing one important kind of innovation area in relation to agriculture, namely soil compaction prevention. Instead, this sentence is suggested: "New technologies such as tire construction, automatic tire inflation systems, lightweight material, and small robot vehicles can decrease soil compaction. Easy-drawn implements like inter-row-hoeing machines with self-seeking coulters can also reduce soil compaction because they do not need heavy tractors. Lower compaction, in turn, increases yield and can reduce anaerobic reactions in the soil and therefore also reduce emissions of both CH4 and N2O (Frankelius, 2020). "Reference: Frankelius, P. (2020). A proposal to rethink agriculture in the climate calculations, Agronomy Journal, 112, (4), July/August, pp. 3216-3221 DOI:10.1002/aj2.20286 https://access.onlinelibrary.wiley.com/doi/abs/10.1002/aj2.202861 may also miss biogas capturing (like covered lagoons) from manure as an important innovation that can stop a lot of GHG emissions. In California they have brought down emissions by 20 % in just a few years.	Noted. This is a very important field. It is further discussed in chapter 12.	The Royal Swedish Academy of Agriculture and Forestry (Group Review)	Kung. Skogs-och Lantbruksakademien	Sweden
28737	9	23	9	23	It's more accurate to use relative decoupling in line with the existing body of literature on the issue.	Accept, reference to decoupling has been removed as it is discussed in other chapters.	louis lubango Mitondo	United Nations	Ethiopia
28735	9	24	9	26	The evidence of relative decoupling exists. What is mixed is evidence of absolute decoupling. Please see previous comments in this chapter.	Accept, reference to decoupling has been removed as it is discussed in other chapters.	louis lubango Mitondo	United Nations	Ethiopia

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
51289	9	25	9	27	"The evidence is mixed" suggests that studies have found indications in both directions. However, if one distinguishes between absolute and relative decoupling, a less balanced picture of decoupling can be painted: To the best of my knowledge there is no evidence showing that technology has led to (production-based) absolute decoupling anywhere in the world in recent history at the speed that is needed to reduce emissions, resource use etc. use in accordance with climate targets.	Accept, reference to decoupling has been removed as it is discussed in other chapters.	Stefanie Kunkel	Institute for Advanced Sustainability Studies (IASS), Potsdam	Germany
70951	9	27	9	27	Is there a more recent reference to support this point?	Accept. We decided to remove the discussion of decoupling here and focus this section more.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
52959	9	28	9	29	This is referred to as the rebound effect. In other words, sometimes efficiency gains can actually result in more final consumption. It is mentioned later in the chapter, but should also be mentioned here.	Taken into account. Rebound effects are discussed in many sections. We decided to not repeat the discussion here but leave it in 16.1, 16.2 (new) and 16.5 (new, briefly) and only summarise it in 16.6.4.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
47349	9	28	10	3	We want to urge governments to provide the necessary support and support international stakeholders and initiatives to reduce the personal carbon footprint and support it internationally	Noted. This is a prescriptive statement, it is not clear what the reviewer would like us to do in the context of the text to which this comment is said to apply.	Khaled Mohamed Madkour	Ain Shams University, Cairo, Egypt	Egypt
15709	9	31	10	1	The reference for this part is wrong. The correct one is "Arvesen, A., Bright R. M., Hertwich E. G., 2011. Considering only first-order effects? How simplifications lead to unrealistic technology optimism in climate change mitigation. Energy Policy 39, 7448-7454." According to the referee, "neglect" would be added at the end of line 31 resulting in "and neglect of interactions".	Accept, the reference has been updated (and this text has been moved to the chapeau of 16.6 (new)).	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16731	9	31	10	1	The reference for this part is wrong. The correct one is "Arvesen, A., Bright R. M., Hertwich E. G., 2011. Considering only first-order effects? How simplifications lead to unrealistic technology optimism in climate change mitigation. Energy Policy 39, 7448-7454." According to the referee, "neglect" would be added at the end of line 31 resulting in "and neglect of interactions".	Accept, the reference has been updated (and this text has been moved to the chapeau of 16.6 (new)).	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
70953	9	31	10	3	This links up with the comment above on how even these essential needs are now a subject for social science research.	Noted.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
12367	10	1	10	3	The sentence does not logically belong here	Accept, the sentence has been moved in a restructuring of the text of 16.6 (it is now only in 16.1).	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
15713	10	5	10	27	For 16.2.3, it is not clear what the key message is and what the catalytic role is (Is the flows and investments from developed counterparts?). Considering the flow of the context, it is not easy to catch up the role of 16.2.3. Therefore, it is necessary to describe the key message more clearly to figure out the flow of the context.	Accepted, we placed this text more clearly in the storyline of the new starting paragraph 16.6.1.	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16735	10	5	10	27	For 16.2.3, it is not clear what the key message is and what the catalytic role is (Is the flows and investments from developed counterparts?). Considering the flow of the context, it is not easy to catch up the role of 16.2.3. Therefore, it is necessary to describe the key message more clearly to figure out the flow of the context.	Accepted, we placed this text more clearly in the storyline of the new starting paragraph 16.6.1.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
70955	10	6	10	27	Unclear how the first paragraph in this subchapter relates to the second paragraph. Link the two or only keep the second.	Accept. We have restructured the text, integrated (and revised) the first paragraph with 16.6.1, and removed the second. The example was too detailed.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
12369	10	8	10	9	"Drawing on Amartya Sen's seminal definition of development as an expansion of humans' ability and freedom to live the life they value" & Drawing on Amartya Sen's seminal definition of development as "the enhancement of freedoms that allow people to lead lives that they have reason to live"	Noted. The revision indeed is an improvement, but this part was removed in the restructuring of the section.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
70957	10	25	10	27	This stands in contrast to the second example a little bit. Nowadays, development is usually framed from a "cooperative" perspective. This sentence sounds a bit top-down oriented and like older development perspectives. Be careful here.	Accept, good points. We have however removed this part of the text in the restructuring of section 16.2 (old).	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
23641	10	29	10	29	Concerning this section, a vast literature in sts is dedicated to the analysis of controversies about innovations in any field (see for example wind turbines contests Joliver, Heiskanen, 2020). Adoption is not only an issue of market or diffusion methods. Political, ethical, moral issues are at stake in many recent innovations: personal data protection, democracy destabilization with social networks, health security (food, ITC), common or private goods? Governance issues should be linked to controversies integration in decision-making.	Accept. We tried to reflect these aspects in the new section 16.6.2.	Government of France	Ministère de la Transition écologique et solidaire	France
52961	10	38	10	38	for a net positive outcome (outcome should be singular, not plural).	Accept, but the text is removed in the meantime.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
70959	10	38	10	40	First and quick mention of social innovation. Either explain more here or earlier in the chapter.	Accept. This topic has been discussed in chapter 5, and is introduced now in various places in chapter 16, including in 16.1.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
59431	10	39			"processes" should be "process"	Accept. Revised.	Government of United States of America	U.S. Department of State	United States of America
70961	10	40	10	42	Complex adaptive systems mentioned but then not elaborated further. Elaborate or leave out / move somewhere else. Then use last sentence of the paragraph to transition to the next paragraph.	Accept. It has been removed here and introduced a bit earlier in 16.6.2.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
70963	10	43	10	45	UC very central in the rest of the chapter. Maybe make visible in the heading; suggestion: Governance of technological change: supporting innovations and addressing unintended consequences	Taken into account. We considered elevating UCs but have instead categorised it under synergies and tradeoffs.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
82979	10	45	45	45	more negativity with unintended consequences - I just think Section 16.2 is in the wrong place.	Accept, restructured and revised.	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
59433	11	4	11	5	This seems to be changing. Confirm that sentence reflects the current state of affairs in "most countries".	Noted. The reference is clear, but indeed a couple of years old. We haven't found a suitable update so the text remained the same.	Government of United States of America	U.S. Department of State	United States of America
23643	11	5	11	6	About the quote "[T]he primary cause for this difference is the bounded rationality of human designers" STS would instead suggest considering as a main cause the user adoption process uncertainty (AKrich 1995; M de Lael Mol, 2000).	Noted. This particular phrasing has been removed in the restructuring of 16.2 into 16.6 (in the FGD).	Government of France	Ministère de la Transition écologique et solidaire	France
63437	11	7	11	9	is this for offshore wind energy or wave/tidal energy? or both?	Noted. It is for wave, tidal and ocean thermal energy conversion.	Government of Canada	Environment and Climate Change Canada	Canada
12371	11	7	11	17	Reported UCs include e.g. worse-than-expected physical damage to infrastructure and resistance from communities, in the rapidly growing ocean renewable energy sector (Quirapas and Taihagh 2020). Gaps between expected and actual performance of building integrated photovoltaic (BIPV) technology have been documented in some studies (Boyd and Schweber 2018; Gram-Hanssen and Georg 2018). In the agricultural sector, new technologies and practices that target the fitness of crop pests have been found to favour resistant variants with unintended effect not limited to chemical treatments but also to putatively more sustainable approaches" (Sadras 2020). In the health sector, the introduction of health information technology in some clinical settings have increased the likelihood of patient harm (Coiera et al. 2016), failed expectations, saturation of electronic health records (EHR) markets, innovation vacuums, physician burnout, and data obfuscation (Colicchio et al. 2019)	Noted. Text has been revised. The health example was a little out of scope so it was removed.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
37303	11	12	11	14	The statement is not clear	Taken into account, the sentence was rewritten, to hopefully make it clearer.	Arun kumar Nayak	Bhabha Atomic Research Centre Trombay Mumbai	India
12373	11	18	11	18	"framework guide" → framework to guide	Noted. Phrasing was removed in the restructuring of this section.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
59435	11	18			"to guide" or "guide to"?	Noted. Phrasing was removed in the restructuring of this section.	Government of United States of America	U.S. Department of State	United States of America
70965	11	27	11	32	Participatory governance not introduced before mentioning its downsides. Add proper introduction to this paragraph as it introduces a third aspect to the subchapter. E.g. link to unintended consequences or to governance approaches at the beginning of the subchapter.	Taken into account. Participatory governance is not included anymore in this section as it's introduced elsewhere in this chapter in the report (including in chapters 13 and 14).	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
59437	11	30	11	32	What is "our" here? Perhaps it would be better to drop this sentence entirely.	Partially accepted: although we feel this sentence is valuable (and was reinforced with another recent and authoritative reference) we feel that removing "our" is a good idea and intend to do this.	Government of United States of America	U.S. Department of State	United States of America
70967	11	33	11	33	This heading does not fully reflect the content of the subchapter. Include sth. about human factors, behaviour, culture etc.	Accept. The section ordering, including its headers, has been changed. This part is now under challenges to governance.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
52963	11	38	11	38	effecting' should change to 'affecting'	Accept, word replaced (but the sentence has also been removed)	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
12375	11	44	11	44	11 44 "stabilising feedback" → inertia, resistance to change?	Taken into account. This part has been removed here but a cross-chapter box (12) has been included focussing on these balancing and reinforcing feedbacks.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
28041	11	44	11	44	Bearing in mind the situation of developing countries, after "2016)", to add "while it is critical to address the affordability and responsiveness of technologies to the national and local needs and circumstances in developing countries".	Taken into account, this particular comment has been addressed in the paragraph immediately following this sentence in the restructured text.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
10875	12	4	12	9	But is not it true that very generally people prefer stability and are hostile to any change? There is nothing specifically against low carbon energy in this attitude. Unless some literature finds differently.	Noted. It is hard to generalise beyond what this paragraph is already doing. A much more extensive discussion on public appetite for change is in chapter 5 and in sector-specific ways in the sectoral chapters.	Philippe Waldeufel	CNRS	France
12377	12	7	12	8	I am unable to understand the precise meaning of the sentence "Empirical studies show that simply ...", as "reframing" does not relate in a meaningful way to the previous sentence.	Noted. The two sentences belong together as portraying technological change as a means of minimising climate change is currently the most common way to frame climate policy.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
12379	12	10	12	10	"barrier to climate change" → barrier to action against the climate change	Accepted, although this sentence has been removed in the restructuring of the section.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
59439	12	15			Remove "offer"	Accepted, this sentence has been removed.	Government of United States of America	U.S. Department of State	United States of America

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
20271	12	19	15	13	<p>There is a general lack of sensitivity to the non-linear nature with which technologies move through the TRLs and the innovation chain more broadly. This has been referenced by various authors in the past and emphasises in broad terms that a technology may progress forwards but can also regress backwards along the TRLs. Some important references for this include:</p> <ul style="list-style-type: none"> <li>- Skea J. et al. (2019) Energy Innovation for the Twenty-First Century. Edward Elgar Publishing ISBN: 978 1 78811 260 4</li> </ul> <p>See Figure 6.1 on p.150 of book chapter 6 in that offers a schematic of how innovation can unfold in this chain-linked way. It is adapted from previous publications from Wilson and Grübler (2014) and IEA (2015), which are referenced in this chapter.</p> <ul style="list-style-type: none"> <li>- Wilson, C. and Grübler, A. (2014) Energy technology innovation. In: Grübler, A. and Wilson, C. (eds) Energy Technology Innovation: Learning from Historical Successes and Failures. New York: Cambridge University Press.</li> <li>- IEA (2015) Energy Technology Perspectives 2015. Paris: International Energy Agency, doi: 10.1787/energy_tech-2015-en.</li> </ul>	<p>Acknowledged. The conceptual framing of this subsection was to discuss the more "linear" model of innovation in this section, as a primer where basic but relevant concepts are provided. The "systemic view of innovation" is discussed in detail in the subsequent section. The point regarding technologies progressing backward has been included in section 16.2.1 (new numbering due to a movement in the chapter) alongside the references provided in the comment. Thank you.</p>	Hannon Matthew	University of Strathclyde	United Kingdom (of Great Britain and Northern Ireland)
59441	12	19	30	20	<p>Section 16.3 appears deficient in so far as it does not address or perhaps only addresses implicitly the differences between opportunity driven and needs driven research and development. Opportunity driven research being that work motivated by new insights resulting from new understandings (a paradigm shift) and needs driven research, research and development motivated by an existing understanding. A trivial but illustrative example being a research effort to develop a bow and arrow with extended range (needs driven) and a research effort to develop gunpowder (an opportunity from new knowledge resulting in a paradigm changing research effort). The fundamental elements, drivers and incentives of these two technology innovation processes can be quite different. Consideration should be taken to include these differences in the narrative.</p>	<p>Acknowledged. Thank you for the comment. The distinction between opportunity driven and needs driven research parallels has been included in the section by linking it to the concepts of radical versus incremental innovation. Radical innovations represent a paradigm shift. Incremental innovation are those representing needs-driven research, based on knowledge that is already available and is improved. This is reflected in section 16.2.1.1 with the sentence "Importantly, R&amp;D activities can incremental, i.e. focused on addressing a specific need by marginally improving an already existing technology, or radical, representing a paradigm shift, promoted by new opportunities arising with the accumulation of new knowledge [cite]."</p>	Government of United States of America	U.S. Department of State	United States of America
70969	12	20	12	21	<p>Text between 16.3 and 16.3.1 missing.</p>	<p>Accepted, we added the text</p>	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
82981	12	21	12	21	<p>In section 16.4, the linear model of innovation is rejected. Ye here it (implicitly) gets set up. Some re-organisation of 16.3/16.4 might be called for. And I missed a reference to the Frascati system for classifying "research and experimental development". That is mainly for the purpose of classifying government spend. Isn't that more the function of the "stages of innovation". More a classification system than a model.</p>	<p>Accepted. See reply to comment 20271 for the first part of the question. At the end of section 16.2.1.1 a sentence has been added with a reference to the Frascati Manual and a link to later parts of the chapter which discuss indicators more at length: Section 16.3.4, Box 16.4, Table 16.7</p>	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
12381	12	29	12	33	<p>"Successfully passing from a stage to the next one in the innovation cycle requires overcoming a "valley of death" (Auerswald and Branscomb 2003; Technology Executive Committee 2017), which is considered most challenging at the demonstration stage (Frank et al. 1996; Weyant 2011; Nemet et al. 2018). As time passes, a given (dominant) technology will reach the obsolescence phase, as new and improved technologies are discovered, but this is not discussed here." è "Successfully passing from one stage to the next one in the innovation cycle requires overcoming a "valley of deaths" (Auerswald and Branscomb 2003; Technology Executive Committee 2017), most notably the demonstration phase (Frank et al. 1996; Weyant 2011; Nemet et al. 2018). Over time, the current dominant technology will become obsolescent as new and improved technologies are discovered. This is not discussed here."</p>	<p>Noted. Your suggestion was incorporated in the text, albeit not verbatim.</p>	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
82095	12	32	12	33	<p>The sentence here mentions that "as time passes, a given (dominant) technology will reach the obsolescence phase, as new and improved technologies are discovered...". Although, the sentence ends by explaining that this is not further discussed here, I think the sentence quoted is a bit inaccurate. The discover and improvement of new technologies does not necessarily go hand in hand with the obsolescence of a (current) dominant technology. An example is the co-existence of internal combustion vehicles (ICVs) and electric Vehicles (EVs). Although EVs are gaining a wider market and might become the dominant technology in the future (with the right stimulus), they have not completely replaced ICVs. In fact, ICVs and EVs are not even the only ones in the market, if we also consider their co-existence with hybrid vehicles.</p>	<p>Accepted. The sentence has been modified to reflect this comment "Over time, new and improved technologies are discovered; this often makes the dominant technology obsolete"</p>	Sofia Rosero Abad	University	Netherlands
10877	12	32	12	33	<p>However, the energy spent by the dominant technology to survive is part of the bottlenecks and roadblocks mentioned a few lines ago! Anyway, since this part of the story is not discussed here, it definitely ought to be discussed somewhere else.</p>	<p>Noted. Please note that we mention the issue of lock-in in section 16.2.2.2. Unfortunately, we cannot discuss this in detail due to space constraints</p>	Philippe Waldteufel	CNRS	France
23645	12	36	12	36	<p>In Table 16.2, we recommend to add in the main funding actors column, NGOs, that are also innovation actors and funders with the support of International Organization (Luxmore, Hull 2011, Schweizer, Dupuis, Buren, 2016. Masuda, Liu, Reddy and al. 2018).</p>	<p>Accepted. The two actors have been included in the Table</p>	Government of France	Ministère de la Transition écologique et solidaire	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
20267	12	36	13	1	<p>Table 16.2 (p.12) lists Technology Readiness Levels 1-9, citing various sources including the IEA. However, the IEA has recently updated their TRL frameworks, expanding this to include 11 TRLs. This offers greater detail around the latter stages of innovation, which have traditionally been somewhat vague.</p> <p>"IEA has extended the TRL scale used in this report to incorporate two additional levels of readiness: one where the technology is commercial and competitive but needs further innovation efforts for the technology to be integrated into energy systems and value chains when deployed at scale (TRL 10), and a final one where the technology has achieved predictable growth (TRL 11)."</p> <p>I recommend that authors make mention of this new development and highlight its potential value.</p> <p><a href="https://www.iea.org/reports/clean-energy-innovation/innovation-needs-in-the-sustainable-development-scenario">https://www.iea.org/reports/clean-energy-innovation/innovation-needs-in-the-sustainable-development-scenario</a></p>	Accepted. The TRL definition in the table has been changed to use the most recent classification by the IEA (2020)	Hannon Matthew	University of Strathclyde	United Kingdom (of Great Britain and Northern Ireland)
84451	13	3	13	25	<p>the section (16.3) was already very well written and comprehensive. even in the research phase startups focus on customer development, under concepts like lean startup. Perhaps it would be good to mention somewhere how corporate procurement and demand for clean energy is affecting the landscape, e.g. Facebook, Amazon, Google want to buy clean energy every hour. I agree that TRLs may not be so relevant today for climate tech and digital tech, as they were originally created for space program. This may even inhibit the more rapid development and testing needed in today's innovation climate.</p>	Accepted. The TRL definition in the table has been changed to use the most recent classification by the IEA (2020)	Kenji Tanaka	the University of Tokyo	Japan
59443	13	4	13	6	<p>The sentence fails to acknowledge that the research component of "research and development" may solely focus on the generation of knowledge unrelated to function and goal.</p>	Accepted. The sentence was poorly written, as the reference to function and goal was meant to apply to the "solving particular problem" part. We rephrased the sentence as follows: "This phase of the innovation process focuses on both generating knowledge or solving particular problems by creating a combination of artefacts that is intended to perform a particular function, or to achieve a specific goal."	Government of United States of America	U.S. Department of State	United States of America
59445	13	4	13	13	<p>This paragraph does not accurately reflect standard definitions for basic and applied research from widely accepted authoritative sources such as the OECD and U.S. Government. For example, in the statement ""Basic research brings specific knowledge on a phenomenon or law of nature; it is often aimed at advancing knowledge rather than solving a problem"" the second phrase is in error. Basic research by definition is not aimed at problem solving (i.e., a problem associated with an application). Note the following definitions:</p> <p>Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. Source: OECD, Frascati Manual 7.0, Chapter 2. The full Frascati Manual and current and upcoming online Annexes are available at <a href="http://oe.cd/frascati">http://oe.cd/frascati</a>.</p> <p>Basic research is defined as experimental or theoretical work undertaken primarily to acquire new knowledge of underlying foundations of phenomena and observable facts. Basic research may include activities with broad or general applications in mind, such as the study of how plant genomes change, but should exclude research directed towards a specific application or requirement, such as the optimization of the genome of a specific crop species. Source: OMB Circular A-11.</p> <p>Basic research: systematic study to gain knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind . Source: FASAB Handbook, Version 16.</p>	Accepted. We agree. The sentence has been revised: we now adopt the definitions of the Frascati Manual.	Government of United States of America	U.S. Department of State	United States of America
59447	13	8			<p>This sentence related to applied research is closer to available authoritative definitions but lacks clarity. For example, why do the authors state ""... uses the scientific method ..."" where available authoritative definitions are clearer (see below)? Applied research is original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective. Source: OECD, Frascati Manual 7.0, Chapter 2. The full Frascati Manual and current and upcoming online Annexes are available at <a href="http://oe.cd/frascati">http://oe.cd/frascati</a>.</p> <p>Applied research: systematic study to gain knowledge or understanding necessary for determining the means by which a recognized and specific need may be met. Source: FASAB Handbook, Version 16.</p>	Accepted. See reply to comment 59445	Government of United States of America	U.S. Department of State	United States of America
59449	13	10			<p>The inclusion of "proof-of-concept to verify the viability" in applied research requires a reference.</p>	Rejected. We adopted the Frascati manual definition of applied research, and this wording is no longer there.	Government of United States of America	U.S. Department of State	United States of America
12383	13	17	13	20	<p>I am unable to understand properly (most) of the reasoning. There is obviously a confusion here.</p>	Noted. The sentence has been modified to increase clarity, including a reference to the environmental externality.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
70971	13	17	13	20	<p>This sentence is phrased in present tense but 3 out of 4 references are very old. Possibly replace or supplement with more recent literature on difficulty of private investment in R&amp;D for climate mitigation (see also next sentence). There have been a lot of changes in this area over the last two decades.</p>	Acknowledged. More recent references were included in support of the point. The sentence has been modified to clarify that the statements refer to situations in which no policy promotes private funding, and no environmental policy contributes to making low-carbon technologies more attractive vis-a-vis incumbent fossil.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

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8813	13	17	13	29	Haas and Kempa (2020) is a potential source, as the authors show that credit rationing might deter investment in low-carbon technologies. Full source: Haas, C. and Kempa, K. (2020), "Low-carbon Investment and Credit Rationing", SSRN Electronic Journal. <a href="http://dx.doi.org/10.2139/ssrn.3521332">http://dx.doi.org/10.2139/ssrn.3521332</a>	Acknowledged. The reference provided, for however relevant, has not passed the scrutiny of peer review and therefore cannot be included. However, to address the comment, other published references were included.	Karol Kempa	Frankfurt School of Finance & Management	Germany
59451	13	18	13	19	Is this statement still true?	Acknowledged. The sentence has been modified to clarify that the statements refer to situations in which no policy promotes private funding, and no environmental policy contributes to making low-carbon technologies more attractive vis-a-vis incumbent fossil. Fossil fuels technologies are still heavily subsidized worldwide and recent references have been added to support this statement. The life time of fossil technologies are notoriously long, and unless the negative externality is internalized and stringent climate targets are imposed, there is no incentive to retire them. Reference has been added to support this point as well.	Government of United States of America	U.S. Department of State	United States of America
23647	13	27	13	28	more and more innovations projects are fostered by international institutions programs (for example, the world Bank or Development Agencies) to provide solutions to societal issues like energy access ( <a href="https://www.lightingafrica.org/">https://www.lightingafrica.org/</a> )	Noted. See reply to comment 7599.	Government of France	Ministère de la Transition écologique et solidaire	France
7599	13	27	13	28	This paragraph seems to be misplaced, too short and disconnected from the rest of the subsection.	Accepted. The sentence was indeed misplaced. It has been moved to a later section 16.4.4.3.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
59453	13	27	13	28	This sentence seems out of place here. Perhaps it would be better placed in Section 16.5.	Accepted. See reply to comment 7599	Government of United States of America	U.S. Department of State	United States of America
70973	13	27	13	28	Very good point. Add one or two additional sentences to make it a paragraph.	Rejected. See reply to comment 7599, the sentence has been moved.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
10879	13	27	13	28	This sentence, although short, hints to a lot of controversial issues. Should R&D priorities be guided by institutions? Should R&D priorities embody specific goals? Who is able to discriminate goals against needs of the poor or marginalised? Which answers to these questions are suggested by past results of R&D? These issues are far from simple with clearcut answers; even people with deep and personal experience of R&D use to be cautious when addressing them.	Noted. See reply to comment 7599.	Philippe Waldeufel	CNRS	France
70975	14	2	14	13	One additional sentence could draw the connection between energy demonstration projects and the energy transition (to match the connection with climate mitigation technologies that is provided in 16.3.1.1 and 3)	Accepted. The following sentence has been added "Demonstration project are an important step to promote the deployment of low-carbon energy and industrial technologies in the context of the transition"	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
23649	14	3	14	3	Suggestion to replace "demonstration" by "development"	Rejected. It is difficult to distinguish clearly between demonstration and development, especially so when talking in more abstract terms, as is the case in this section. We have included a walk through paragraph at the beginning of Section 16.2 (old numbering 16.3) to explain that this section offers a basic and rather simplified overview of the stages. We do acknowledge in section 16.2.1 that all stages are not clearly separated. Yet, we did not substitute Development with demonstration, as suggested, because development is described in section 16.2.1.1. (old numbering: 16.3.1.1). Section 16.2.1.2 (old numbering: 16.3.1.2) is about demonstrating the applicability of the technology in out-of-the-lab (in very simple terms)	Government of France	Ministère de la Transition écologique et solidaire	France
23651	14	19	14	20	We recommend to complete de statement "Transfer of technology is an important component of stringent mitigation strategies as well as international agreements". Indeed, the transfer of technology is one of the means for accelerating technology access in developing countries. But it is not the only one; for 15 years, frugal innovation and grassroots innovations are new design approaches dedicated and tackling developing countries' needs. Some of these innovations, often environment-friendly, are diffused in developed countries in a "reverse engineering" trajectory (Basu, Banerjee and al, 2013).	Acknowledged. The specific phrase commented related to the definition of deployment and diffusion concepts, so we did not add the suggested text. Note that the specific sentence was modified in any case due to other comments. However, the point you raise is a crucial one. We therefore highlighted these different concepts of innovation (frugal, grassroots) earlier in the section (section 16.2.1)	Government of France	Ministère de la Transition écologique et solidaire	France
23653	14	38	14	38	Regarding technology standards, governments also play an essential role in defining the end-life cycle treatment of products. Regarding solar devices for energy access in sub Saharan Africa, the lack of standards, law, obligations about the panels and batteries' end-life drive to an electric waste proliferation (Cross, Murray, 2018)	Accepted. A mention of end of life cycle treatment has been added, including the suggested reference	Government of France	Ministère de la Transition écologique et solidaire	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
82983	14	40	14	40	might be useful to say that TRL was originally used for the readiness of components forming part of technological system. Not for whole technologies.	Accepted. The initial paragraph of the TRL subsection has been modified to include this point	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
59455	14	40	15	10	There are at least two and probably many more frameworks for the categorization of technical maturity. The authors need to address why the NASA TRL categorization is the only one addressed in the narrative.	Accepted. The initial paragraph of the TRL subsection has been modified to mention the other TRL classifications. Also, Table 16.2 was revised to refer to the most recent IEA classification. This, in turn, was chosen given the fact that (1) it covers also the latest stages of the innovation process and (2) the IEA is an international organization that includes many countries.	Government of United States of America	U.S. Department of State	United States of America
6097	14	40	15	11	there are two classifications of TRL, the NASA and the EU, their applicability to developing countries / least-developed countries might needs modification / adjustment, in terms of definition, because "technology leapfrog" is highly possible in the above-mentioned nations, not just "technology transfer"	Accepted. See reply to comment 59455	Liwah Wong	EIT Climate KIC, EIT RawMaterials	Germany
12385	14	48	14	48	Please consider deleting "In the field of energy technologies, they" as it is improperly restrictive	Accepted. The statement has been deleted	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
10043	14				(sub chapter 16.3.1.3 Deployment and diffusion)It would be great if lessons learned regarding how to address deployment and diffusion of "low quality" new technology, e.g. low quality LED lamps that often breaks down and leads to more electronic waste compared to CFL, is added.	Noted. See reply to comment 23653. A brief mention of life cycle considerations and waste proliferation was added.	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
12387	15	2	15	2	Please consider deleting "thus" as there is no causality here.	Accepted. The word has been deleted	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
82097	15	5	15	5	The sentence mentions that the usefulness of TRLs is limited by several factors. However, that doesn't mean it is not a useful tool. I think here it would be important to mention the possibilities of using TRLs as indicators in combination with other tools (Depending on the aim of the analysis) like SRLs and economic indicators on the investment, returns, etc, rather than simply explaining its limitations. In fact, I would consider explaining the opportunities and possibilities of using TRLs specially because they are also used as (main) indicators in other chapters of the IPCC report.	Accepted. The tone of the paragraph was unduly negative wrt to TRLs. Indeed, notwithstanding their limitations, they are undoubtedly useful. A sentence has been added to also point to the need to use the alongside other indicators.	Sofia Rosero Abad	University	Netherlands
84453	15	13	17	17	Related to this sentence: "Initially new technologies are often expensive or characterized by low technological and environmental performance and cannot compete with the incumbent technologies (Cowan 1990)". My idea: This is from 1990, when technological development and companies were focused on different things. I think today, new technologies can have high technological performance and potential to reduce emissions, but perhaps cannot compete economically with incumbent technologies at the first decade until reaching critical mass.	Taken into account. Please note that this sentence directly refer to the previous sentence. The aim of this discussion in the highlight a result from economic theory that - in the presence of learnign by doing - the market fails to deliver economically optimal option. Of course, you are right that there are other systemic factors that are not captured by economic theory and it is important that the chapter discuss these other factors. The solution is that we separate these two areas: section 16.3 discusses mostly "economic" factors and theory and section 16.4 discusses other perspectives (included the one you mention). We changed the sentence to emphasize that the sentence refers to the economic dimension only.	Kenji Tanaka	the University of Tokyo	Japan
59457	15	15	15	17	What is the reference for this statement?	Rejected. We needed to delete this sentence due to space constraints	Government of United States of America	U.S. Department of State	United States of America
59459	15	16	15	17	Should be "looking for a new..." or "solutions (e.g., blueprints)"	Accepted. Thank you for noting this!	Government of United States of America	U.S. Department of State	United States of America
59461	15	16			The term "learning-by-doing" appears to be used as a specific term of art within the narrative. As such, the authors should reference the source or define it comprehensively.	Taken into account. We attempted to define the term learning-by-doing in the first paragraph of 16.2.2.1. Please note that we cannot include a long definition of the term due to space constraints	Government of United States of America	U.S. Department of State	United States of America
59463	15	17			This applies more broadly than production methods and more broadly than just increasing efficiencies, unless those two terms are very broadly defined. R&D can lead to entirely new methods or products as well as increased productivity.	Taken into account. We changed this part of the sentence to: "increase the efficiency of existing production methods or result in entirely new methods, products or services". Please note that reference to productivity would require reference to the use of inputs and this would make the sentence over-complicated, especially for non-economists.	Government of United States of America	U.S. Department of State	United States of America
59465	15	19			Change to "limit the ability of others to exploit it"	Rejected. We needed to delete this sentence due to space constraints. We left a more detailed discussion of R&D in section 16.3.1.1.	Government of United States of America	U.S. Department of State	United States of America
59467	15	20			Change to read "... new machines or processes that allows ..."	Accepted. Thank you for this suggestion!	Government of United States of America	U.S. Department of State	United States of America
70977	15	23	15	24	First sentence of the paragraph is formulated a bit too hesitantly/vague ("could") and does not completely match rest of the paragraph.	Accepted. We deleted "could". We edited sentence (and the entire paragraph) to make its message clearer	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium



Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
59469	15	29			Seems that more recent citations should be available. This citation should also at least refer to the PV box (Box 16.2).	Accepted. We added the reference for 16.2	Government of United States of America	U.S. Department of State	United States of America
12389	15	35	15	35	"equilibrium level of investment is below its social optimum." A clearer and more accurate formulation would be: "the market, left to its own, tends to generate less investment than socially optimal"	Accepted. Thank you for this suggestion!	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
12391	15	36	15	37	"Moreover, if learning-by-doing is necessary to drive the cost of technology down, there is a risk that this technology will not be adopted by the market even if its adoption could bring societal benefits." & "Moreover, if the cost of a technology is too high before a large amount of learning-by-doing has occurred, there is a risk that it will not be adopted by the market even if socially advantageous. Indeed, ....	Accepted. Thank you for this suggestion!	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
82099	15	36	15	39	This sentence mentions that "new technologies are often expensive or characterised by low technological and environmental performance and cannot compete with the incumbent technologies (Cowan 1990). " To begin with, the reference in this sentence, is too old (1990) and I think it is necessary to replace it by a more recent source. Because of this same reason, I believe this sentence misses a bit the point of what are the current challenges for sustainable and environmentally friendly technologies. Although some new technologies might in fact be expensive, technology development has been aiming to improve the environmental performance of technologies and processes. PVs, airborne wind energy, EVs, biofuel conversion technologies, are all wxamples of technologies and processes with improved environmental performance compared to the (dominant) technologies. The reasons why they cannot compete with incumbent technologies in this case do not only have to do with the fact that they are more expensive than the incumbent technology (although it is a big factor) but also with the lack of push and pull policy supporting the introduction and use of these technologies.	Taken into account. Please note that this sentence directly refer to the previous sentence. The aim of this discussion in the highlight a result from economic theory that - in the presence of learn by doing - the market fails to delived economically optimal option. We changed the sentence to emphasize that the sentence refers to the economic dimension only. We refer to the effects you mention in section 16.3.3.5 and in section 16.5. Please note that, this is the first time technology chapter is included in the report. Since in some places we have to refer to some basic economic results, we need to use old references.	Sofia Rosero Abad	University	Netherlands
1741	16	1	16	1	"mentioned", replace with "used"? The way it's worded seems to imply there is a third or fourth category that we don't discuss. Could say "Policies to address these market failure can be understood/[categorized/etc] as "technology-push" or "demand-pull..."	Accepted. Thank you for this suggestion! We changed the sentence	Clara Galeazzi	University of Cambridge, Center for Energy, Environment and Natural Resource Governance	United Kingdom (of Great Britain and Northern Ireland)
52965	16	1	16	1	Correct. But sometimes, if the intervention occurs wrongly, the intervention is what causes the failure.	Taken into account. Of course, you are right. Please note that in this section we only wanted to give some economic background motivating intervention. More detailed discussion of policies that could support innovations are discussed in section 16.4 and 16.5	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
76671	16	6	5	8	Innovation surveys have also been a valuable source of information to measure the innovation activities of companies and countries. Perhaps a brief reference to the Oslo Manual and the CIS can be made.	Rejected. Unfortunately, we could not locate the part you are referring to. This line refers to push and pull policies.	Miranda Luis Francisco	University of Magdalena	Colombia
9251	16	9	16	11	The technical type of the review article in the original text covers energy production, supply, and storage technology, but does not include end-of-pipe governance. Can be added. Specific revisions (it is recommended to add the red part in the original text: "The results from this literature include estimates for energy technologies (McDonald and Schratzenholzer 2001), electricity generation technologies (Rubin et al. 2015; Samadi 2018), for storage (Schmidt and Sewerin 2017), for end-of-pipe control (Kang et al., 2020) and for energy demand and energy supply technologies (Weiss et al. 2010)."). The supporting literature is: Kang, JN, Wei, YM, Liu, L., et al. (2020). The Prospects of Carbon Capture and Storage in China's Power Sector under the 2° C Target: A Component-based Learning Curve Approach. International Journal of Greenhouse Gas Control, 101, 103149.	Accepted. We included this reference.	Yongxiang Zhang	National Climate Center	China
52967	16	13	16	14	Needs to distinguish between the different learning rates of the different 'parts' of the technology. In solar PV for example, the modules followed a 20% learning curve. But the balance-of-systems followed a 10% learning curve. Many fall in the trap of bundling the whole technology in one learning curve. Refer to Elshurafa et. al., Estimating balance of systems learning curve for solar PV, Journal of cleaner production, 2018.	Accepted. We included this reference.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
20269	16	30	16	34	You quite rightly reference the excellent paper from Bento and Wilson (2016) relating to the typical timeframe for diffusion of new energy technologies. However, you omit another excellent paper, which was published at a similar time. It is referenced below and offers relatively similar results but employing a slightly different methodology. They find a range of 20 to almost 70 years but with considerable variation across technologies.  Gross R, Hanna RF, Gambhir A, Heptonstall P, Speirs Jet al., 2018, How long does innovation and commercialisation in the energy sectors take? Historical case studies of the timescale from invention to widespread commercialisation in energy supply and end use technology, Energy Policy, Vol: 123, Pages: 685-699, ISSN: 0301-4215  <a href="https://www.sciencedirect.com/science/article/pii/S0301421518305901?via%3Dihub">https://www.sciencedirect.com/science/article/pii/S0301421518305901?via%3Dihub</a>  I recommend that the authors reference this paper alongside Bento and Wilson's.	Accepted. We added this reference, thank you.	Hannon Matthew	University of Strathclyde	United Kingdom (of Great Britain and Northern Ireland)
76669	16	31	4	34	More references are needed. Could you cite some empirical studies that provide evidence on this statement?	Rejected. Unfortunately, we could not localize the part you are referring to. Page 16 has only 20 lines.	Miranda Luis Francisco	University of Magdalena	Colombia

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
10045	16				Table 16.3 row 3 Demand Pull: what is the requirement to make effective of demand pull policies such as feed-in tariff?	Taken into account. Of course, you are right. Please note that in this section we only wanted to give some economic background motivating intervention. More detailed discussion of policies that could support innovations are discussed in section 16.4 and 16.5	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
59471	17	6	17	8	There are more factors that influence the range of investments. Suggest changing "the reason" to "a reason" or "an important reason" in both instances.	Accepted Thank you for noting this!	Government of United States of America	U.S. Department of State	United States of America
52969	17	20	17	20	Sometimes it is also the swing in global trade dynamics that impact raw material prices. Refer to Elshurafa et. Al., Blind spots in energy transition policy, Energy Reports, 2018.	Rejected. We wanted to mention material costs, since they are important for estimating the impact of factors related to innovation process (such as learning by doing and learning by searching). Unfortunately, we are very space constrained and we cannot include a more detailed discussion of changes in material costs	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
59473	17	21	17	22	This sentence appears to be overly broad. Provide a reference that indicates that "Every innovation and every addition ..."	Accepted. Indeed, the sentence was too strong. Its aim is only to explain the principles of spillovers. We changed the sentence to "Knowledge embedded in innovations by one innovator give an opportunity for others to create new innovations and increase the knowledge stock even further"	Government of United States of America	U.S. Department of State	United States of America
52971	17	33	17	33	In other words, the renewable (new entrant) technology is competing with a 'moving target'.	Noted. Yes, exactly	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
59475	17	33			"its cost" here is presumed to refer to the cost of implementing climate policy and not to the cost of climate change impacts. Suggest clarifying "... increases the cost of those policies."	Accepted. Thank you for this suggestion!	Government of United States of America	U.S. Department of State	United States of America
7601	17	34	17	34	What is "temporary policy"	Accepted. We rephrased the paragraph and deleted the word "temporary".	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
23655	17	34	17	35	in the sentence "The spill-over effect associated with innovation in low-emission technologies implies that temporary policy can lead economies to become locked-in to low-emission technologies in the long-run (Aghion 2019).", suggestion to replace "can lead economies to become locked-in" by "can prevent economies from becoming locked-in"	Rejected. The original paper suggested that the economies can become locked-in in low-carbon technologies	Government of France	Ministère de la Transition écologique et solidaire	France
23657	17	38	17	38	We suggest to replace replace "the value of clean industries will be so high," by "the productivity of research in the clean industry will be so high..."	Rejected. Indeed, this could be an alternative way of putting this. However, we believe that reference to the value of the industry (i.e. profit of technology firms) capture the intuition better, especially for non-economists.	Government of France	Ministère de la Transition écologique et solidaire	France
9741	17	40	17	48	Add cross-sectoral technology spillovers impacts on GHG emissions -- you may cross-reference section 12.6.3.	Taken into account. As agreed, we moved the subsection on knowledge spillover (12.6.3.3) to section 16.2.4	Mustafa Babiker	Saudi Aramco	Saudi Arabia
10047	17	40		48	What about the impact of potential reverse spill-over where because of an unilateral effort to reduce emission increases its export of non-compliance ("dirty") technologies, perhaps with price dumping, to countries without such restrictions?	Taken into account. We added a subsection 16.2.3.3, which discusses various trade effects. Due to space constraints we had to limit our attention to the selection of trade effects - those that were emphasized in the literature	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
63439	17	42	17	48	Does this paragraph imply a carbon tax will result in emissions spill-over? It does not seem entirely clear	Accepted. We rephrased the paragraph to make it more clear	Government of Canada	Environment and Climate Change Canada	Canada
70979	17	44	17	46	"Negative effect on emissions" is a bit tricky to read, maybe change to the actual effect e.g. reduction and increase	Accepted. Thank you for this suggestion!	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
10881	18	13	18	19	This paragraph develops convincingly a point made earlier about sentence p13 lines27-28: it is not efficient to guide R&D along too narrow a road, because breakthroughs more often than not come from unexpected directions.	Taken into account. Indeed, that is our point. Note the GPTs now sit in a separate sub-section, the text has been revised.	Philippe Waldteufel	CNRS	France
70981	18	23	18	23	Rebound effects are referred to in 16.1 and a few times in 16.2 but never explained. This should be done shortly to address readers who are not familiar with the term.	Taken into account. We deleted the reference to rebound effect in this subsection. Please note that the rebound effect is discussed in chapter 2 and 5. Its definition is included in a glossary. Note the GPTs now sit in a separate sub-section, the text has been revised.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
8899	18	26	18	27	I would consider AI and 3D printing highly relevant to the Energy sectors as well.	Noted. Unfortunately, we had to delete the table with GPTs due to space constraints. We decided that in this section we will focus on general features of innovation process. We refer to specific examples only as an illustration of these features. We had to restrain from discussing all relevant technologies in detail. Note that the role of specific technologies is discussed in sectoral chapters.	Seth Dunn	ServiceMax	United States of America
72313	18	26	19	1	Table 16.4 Cross-sectoral applications of general purpose technologies and their relevance to climate change mitigation: 3D printing is already used for buildings; AI will also be used for transport and industry: IoT will also be used for buildings.	Noted. Unfortunately, we had to delete the table with GPTs due to space constraints. We decided that in this section we will focus on general features of innovation process. We refer to specific examples only as an illustration of these features. We had to restrain from discussing all relevant technologies in detail. Note that the role of specific technologies is discussed in sectoral chapters.	bertoldi paolo	european commission	Italy
70983	18	26	19	1	Table 16.4 Cross-sectoral applications of general purpose technologies and their relevance to climate change mitigation: 3D printing will also be used for buildings; AI will also be used for transport and industry: IoT will also be used for buildings	Noted. Unfortunately, we had to delete the table with GPTs due to space constraints. We decided that in this section we will focus on general features of innovation process. We refer to specific examples only as an illustration of these features. We had to restrain from discussing all relevant technologies in detail. Note that the role of specific technologies is discussed in sectoral chapters.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
53023	18	26	19	27	Table 16.4 Cross-sectoral applications of general purpose technologies and their relevance to climate change mitigation.  CCUS tech wasn't introduced as a tech solution in the Energy sector.  All tech presented from the consumer's overview; it shows discriminatory technology as it doesn't show the economic perspective for developing countries.	Noted. Unfortunately, we had to delete the table with GPTs due to space constraints. We decided that in this section we will focus on general features of innovation process. We refer to specific examples only as an illustration of these features. We had to restrain from discussing all relevant technologies in detail. Note that the role of specific technologies is discussed in sectoral chapters.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
51297	18	26			Are ICT really a distinct category from AI? Classification in the table is unclear to me.	Noted. Unfortunately, we had to delete the table with GPTs due to space constraints. We decided that in this section we will focus on general features of innovation process. We refer to specific examples only as an illustration of these features. We had to restrain from discussing all relevant technologies in detail. Note that the role of specific technologies is discussed in sectoral chapters.	Stefanie Kunkel	Institute for Advanced Sustainability Studies (IASS), Potsdam	Germany
74279	18	27	18	27	The section on hydrogen in Table 16.4 should be modified to indicate that hydrogen can also be produced from carbon free nuclear energy. <a href="https://www.fchea.org/in-transition/2020/5/11/using-nuclear-power-to-produce-green-hydrogen">https://www.fchea.org/in-transition/2020/5/11/using-nuclear-power-to-produce-green-hydrogen</a>	Taken into account. We deleted the table but we included this sentence in the main text. However, we deleted the reference to fossil and renewable sources.	Jeffrey Merrifield	Pillsbury Law Firm	United States of America
5583	18	27	18	27	In the table 16-4, replace "renewable " by low carbon". This source may be nuclear as well.	Taken into account. We deleted the table but we included this sentence in the main text. However, we deleted the reference to fossil and renewable sources.	Michel SIMON	Retraité/ Pdt d'association	France
66805	18	27	19	0	The example on ICT is relatively trivial - would it be preferable to cite a better example from one of the categories listed (buildings, energy, transport etc)?	Taken into account. We needed to delete this table due to space constraints. For ICT and digital technologies we now refer to the cross-chapter box on this topic	Emma Fryer	techUK	United Kingdom (of Great Britain and Northern Ireland)
70985	18	34	24	23	The start of this section could be shorter and more focused, which would also enable more targeted key messages to be lifted to the SPM. Its title is "Assessment of results of studies". Yet the pages up to page 21 mostly repeat general concepts amply discussed in other chapters, including the IAM and sectoral modelling chapters 3-4. The added value appears to start on page 21 line 13 where it argues that certain scenarios add something more when it comes to sustainable development. Are any of the studies / scenarios mentioned here particularly different compared to those assessed in earlier chapters? For example, DDPP and Vandyck et al are definitely part of the existing mitigation modelling 'community', whereas Grübler et al and TWI 2050 possibly offer a more radically different perspective.	Rejected. Unfortunately, we cannot find the part of the text you refer to. Page 18 has only 27 lines. We also cannot find a phrase "Assessment of results of studies".	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
63441	18				Recommend to use full acronym for "ICT" in last line of Table	Noted. Unfortunately, we had to delete the table with GPTs due to space constraints. We decided that in this section we will focus on general features of innovation process. We refer to specific examples only as an illustration of these features. We had to restrain from discussing all relevant technologies in detail. Note that the role of specific technologies is discussed in sectoral chapters.	Government of Canada	Environment and Climate Change Canada	Canada

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
51271	18				In the table 16.4 when the hydrogen is mentioned. It should be mentioned the nuclear energy.	Taken into account. We deleted the table but we included this sentence in the main text. However, we deleted the reference to fossil and renewable sources.	Emilio Mínguez	Universidad Politécnica de Madrid (UPM)	Spain
82985	19	1	19	1	The digitalisation topic is so critical, I might have expected to see it covered in the text, even a separate section, rather than being placed in an (excessively long) box.	Accepted. A new subsection has been included in section 16.2 on GPTs and digitalization (which were previously treated jointly with knowledge spillovers). The text from the old box has been tightened and shortened.	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
8901	19	1	20	48	(other source to reference: CFR)	Rejected. The comment is not clear. We would need more detail on this reference.	Seth Dunn	ServiceMax	United States of America
51291	19	1	24	5	In my view, an overly optimistic picture of digitalisation is painted in this box that very much resembles the optimism regarding the positive environmental effects of digitalisation of the early 2000s . Strong dematerialisation, decline in business-related travels, energy efficiency increases etc. have been anticipated, which, however, did not lead to overall decline in emissions or resource use (of course, one could argue about possible outcomes in a counterfactual scenario in which those efficiency gains would not have been realized). I would take a more cautious stance on presenting digitalisation as part of the solution to the problem of sustainability. Indirect effects should be prominently discussed (see, e. g., Assessing indirect environmental effects of information and communication technology (ICT): A systematic literature review; by Bieser & Hilty, 2018). As I have shown in my own research, there are tendencies in policy documents taking the narrative up and tending to present digitalisation as contributing to sustainability in industry, but with no clear links to the country context and no clear evidence on how positive sustainability effects should come about ( <a href="https://www.sciencedirect.com/science/article/pii/S146290112030157X">https://www.sciencedirect.com/science/article/pii/S146290112030157X</a> ). In fact, relatively little scientific evidence is available showing through which mechanisms digital technologies have already contributed to realizing the anticipated savings. I would suggest, that the core question of the entire box be changed towards the question of how innovation in digital technologies can be geared towards positive environmental outcomes instead of towards efficiency increases. Currently, it feels to me that the positive sides are stated first and the systemic problems are only discussed at the end of the section. Instead: How would digitalisation have to evolve in order to tackle its direct and indirect* negative impacts, (such as very likely energy-efficiency induced rebound effects), and maximise positive environmental effects? What governance is needed? Which specific incentives do private companies need (e. g. carbon price, targeted environmental innovation) to foster such digital innovation?  *(see also regarding indirect effects of ICT, <a href="https://files.ifi.uzh.ch/hilty/t/Literature_by_RQs/RQ%20301/2015_Galvin_The_ICT%EF%80%A2electronics_question.pdf">https://files.ifi.uzh.ch/hilty/t/Literature_by_RQs/RQ%20301/2015_Galvin_The_ICT%EF%80%A2electronics_question.pdf</a> )	Noted. Thank you. The text of the box has been revised throughout. The references suggested have been included. At the beginning of the box there is clear mention of sustainability concerns raised by digital technologies. Negative effects are also discussed at length.	Stefanie Kunkel	Institute for Advanced Sustainability Studies (IASS), Potsdam	Germany
51301	19	1	24	5	In addition, as in the case of the statement on p. 20, line 36/37, more hints to the level of confidence of the argumentation could be made in the chapter (I am not sure about the methodology behind the "confidence intervals" so this might not be applicable).	Accepted. Confidence levels added.	Stefanie Kunkel	Institute for Advanced Sustainability Studies (IASS), Potsdam	Germany
84457	19	1	24	5	Cross-Chapter Box 8, Table 1: For residential energy use, what about things like AMI and DR? Also perhaps smart grid for DER integration could either be a row, or part of the smart city row?	Rejected. No reference was provided for inclusion in the table	Kenji Tanaka	the University of Tokyo	Japan
84455	19	1	24	5	Cross-Chapter Box 8: "Digital technologies, analytics and connectivity consume large amounts of energy": I think it would be useful to note that data centers and even crypto-mining can be used to avoid renewable curtailment. There are some interesting developments in data centers related to energy, e.g. The use of machine learning to maximize efficiency and renewable energy consumption, or hyperscaling.	Accepted. We added a sentence on load management of data centers.	Kenji Tanaka	the University of Tokyo	Japan
6101	19	1	24	5	the term "OECD" is too generic - many OECD countries in the Eastern Europe are not as developed (economy-wise, institutional system-wise) as many developing countries especially when it comes to digitalization. Also, many European OECD countries are not as digitally advance as many developing countries.	Noted. The text of the box has been revised and the comment is no longer relevant as no reference is made to OECD countries	Liwah Wong	EIT Climate KIC, EIT RawMaterials	Germany
6099	19	19	19	22	but the fact is: digital application and adoption in developed countries is slower than developing countries due to bureaucratic "lock-in" e.g The General Data Protection Regulation in the EU is hindering the adoption of digital technologies	Accepted. This has been recognized in section 16.2.2.3 on GPTs and Digitalization, as well as in the box	Liwah Wong	EIT Climate KIC, EIT RawMaterials	Germany
66807	19	20	19	22	citation needed, also this seems to contradict the statement below (p 20 line 11) relating to potential for leapfrogging	Noted. The text of the box has been revised and the comment is no longer relevant	Emma Fryer	techUK	United Kingdom (of Great Britain and Northern Ireland)
12393	19	25	19	26	"in the balancing of the electricity system and to shift away from asset redundancy" è in the balancing the electricity system and reducing asset redundancy	Noted. The text of the box has been revised and the comment is no longer relevant	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
16677	19	27	19	27	Applying digital technology at home contributes to reducing energy consumption. Therefore, it is also necessary to mention the application of energy management systems such as BEMS(building energy management syste), HEMS(Home energy management system) as an example.	Accepted. A mention of BEMS and HEMS has been specifically included	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
59477	19	27	19	32	These statements are overly definitive, particularly when considering less developed countries and regions. It is true that these changes are occurring more frequently and have significantly affected many of the sectors discussed here. Absent a time frame, however, it is more appropriate to note that digital technologies are in the process of transforming these sectors and have the potential to become ubiquitous.	Accepted. The sentence has been modified according to suggestions	Government of United States of America	U.S. Department of State	United States of America

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
16675	19	32	19	34	Digital technologies can also contribute to increasing renewable energy generation through predictive control. Therefore, additional information on increasing renewable energy productivity due to the application of digital technology is also needed.	Noted. A mention of this has been added	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
66809	20	14	20	14	Clouds should read cloud	Rejected. The wording has been eliminated	Emma Fryer	techUK	United Kingdom (of Great Britain and Northern Ireland)
16679	20	20	20	21	In order to use renewable energy in a data center, it is necessary to discuss the limitations due to the output volatility and institutional constraints of renewable energy generation.	Accepted. A mention of volatility of renewable energy sources has been included	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12395	20	21	20	21	"safety valve" è provider	Accepted. The wording was changed	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
5585	20	21	20	21	At the end, add a sentence: However, data centers require strong guarantee of electricity supply, and must be fed by permanent reliable low carbon surces, like nuclear power plants.	Noted. See reply to comment 16679.	Michel SIMON	Retraité/ Pdt d'association	France
66811	20	33	20	35	Data centres will also help drive the market for fuel cells and battery storage and can act as prosumers in the energy market (see <a href="https://www.techuk.org/resource/data-centre-energy-routemap.html">https://www.techuk.org/resource/data-centre-energy-routemap.html</a> )	Accepted. A mention and reference was included	Emma Fryer	techUK	United Kingdom (of Great Britain and Northern Ireland)
59479	20	39			"run-away effects" implies an inability to control the system, which is substantially different than either diminished savings or even increased emissions. The cross-reference to Chapter 5 shows no clear citation to support this statement.	Accepted. The wording of "run-away" has been deleted	Government of United States of America	U.S. Department of State	United States of America
1771	20	43	29	46	There are some lit. assessed big data and AI solution. You can cite: Bibri, S.E. 2019. Data-driven smart sustainable urbanism: the intertwined societal factors underlying its materialization, success, expansion, and evolution. GeoJournal, <a href="https://doi.org/10.1007/s10708-019-10061-x">https://doi.org/10.1007/s10708-019-10061-x</a> ; Bibri, S.E. 2019. The anatomy of the data-driven smart sustainable city: instrumentation, datification, computerization and related applications. J Big Data 6, 59. <a href="https://doi.org/10.1186/s40537-019-0221-4">https://doi.org/10.1186/s40537-019-0221-4</a> ; UN (United Nations). 2015a. Habitat III Issue Papers, 21—Smart cities (V2.0), New York, <a href="https://collaboration.worldbank.org/docs/DOC-20778">https://collaboration.worldbank.org/docs/DOC-20778</a> ; Arfanuzzaman, M. 2021. Big data for smart cities and inclusive growth. In: Bears, R. C. The Palgrave Encyclopedia of Urban and Regional Futures	Accepted. We included the peer-reviewed references into the box. Given the box was restructured, and that the references seemed to fit better elsewhere, they were not included where you suggested but rather in a different paragraph in the box.	Md Arfan Uzzaman	FAO	Bangladesh
59481	20	48			Confirm numbering for chapter sections begin with the numeral "5".	Accepted and changed.	Government of United States of America	U.S. Department of State	United States of America
16681	21	1	21	3	The application of digital technology is a major factor in reducing GHG emissions not only in the residential sector, but also in commercial and public buildings. so it is necessary to expand it to buildings instead of limiting it to residential part.	Noted. We now clearly state that the table includes only examples of possible approaches. This has been made apparent in the table title. Yet, your comment is well-taken. We have included a mention of public buildings, in addition to residential ones, in the text of the box.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
16683	21	1	21	3	New digital technology on energy supply sector should be added.	Noted. We now clearly state that the table includes only examples of possible approaches. This has been made apparent in the table title. The issue of digital and energy supply is dealt with in the text. Due to space reasons, we did not include an extra row in the box.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
8903	21	1	22	1	I was expecting a section on Energy Supply/Delivery and the range of digital technologies (asset performance management, DER management, mobile workforce management) that exist to improve energy processes. One good source on this topic is V. Sivaram, ed., Digital Decarbonization: Promoting Digital Innovations to Advance Clean Energy Systems, Council on Foreign Relations, June 2018.	Rejected. We now clearly state that the table includes only examples of possible approaches. This has been made apparent in the table title.	Seth Dunn	ServiceMax	United States of America
59483	21	3			Should be "Systems" not "System's"	Accepted. The mistake has been corrected. Thank you	Government of United States of America	U.S. Department of State	United States of America
51293	21		22		The systemic perspective for Industry application of IIoT should be filled it. IIoT is also likely to entail rebound effects by optimizing unsustainable production patterns and increase overall output in the process. GeSI, 2012 who I assume is contributing the abatement potential figure is an industry-association study whose methodology has been criticized. In light of the methodological questions, I am not sure if the specific abatement potential should be included in the report	Rejected. Rebound effects are mentioned in the box. No further mentioning in table required.	Stefanie Kunkel	Institute for Advanced Sustainability Studies (IASS), Potsdam	Germany
66813	22	0	22	0	demand side response not just reliant on big data at as it can also function at system (electricity distribution) level See <a href="https://www.techuk.org/resource/data-centre-energy-routemap.html">https://www.techuk.org/resource/data-centre-energy-routemap.html</a>	Noted. This aspect is mentioned in the text of the box. Reference was not added as it belongs to grey literature	Emma Fryer	techUK	United Kingdom (of Great Britain and Northern Ireland)
15663	22	7	22	7	"used" should be changed into "uses".	Accepted. The mistke has been corrected. Thank you	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16685	22	7	22	7	"used" should be changed into "uses".	Accepted. The mistke has been corrected. Thank you	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
59485	22	9			Seems that lower environmental protection is more relevant than environmental quality in this context.	Accepted. The phrasing has been change.	Government of United States of America	U.S. Department of State	United States of America
66815	22	12	22	14	citation needed	Noted. The sentence has been modified and the comment is no longer relevant.	Emma Fryer	techUK	United Kingdom (of Great Britain and Northern Ireland)

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
15327	22	12	22	17	After noting that the current form of digitization favors oligopoly of the global digital market, it highlights the concentration of profits and power in OECD countries and China to extract data from other regions and manipulate it, and points out the implications for inequality and equity issues. The statement is too subjective with only one reference. The content is not related to the topic of decarbonization of digital technology and it is suggested to delete this statement.	Noted. The paragraph has been modified and the comment is no longer relevant.	Government of China	China Meteorological Administration	China
8905	22	23	22	25	Some argue that digital is "equal opportunity" vis-à-vis decarbonization, i.e. it can benefit carbon-intensive technologies as well. See Victor in V. Sivaram, ed., Digital Decarbonization: Promoting Digital Innovations to Advance Clean Energy Systems, Council on Foreign Relations, June 2018.	Accepted. A mention of this has been added. Reference included.	Seth Dunn	ServiceMax	United States of America
59487	23	11	23	12	As written, this sentence is largely meaningless, saying that digital technologies might make things better or they might make things worse. It would be more meaningful to say that authors don't know how digital technologies will affect climate policy implementation.	Accepted. The sentence has been modified according to suggestions	Government of United States of America	U.S. Department of State	United States of America
28043	23	12	23	12	After "countries", add "bearing in mind their level of development and national circumstances".	Accepted. The sentence has been modified according to suggestions	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
66817	23	14	23	47	These arguments need more detailed evidence, substantiation and citation.	Noted. Please note that the box was revised. More reference to support the statements were added	Emma Fryer	techUK	United Kingdom (of Great Britain and Northern Ireland)
59489	23	31			Needs rephrasing: "At the core is a question of power" or similar.	Accepted. The sentence has been modified according to suggestions	Government of United States of America	U.S. Department of State	United States of America
51299	23	34	23	47	Include Open data/open software as an approach to help reduce the tendency for data agglomeration and power concentration among few firms. Additionally, mention green and open source software initiatives as ways for citizens to contribute.	Accepted. Sentence added.	Stefanie Kunkel	Institute for Advanced Sustainability Studies (IASS), Potsdam	Germany
59491	23	36			Change "decide about" to "influence"	Accepted. The sentence has been modified according to suggestions	Government of United States of America	U.S. Department of State	United States of America
59493	23	37			Use of the term "control" is overly strong. "influence" seems more appropriate.	Accepted. The sentence has been modified according to suggestions	Government of United States of America	U.S. Department of State	United States of America
59495	23	38			The term "decentral" should be "decentralized"	Accepted. The sentence has been modified according to suggestions	Government of United States of America	U.S. Department of State	United States of America
59497	23	41			The term "decisive" seems overly strong.	Noted. The sentence was modified	Government of United States of America	U.S. Department of State	United States of America
12397	23	45	23	45	"overconsumption of for realising efficiency" ????	Accepted. The typo was corrected, the sentence modified	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
59499	23	45	23	46	The sentence appears to be missing a word or phrase. Also, "overconsumption" implies an agreed-upon level of appropriate consumption. Using "consumption" is more neutral and appropriate.	Accepted. See reply to comment 12397. The term consumption is now used instead.	Government of United States of America	U.S. Department of State	United States of America
8907	24	1	24	3	Is this an assertion that digitalisation can at best marginally decrease emissions? What is the level of evidence / agreement for this assertion? I believe the case has been made for a larger impact and hope that the potentially significant impact of digitalisation is adequately covered here (and in the SPM).	Accepted. The sentence contained a misplaced word. Overall the potential can be substantial but it crucially depends on governance of both digitalization and climate change mitigation policies (such as CO2 pricing etc). Updated wording of the box reflects this. the specific sentence has however been reworded, in any case along the lines suggested by this comment	Seth Dunn	ServiceMax	United States of America
70987	24	8	24	9	I think it should be "cost reductions" here	Accepted. Thank you for noting this!	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
52973	24	12	24	12	Cost reductions as a function of production is also known and Henderson's Law (the founder of BCG as he was among the first to articulate this concept, describe it mathematically, and apply it to actual industries)	Accepted. We added: also known as Henderson's Law	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
82987	24	14	24	16	Expand on this? Didn't quite get the point.	Accepted. We changed this sentence to make it more clear	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
70989	24	14	24	16	Not completely clear. Have modular technologies been introduced before and how do they add to the statement? (small addition: year missing in reference)	Accepted. We changed this sentence to make it more clear and added a year of publication	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
15665	24	16	22	16	"realise" should be changed into "realised".	Accepted. Corrected, thank you for spotting the typo	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
15667	24	16	22	16	The reference "Meng et al" could not be found by Googling.	Noted. The reference is published and available here in open source: <a href="https://www.pnas.org/content/118/27/e1917165118/tab-article-info">https://www.pnas.org/content/118/27/e1917165118/tab-article-info</a>	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16687	24	16	22	16	"realise" should be changed into "realised".	Accepted. Corrected, thank you for spotting the typo	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
16689	24	16	22	16	The reference "Meng et al" could not be found by Googling.	Noted. The reference is published and available here in open source: <a href="https://www.pnas.org/content/118/27/e1917165118/tab-article-info">https://www.pnas.org/content/118/27/e1917165118/tab-article-info</a>	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
59501	24	16			Should the term "realise" be "realised"?	Accepted. Thank you for noting this!	Government of United States of America	U.S. Department of State	United States of America
59503	24	17	24	19	Given the declarative nature of this sentence, the authors should consider providing a reference.	Taken into account. The time dimension is not important here, so we rephrased the sentence: "Recent studies attempt to . . ." We evaluate this in the remaining part of the paragraph	Government of United States of America	U.S. Department of State	United States of America
82989	24	20	24	20	Explain 2-factor curve. Examples of the factors?	Accepted. We rephrased the sentence to make it clearer: Some studies explain cost reductions with two factors...	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
7603	24	21	24	22	Not so difficult. The problem is on private R&D which represents the largest share in total R&D.	Accepted. The phrase was imprecise: public energy R&D by governments for OECD countries are available. Note, however, that these represent budget outlays, not actual spending, so they are not always allocated to the correct "time window". Furthermore, they cannot be mapped into industrial sectors. These are major shortcomings. In any case, the original comment was very pertinent, and we changed the sentence accordingly.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
70991	24	21	24	22	Focus only on energy here without justifying (table in subchapter above still features all kinds of sectors). Introduce somewhere at the beginning of this subchapter that the focus will be on energy?	Taken into account, we included a note in the first sentence of the paragraph that it refers specifically to energy technologies. Other paragraphs describe mechanisms that could apply also to other technologies	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
52975	24	26	24	26	There is also a situation where cost reductions are achieved, but not reflected in the final retail price due to excessive demand. In other words, profits are increasing. This happened in the Solar PV industry from 2004 till 2008 (the financial crisis). Refer to Elshurafa et. Al., Blind spots in energy transition policy, Energy Reports, 2018.	Rejected. We assume that you refer to section 2.3 in the article by Elshurafa et al. (2018). The German case is indeed interesting and shows a potential risk in the short-run. However, please note that in this section we primarily focus on the long-run changes. We are not able to cover all potential risks and dynamics of cost reductions in the short-run due space constraints.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
7605	24	29	24	32	I would delete those references. It is basic microeconomics	Rejected. In the previous round of the reviews we were explicitly asked (by several reviewers) to discuss economies of scale	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
23659	24	40	24	40	In this section, it would be interesting to mention the reputation concerning stake-holders, that is also a factor in changing direction in terms of corporate strategy. A more environmentally friendly company and products are a source of better employee engagement and avoid smear campaigns by climate activists.	Rejected. Due to space constraints, we decided to focus in this section on the "mainstream" economic mechanisms of innovation process	Government of France	Ministère de la Transition écologique et solidaire	France
12335	24	40	26	33	The choice of references in this section is in part hard to justify. E.g., the first theorem of welfare economics is not due to Mas-Colell but to Pareto (1906), while the mentioned textbook by Mas-Colell is typically used in advanced micro classes and not appropriate as an introduction to decision-makers/public. Why then use this reference? Etc., in particular w.r.t. endogenous growth theory.	Accepted. Indeed, the reference to the first welfare theorem is not necessary. We rephrased the sentence: Market forces alone cannot deliver Pareto optimal (i.e. socially efficient) due to at least two types of externalities: GHG emissions that cause climate damage and knowledge spillovers that benefit firms other than the inventor	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
12337	24	40	26	33	Price-induced technological change to, say, reduce carbon emissions has often a serious drawback: It is based on market prices, which commonly are distorted by serious externalities. Crucially, these externalities can become much more severe as the new technology imposes itself. For example, batteries may depend on a heavy use of lithium. As the technology scales up, the hidden costs of lithium extraction can become severe. Thus, trying to alleviate a carbon externality may aggravate other externalities. Or, put more technically: Recommendations for technical changes often neglect secondary externalities and are based on local analyses, and can therefore be seriously misleading. Wouldn't it be appropriate to at least mention it? <a href="https://doi.org/10.1038/s41467-019-13067-8">https://doi.org/10.1038/s41467-019-13067-8</a>	Accepted. We added the note and the reference.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
7607	24	42	25	9	I would suggest rephrasing	Accepted. We rephrased this paragraph to make the message clearer	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
53025	25	3	25	4	"In particular technological progress that is biased against carbon intensive production could decouple growth and the use of fossil fuels"	Taken into account: we rephrased this sentence.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
84459	25	8	26	33	I also noticed startups were not mentioned anywhere, but perhaps this is covered elsewhere in the IPCC report.	Taken into account. In this section we cover standard (mainstream) economic perspective. Section 16.4 covers some topics related to market formation and the competition against incumbents	Kenji Tanaka	the University of Tokyo	Japan
9253	25	8			The current section 16.3.3.2 mainly introduces three factors that determine the direction of technological change: price, market and government. It is recommended to increase Social acceptability. The supporting literature is: [1] Gough, C., Cunningham, R., & Mander, S. (2017). Societal responses to CO2 storage in the UK: media, stakeholder and public perspectives. <i>Energy Procedia</i> , 114, 7310-7316. [2] Selma, L., Seigo, O., Dohle, S., & Siegrist, M. (2014). Public perception of carbon capture and storage (CCS): A review. <i>Renewable and Sustainable Energy Reviews</i> , 38, 848-863. [3] Oltra, C., Upham, P., Riesch, H., Boso, A., Brunsting, S., Dütschke, E., & Lis, A. (2012). Public responses to CO2 storage sites: lessons from five European cases. <i>Energy &amp; Environment</i> , 23(2-3), 227-248.	Rejected. Due to space constraints, we decided to focus in this section only on the "mainstream" economic mechanisms of innovation process, which you listed in your comment	Yongxiang Zhang	National Climate Center	China
59505	25	33			Should read "a carbon-intensive sector" or "carbon-intensive sectors".	Rejected. We deleted this part due to space constraints	Government of United States of America	U.S. Department of State	United States of America
28045	25	36	25	38	Distorting trade policies could significantly reduce competitiveness of developing countries. This sentence should be revised substantially or be deleted.	Rejected. The statement is policy relevant and supported by the scientific articles, which we refer to.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
59507	25	40			Should read "... substitute for the ..."	Rejected. We deleted this part due to space constraints	Government of United States of America	U.S. Department of State	United States of America
28047	25	42	25	48	Developing countries will make decisions for infrastructure based on their national priorities and circumstances. Therefore, it is critical to provide the policy space to decide about their priorities for development. These two sentences should be revised completely, as support in technology fields should be provided to the developing countries.	Rejected. This paragraph highlights the importance of "bolstering the credibility and durability of policies" (which we support with reference from the literature). It does not contradict the effects mentioned in your note	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
15669	25	47	25	47	"as the grow" should be changed into "as they grow".	Accepted. Thank you for noting this!	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16691	25	47	25	47	"as the grow" should be changed into "as they grow".	Accepted. Thank you for noting this!	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
59509	26	1			"policy" should read "policies"	Accepted. Thank you for noting this!	Government of United States of America	U.S. Department of State	United States of America
70993	26	6	26	8	Not clear what "enhancing robustness" with overlapping policies means here.	Accepted. We deleted the phrase "enhancing robustness".	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
23661	26	9	26	9	We recommend to complete this section. We consider finance as a variable forcing innovation against climate change that does not say it is concerned by innovation. However, the business as usual of finance which now integrates crises into the functioning of the economy can only reduce reduction and adaptation strategies as long as these do not lead to a maximization of corporate profit.	Rejected. Due to space constraints, we cannot extend this section. Please note however, that the more detailed discussion of finance is in chapter 15.	Government of France	Ministère de la Transition écologique et solidaire	France
5587	26	9	26	22	The paragraph 16.3.3.3 deals only with renewables and private financial investors. I suggest you add a few lines to mention development programs funded by private sectors in nuclear area, for example the TerraPower program or the Canadian program for Molten salt IMSR units by Terrestrial energy. These programs may bring interesting parts of solutions for low carbon energy production and should be mentioned in IPCC report.	Rejected. Due to space constraints, we cannot extend this section. Please note however, that the more detailed discussion of finance is in chapter 15.	Michel SIMON	Retraité/ Pdt d'association	France
48703	26	21	26	22	"The role of finance in directing investment and technological change is further 22 discussed in Chapter 15, Section 15.6." It is not clear to me. Please specify the specific section of the chapter 15.	Taken into account. This topic is mostly covered in section 15.6.2 (we added this reference in the new version). Please note that we changed the sentence to make it more precise. Now it reads: The role of finance in directing investment is further discussed in Chapter 15, section 15.6.2.	Yeong Jae Kim	RFF-CMCC European Institute on Economics and the Environment	Italy
52977	26	24	26	24	because 'the' first	Rejected. Thank you for noting this, we decided to delete this part of the sentence	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
28725	26	27	26	27	The description....once the intellectual property rights are in place...is not accurate. Please consider the following....once the favourable intellectual property right regimes (i.e. the laws or rules or regulation on protection and enforcement) are in place, IPRs are just the rights. Their availability do not induce what is described. It's rather the quality of institutions generating those rights that induce change. Please see the paper by Lubango LM (Elsevier's Technology in Society, 42, pp. 150-159. doi: 10.1016/j.techsoc.2015.05.001)	Accepted. We followed your suggestion. Thank you!	louis lubango Mitondo	United Nations	Ethiopia



Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
28727	26	28	26		The claim one the intellectual property rights are in place, a price on carbon that correct the emission externality is sufficient to induce green technological change .....is not correct. Please read more literature on the topics. See for e.g. the works of Tirole Jean, Rosenberg Nathan, David Teece (1976/76, Lubango LM (2020), bronwyn Hall (2010), Jaffe A (1990, 2002, 2006)...Overall, technological change is a multivariate process. Intellectual property laws and enforcement are just one variable. There are so many others that usually outweigh the availability of such rights, particularly in the areas of green and digital technologies. In addition, green technologies are not homogenous. They are different. Such a difference alone is sufficient enough to cause various repormse the the workings of the market. In South Africa for e.g. carbon pricing has been experiemnted for sometime. IPR regimes have been improved. They are higher than those in India and China. However, performance of South Africa regarding green technological change is far below that on China and India.	Taken into account. We corrected the sentence following you suggestion in comment number 28725. Please note that the only purpose of this sentence was to disentangle the climate externalities with externalities related to problems with intellectual property rights.	louis lubango Mitondo	United Nations	Ethiopia
28723	26	29	26	30	The concept of subsidy - subsidising is too broad. The right concept widely used in the literature of technological change is expenditure in R&D (GERD % GDP). In data analysis in his paper, Acemoglou uses expenditure in R&D data.	Rejected. We refer to the theoretical part of Acemoglu paper. The theoretical result refers directly to subsidies.	louis lubango Mitondo	United Nations	Ethiopia
28729	26	31	26		The description generates some confusions. It will be important to indicate and segregate where (location/county/region) van den Bijgaart and Hemous have made those observations. The reason is because all regions, all coalition do not have the same institutional endowments, constraints....	Taken into account. Please note that we deleted this references due to space constraints.	louis lubango Mitondo	United Nations	Ethiopia
9255	26	45			The current section 16.3.4.1 Technology cost development only introduces two learning curve models, one-factor and two-factor (learning by doing and learning by research). However, there have been a lot of studies on the derivation and expansion of the energy technology learning curve model from the perspective of the Cobb-Douglas-like production function, and a multi-factor energy technology learning curve model containing cumulative output, cumulative knowledge, scale effect, and input factor price factors ( Three factors, four factors, etc.). Specific amendments (it is recommended to supplement the introduction in this part). The supporting literature is: [1] Yu, C. F., Van Sark, W. G. J. H. M., & Alsema, E. A. (2011). Unraveling the photovoltaic technology learning curve by incorporation of input price changes and scale effects. Renewable and Sustainable Energy Reviews, 15(1), 324-337. [2] Kahouli, S. (2011). Effects of technological learning and uranium price on nuclear cost: preliminary insights from a multiple factors learning curve and uranium market modeling. Energy Economics, 33(5), 840-852.	Accepted. This section now contains a mention to "multi-factor learning curves" as well as the suggested references. Thank you.	Yongxiang Zhang	National Climate Center	China
50023	27	7	27	8	Along the line of Krey et al. (2019), Shiraki and Sugiyama (2020, <a href="https://doi.org/10.1007/s10584-020-02731-4">https://doi.org/10.1007/s10584-020-02731-4</a> ) compared the costs used in the IAMs. In one extreme case, the cost of solar in models does not reach the actual level in 2100.	Accepted. Thank you. The suggested references has been included in section 16.2.4.3 as it makes very relevant points for that specific section	Masahiro Sugiyama	University of Tokyo	Japan
3553	27	8	27	10	Maybe a sentence to explain what mechanisms are missed with such exogenous representation, and how it changes the modelling results along key dimensions (eg overall cost of mitigation, optimal timing of action...)	Accepted. A sentences was added to illustrate that exogenous assumption on cost dynamics may underestimate costs, as, among other things, they do not account for policy-induced technical change and spillovers effects.	Celine Guivarch	CIREN	France
3555	27	24	27	29	Say in a few words what are the other approaches, and what are the strengths and weakness of alternative approaches	Accepted. The phrase was poorly written. The alternative approach is described in the following sentences (knowledge generation and spillovers). To improve, the first sentence of the paragraph was modified.	Celine Guivarch	CIREN	France
3557	27	31	27	31	Do models really forecast diffusion, or rather simulate possible paths depending on "what if" assumptions?	Accepted. The sentence has been rephrased to "To simulate possible paths of technology diffusion, models rely on assumptions about the cost of a given technology cost relative to the costs of other technologies and its ability to supply the energy demand under the relevant energy system and physical constraints". While the term "forecast" exactly means that in the context of IAMs modelling, the rephrased sentence is clearer for a much broader community. Thank you.	Celine Guivarch	CIREN	France
70995	27	31	27	33	Focus on energy technologies here, while rest of the section is phrased in a technology-open way. Consolidate.	Accepted. We rephrased the introduction text in section 16.2.4 (new numbering) to state clearly the the whole section is about energy technologies.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
59511	27	33	27	35	The sentence needs to be edited for clarity. The problem is that the first word "This" should refer to a specific thing just mentioned; however, it is unclear to which element of the preceding sentence "This" is referring.	Accepted. The sentences has been edited for clarity (alongside the preceding sentence). It now reads "these assumptions include, for example, etc etc"	Government of United States of America	U.S. Department of State	United States of America
7609	27	39	28	11	I miss a mention to administrative barriers in this paragraphs.	Accepted. Administrative and institutional barriers are now explicitly mentioned in this subsection	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
3559	28	1	28	11	Even if literature is still not fully consolidated, are there some conclusive results that can be drawn from it, about what these barriers mean for policy design/instruments/timing...?	Noted. The revised first paragraph of the following section partly addresses these comments. Yet, it is hard to draw implication for specific innovation policy design (as opposed to general policy design), which is the focus of this chapter. For this issue, we would like to refer to Section 16.4, which deals at length with issues linked with innovation policy design.	Celine Guivarch	CIREN	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
19971	28	13	28	15	Participatory multi-target Backcasting also provides a method to incorporate qualitative elements in model-based scenarios on future change See e.g., van der Voorn, T., Svenfelt, A., Björnsberg, K.E. et al. Envisioning carbon-free land use futures for Sweden: a scenario study on conflicts and synergies between environmental policy goals. Reg Environ Change 20, 35 (2020). <a href="https://doi.org/10.1007/s10113-020-01618-5">https://doi.org/10.1007/s10113-020-01618-5</a>	Accepted. Citation was included in the list of alternative methods, none of which is dealt with in detail due to space constraints	Tom van der Voorn	Institute of Environmental Systems Research	Netherlands
3561	28	18	28	21	Can conclusion be more precise/specific... At this stage, what the reader gets is that pathways could be either too pessimistic or too optimistic on technology diffusion... so not very useful...	Accepted. The sentence was rephrased to suggest that IAMs are too pessimistic when it comes to renewable technologies, especially fast developing ones, and too optimistic when it comes to energy efficiency and consumer behavior.	Celine Guivarch	CIREC	France
28049	28	30	28	30	Delete "and a rapid phase out of fossil-based options".	Rejected. Results from modelling efforts and from the broader literature reviewed in this report are consistent with this statement (See chapters 3 and 4, for instance, and other sector-specific chapters). Furthermore, no reason was provided to show that the text was incorrect.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
5589	28	30	28	30	Replace "Renewable" by "Low carbon sources i.e. renewable or nuclear"	Accepted. Renewable has been substitute by low-carbon	Michel SIMON	Retraité/ Pdt d'association	France
78255	28	44	28	44	Unspecific - "Nuclear current and future costs reflect the high uncertainty regarding this technology." is without reference and may be removed.	Accepted. The phrase has been removed	Reetesh Chaurasia	Department of Atomic Energy, Government of India	India
5603	28	44	28	44	You write : "Nuclear current and future costs reflect the high uncertainty regarding this technology.". What does that mean? What kind of uncertainty?	Accepted. See reply to comment 78255	Michel SIMON	Retraité/ Pdt d'association	France
51273	28	44	29	2	The uncertainties in the price of new nuclear reactors seems to me very small, because the Small Modula Reactors have a lower investment cost in comparison with NPPs of 1400 Mwe. Due to small number of systems and buildings is expected to have reductions in the final cost about 30-40% of the present cost, then will be competitive with renewable energies. Beside with new innovative concepts, now under certification, can reduce the volumen and radiological hazard of the nuclear wastes, because a circular economy, reusing these wates to generate energy.	Noted. However, please note: as clearly stated in the text, the figure are based on the data contained in the AR6 Database, which includes modelling results submitted to the database. Furthermore, the updated figure based on the latest AR6 database reflects lower ranges. Finally, no reference was provided to accompany your statement	Emilio Minguez	Universidad Politécnica de Madrid (UPM)	Spain
5591	29	6	29	6	after places, add : ' when neglecting the cost of intermittence i.e. cost of storage or cost of alternate supply, cost of network extension, etc". You cannot talk of competitiveness when comparing two services which are so different!	Rejected. The sentence was deleted, the comment is no longer relevant	Michel SIMON	Retraité/ Pdt d'association	France
5593	29	8	29	8	Replce Renewable by "low carbon sources"	Accepted. Renewable has been substitute by low-carbon	Michel SIMON	Retraité/ Pdt d'association	France
52979	30	1	30	1	Figure is blurry. Not clear.	Accepted. The figure quality has been increased.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
3639	30	1	30	3	Figures are blurry and unreadable.	Accepted. The figure quality has been increased.	Parag Rastogi	arbnco Ltd.	United Kingdom (of Great Britain and Northern Ireland)
78487	30	1	30	11	Figure 16.1, panel a), "Solar PV" has far too high capital costs. Hard to believe that the orange symbols should reach about the same level as today (black symbols) by 2030! How come? As Principal Scientist of one of the world's largest solar manufacturers, I can assure you that the cost of capital will continue to fall. We, like everyone in the PV industry, have a clear technical roadmap to keep getting cheaper. As PV will have an important part in the energy transition, panel "solar PV" has a great leverage, as inconspicuous as this panel is. This needs to be changed urgently. The current picture is completely unrealistic. Similarly with wind. I'm not an expert there, but it's obvious that panel "Wind On" is the same catastrophic miscalculation, and very likely "Wind Off" as well. And in panel b), "Gas": why isn't the installed capacity of gas going down? Do you think gas is necessary as a transition technology? This is unsubstantiated: see the very different situations for the Netherlands [Verhagen], the UK [McGlade] and Switzerland [Diaz]. Of course, large parts of the gas grid can be used for hydrogen, for transport and for storage, but natural gas has to be ramped down because we need CCS to get the CO2 out of the air, not out of fossil gas. This is clear from chapters 6 and 4. All these cost and capacity assumptions need to be changed urgently to make realistic and responsible predictions.	Noted. Please note, as clearly stated in the text and caption of the figure, that the data underlying these graphs come from the AR6 Database, to which modelling teams from a wide range of models have submitted results. The figure has been updated to match the latest version of the database. Also note that it is well accepted that predictions of costs from models and experts are generally higher than realized costs. This is discussed in the text, and a proper reference demonstrating this point is added (Meng et al. 2021,PNAS)	Pietro Altermatt	Trinasolar, Changzhou, China	Germany
74281	30	1	30	11	This chart significantly overstates the projected cost of nuclear power plants, particularly advanced nuclear which is projected to be between \$2,500 and \$5,000 U.S. per KW. <a href="https://www.catf.us/wp-content/uploads/2018/04/Advanced_Nuclear_Energy.pdf">https://www.catf.us/wp-content/uploads/2018/04/Advanced_Nuclear_Energy.pdf</a>	Noted. Please note that the figures are based on the data submitted to the IPCC AR6 database from all modelling teams which did so. Also note that in the updated figure, based on the latest version of the database, the range of projected costs include lower estimates than before.	Jeffrey Merrifield	Pillsbury Law Firm	United States of America
3641	30	9	30	11	While the "M" and "S" explanation makes sense, is it actually referencing something in the figure above?	Noted. The low quality of the figure meant that the M and S legenda on the actual graphs could not be read. We increased the quality of the figure and the relation between the notes to "S" and "M" and the figures should be clear now.	Parag Rastogi	arbnco Ltd.	United Kingdom (of Great Britain and Northern Ireland)

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
1457	30		30		figure 16.1 has no quality	Accepted. The figure quality has been increased.	Hamideh Dalaei	climatologist at Islamic Republic of IRAN Meteorological Organisation	Iran
3215	30		30		figure 16.1 has no quality to read.	Accepted. The figure quality has been increased.	Hamideh Dalaei	climatologist at Islamic Republic of IRAN Meteorological Organisation	Iran
50359	30		30		figure 16.1 has no quality to read.	Accepted. The figure quality has been increased.	Government of Iran	Islamic Republic of Iran Meteorological Organization (IRIMO)	Iran
43453	30		30		figure 16.1 has no quality to read.	Accepted. The figure quality has been increased.	sadegh zeyaeyan	Head of national center for forecasting and weather hazards management of Islamic Republic of Iran Meteorological Organization (IRIMO)	Iran
23663	31	2	31	2	We recommend a clarification as for how this section is articulated to previous ones. It seems the chapter adopts a new perspective (quite different) about innovation processes (after a linear description, the systemic view appears as an alternative).	Accepted. The rationale for the sequencing of section 16.2 and 16.3 (new numbering due to a reshuffling in chapter sections) is now clarified in two places: The initial paragraph of 16.2 and the initial paragraph of 16.3. In section 16.3, the text now reads: "This section reviews the literature focusing on innovation as a systemic process. This now predominant view enriches the understanding of innovation as presented in section 16.2; it conceptualizes innovation as the result of actions by, and interactions among, a large set of actors, whose activities are shaped by, and shape, the context in which they operate and the user group with which they are engaging	Government of France	Ministère de la Transition écologique et solidaire	France
82991	31	2	31	2	shoukd have come much earlier!	See reply to comment 23663	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
7611	31	18	31	18	I disagree that, in the realm of mitigation technologies and, particularly, renewable energy technologies, "the most common application of this framework is on the NIS". I think there are much more applications of the TIS than the NIS in this context (see, e.g., the 59 papers on TIS in renewable energy technologies found out in the revision of del Rio and Kiefer 2021). Del Rio, P., Kiefer, C. 2021. Analysing the effects of auctions on technological innovation. Report D4.2 of the EU-funded project. Available at <a href="http://aures2project.eu/">http://aures2project.eu/</a>	Accepted. The point is well taken. The text has been modified to state: "One application....". Please note that we unfortunately cannot refer to the specific study cited as not yet published	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
70997	31	32	31	32	The term is "Technological innovation systems"	Accepted. Thank you, we corrected the typo. Indeed, "technological system" was the phrasing used in the next sentence.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
12399	32	2	32	2	"therefore the outside". Delete "the"?	Accepted. "the" has been deleted	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
20169	32	12	32	12	Also in integrative SI (and comparative) approaches, see: -Koasidis, K., Nikas, A., Neofytou, H., Karamaneas, A., Gambhir, A., Wachsmuth, J., & Doukas, H. (2020). The UK and German low-carbon industry transitions from a sectoral innovation and system failures perspective. <i>Energies</i> , 13(19), 4994. -Koasidis, K., Karamaneas, A., Nikas, A., Neofytou, H., Hermansen, E. A., Vaillancourt, K., & Doukas, H. (2020). Many miles to Paris: A sectoral innovation system analysis of the transport sector in norway and canada in light of the Paris Agreement. <i>Sustainability</i> , 12(14), 5832.	See reply to comment 20093. Given the scope of this paragraph, we abstracted from the specific information that the studies are comparative in nature.	Nikas Alexandros	National Technical University of Athens	Greece
20093	32	12	32	16	For innovation system approaches in industry and transport respectively see: -Koasidis, K., Nikas, A., Neofytou, H., Karamaneas, A., Gambhir, A., Wachsmuth, J., & Doukas, H. (2020). The UK and German low-carbon industry transitions from a sectoral innovation and system failures perspective. <i>Energies</i> , 13(19), 4994. -Koasidis, K., Karamaneas, A., Nikas, A., Neofytou, H., Hermansen, E. A., Vaillancourt, K., & Doukas, H. (2020). Many miles to Paris: A sectoral innovation system analysis of the transport sector in norway and canada in light of the Paris Agreement. <i>Sustainability</i> , 12(14), 5832.	Accepted. Thank you. The specific references for transport and industry have been included.	Haris Doukas	National Technical University of Athens, Greece	Greece
7613	32	14	32	16	del Rio and Kiefer (2021) provide an in-dept review of the TIS literature applied to renewable energy technologies (RETs). Del Rio, P., Kiefer, C. 2021. Analysing the effects of auctions on technological innovation. Report D4.2 of the EU-funded project. Available at <a href="http://aures2project.eu/">http://aures2project.eu/</a>	Noted. However, note that we did not include the specific study as it has not been peer-reviewed.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
70999	32	17	32	23	The functions were developed specifically for TIS. Check whether they also appropriately link up with the other types and literatures of Innovation Systems.	Accepted. The sentence has been rephrased to state "In the context of TIS, a number of functions can be used to understand and characterise the innovation system...."	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
20171	33	16	33	17	Nikas, A., Neofytou, H., Karamaneas, A., Koasidis, K., & Psarras, J. (2020). Sustainable and socially just transition to a post lignite era in Greece: a multi-level perspective. Energy Sources, Part B: Economics, Planning, and Policy, 15(10-12), 513-544.	See reply to comment 20095.	Nikas Alexandros	National Technical University of Athens	Greece
20095	33	16	33	17	Also: -Nikas, A., Neofytou, H., Karamaneas, A., Koasidis, K., & Psarras, J. (2020). Sustainable and socially just transition to a post-lignite era in Greece: a multi-level perspective. Energy Sources, Part B: Economics, Planning, and Policy, 15(10-12), 513-544.	Accepted. The reference has been added	Haris Doukas	National Technical University of Athens, Greece	Greece
74283	33	41	34	11	Table 16.6 and the accompanying language before and after the table only reference challenges to renewables. This should be expanded to include challenges to all carbon-free energy sources, including nuclear.	Noted. The language before table 16.6 has been checked: it did not contain specific mention of renewable technologies, and could be applied to other technologies as well. Conversely, Table 16.6 refers specifically to renewables at it summarizes an analysis specifically focusing on renewables.	Jeffrey Merrifield	Pillsbury Law Firm	United States of America
20173	34	7	34	8	This has been approached in the literature in comparative settings, e.g. see comment above	Accepted. The references have been added	Nikas Alexandros	National Technical University of Athens	Greece
20097	34	7	34	9	For innovation system approaches coupled with system failures analysis in specific national and sectoral context see also: -Koasidis, K., Nikas, A., Neofytou, H., Karamaneas, A., Gambhir, A., Wachsmuth, J., & Doukas, H. (2020). The UK and German low-carbon industry transitions from a sectoral innovation and system failures perspective. Energies, 13(19), 4994. -Koasidis, K., Karamaneas, A., Nikas, A., Neofytou, H., Hermansen, E. A., Vaillancourt, K., & Doukas, H. (2020). Many miles to Paris: A sectoral innovation system analysis of the transport sector in norway and canada in light of the Paris Agreement. Sustainability, 12(14), 5832.	Noted. See reply to comment 20095. Since the references were already included, we only left here the reference to Negro et al (2012) as an example. Please however note reply to comment 20173	Haris Doukas	National Technical University of Athens, Greece	Greece
74285	34	13	37	16	These sections reference challenges to the deployment of solar photovoltaics. While it is useful information, similar information should be provided for other carbon free energy sources including advanced nuclear energy.	Rejected. Box 16.2 is to be considered an illustrative example. For reasons of space, it was not possible to provide the same analysis for all technologies relevant for decarbonization (including non-energy ones).	Jeffrey Merrifield	Pillsbury Law Firm	United States of America
31691	34				This table nicely summarises the problems and are therefore very informative for the decision makers. Is it possible to update the number of cases from other papers? (it seems these are till 2012).	Rejected. To the best of our knowledge, there is no such analysis available. This is outside of the scope of this review report.	Shreya Some	Ahmedabad University	India
12403	35	9	35	10	"that it is not important only in those initiating countries." ????	Accepted. Thank you. The sentence was change to: "PV is now so inexpensive that it is important in an expanding set of countries"	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
59513	35	31			"assess" or "make an assessment of"	Rejected. We were not able to find the word "assess" on page 35 of chapter 16. line 31	Government of United States of America	U.S. Department of State	United States of America
85905	35	34	35	35	Suggest also highlighting that not only did Australia train Chinese entrepreneurs, but Australian researchers also invented the technology which was then mass produced in China and then globally. Hence, we suggest an addition to this section so that it reads: 'Chinese entrepreneurs, almost all trained in Australia and using Australian invented passivated emitter rear cell technology, building supply chains and factories of gigawatt scale in the 2000s.'	Accepted. The sentence has been changed as per suggestion. Thank you	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
15671	35	35	35	35	"leading" should be inserted after "the world".	Accepted. The sentence has been changed as per suggestion. Thank you. See also reply to comment 85905	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16693	35	35	35	35	"leading" should be inserted after "the world".	Accepted. The sentence has been changed as per suggestion. Thank you. See also reply to comment 85905	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
52981	35	37	37	16	There are three fundamental reasons that were not mentioned here as to why PV costs went down. Most notably is that the PV technology (silicon modules) benefitted substantially from the integrated circuit (microelectronic industry). The manufacturing process is identical. PV just borrowed an already mature technology. This must be mentioned. PV would not have done this on its own with an already existing multi-billion-dollar industry that was flourishing and established. The other two reasons for PV progress is the abundance of silicon on earth, and the fact that silicon is non-toxic.  If these three reasons are mentioned, the story becomes more comprehensive. Many people ignore/disregard the impact the integrated circuit industry had on PV. Should be included.	Accepted. We included a mention of this in bullet 4 of the box, which now reads: "4)Japanese electronic conglomerates, with experience in semi-conductors, serving....."	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
5605	36	11	36	36	I do not believe that this comparison really make sense. I suggest you delete it.	Rejected. Comment unclear, it suggests deleting 20 lines with no explanation. Could not be addressed	Michel SIMON	Retraité/ Pdt d'association	France
85907	36	24	36	26	Suggest also highlighting the countries in particular that contributed to incremental improvements in PV, as they have been concentrated in certain nations. Hence we suggest a clause be added so this section reads: 'as well as incremental improvements, by researchers in Europe, Australia, Japan and the U.S., in the PV devices themselves, such as passivated emitter rear contact cells and bifacial modules, which reduced electricity costs by increasing PV efficiency.'	Noted. Please see reply to comment 85905. For reasons of space we could not include all the suggestions from the comment	Government of Australia	Department of Industry, Science, Energy and Resources	Australia
12405	36	34	36	35	"Compare this to the approximately 1000 nuclear reactors ever constructed. This provides PV with a million times more opportunities for learning-by-doing". The comparison is faulty (think of the billion more opportunities offered by the production of nails, e.g.... ).	Rejected. LbD is well established in energy technologies. Yes, Adam Smith focused on LBD in nails but power function means that learning slows so this is not a helpful comparison.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
28051	37	2	37	2	Replace "electronic" with "electric" vehicles.	Accepted. The sentences was modified as suggested	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
23665	37	7	37	7	We recommend to take into account the complex relation between states and companies in regards to innovation in solar. Furthermore, the factors influencing the development of solar can also be the consequence of social and health pressures (e.g with pollution), or to lead a market in renewables for example. The diagram could be completed with more subtle factors	Rejected. Out of scope. This is a terse box so not mean to be comprehensive and not enough space for subtle effects only the most important ones.	Government of France	Ministère de la Transition écologique et solidaire	France
72925	37	10	37	12	the mention of "small nuclear reactors" as analogous to the development of solar power is misleading and should be removed: SMRs mean under 300 MW, they address none of the developing country hurdles for grids, nor regulatory process problems in most countries. The numbers of SMRs even in optimistic scenarios do not fit with the development of solar in recent years by factors of several thousands.	Noted. Small did not mean SMRs. It means SMRs and micro-reactors, which are the scale of diesel generators and could possibly fit in this scenario. To account for the comment, "small" was changed to "micro"	Antoine BONDUELLE	EE-Consultant	France
76645	37	11	37	12	Many reasons contribute to make SMR following solar's path highly unlikely. The respective scales are not comparable, since most « Small » nuclear reactors actually range from 60 to 300 MWe, which bears no comparison with solar's granularity. And while solar costs have been dramatically falling in the next decades, SMR electricity cost are higher than for a large reactor and will likely remain so. A recent (March 2021) report issued by Öko-Institut for the German Federal Office for the Safety of Nuclear Waste Management on SMRs states that significant cost savings due to greater modularity have not been observed in past reactor developments and are not expected in the future. It highlights the fact that specific construction costs are higher for SMRs than for large nuclear plants due to the loss of economics of scale. According to this report, about 3000 SMR would have to be produced to make SMR production feasible. Thus the structural cost disadvantage of low-power reactors is not expected to be compensated by learning or mass effect. (Sicherheitstechnische Analyse und Risikobewertung einer Anwendung von SMR-Konzepten(Small Modular Reactors), urn:nbn:de:0221-2021030826028).	Noted. Small did not mean SMRs. It means SMRs and micro-reactors, which are the scale of diesel generators and could possibly fit in this scenario. To account for the comment, "small" was changed to "micro"	Charlotte MIJEON	Réseau "Sortir du nucléaire" (organisation affiliated to the French Climate Action Network)	France
12407	37	17	37	17	"perhaps by a factor of 4". And perhaps more, or less. Consider deleting.	Noted. 4x referred to timeline for PV (60 years) compared to timelines for technologies like DAC (15 years) to go from 1st commercial application to low cost in a mass market setting. The sentence has been amended to clarify this	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
30609	37	18	38	8	The private sector is the primary actor in innovating technology and in delivering technology, but its role is hardly examined in this chapter. There is only a small section 16.4.3 that deals with the private sector, but the role of the private sector is not limited to innovation. In order to mitigate climate change he private sector needs to invest and implement climate technologies, and such role of the private sector needs to be highlighted and discussed.	Noted. Please note that the section commented has been significantly shortened due to space constraints. Also note that in this chapter the role of businesses is examined only with respect to innovation. Other parts of the report deal with the role of businesses in other aspects of the transition.	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
5595	37	25	38	6	Same remark as N° 255 : You refer only to renewable sources. Similarly, private capital is overcoming the "Valley of the death" in nuclear field, with the examples given: Terra power and Terrestrial Energy	Noted. See reply to comment 30609. Note that the text had to be shortned due to space constraints	Michel SIMON	Retraité/ Pdt d'association	France
52983	37	27	37	27	It is important to know the total number of start-ups.	Noted. See reply to comment 30609. Note that the text had to be shortned due to space constraints. Also, no data source was found reporting the total number of start-ups	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52985	38	10	38	10	Figure is blurry. Not clear.	Accepted. We improved the quality of the figure. Note that it has been moved to a Box	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
20175	38	12	38	12	See also: - Rogge, K. S., Pfluger, B., & Geels, F. W. (2020). Transformative policy mixes in socio-technical scenarios: The case of the low-carbon transition of the German electricity system (2010–2050). <i>Technological Forecasting and Social Change</i> , 151, 119259. - Edmondson, D. L., Rogge, K. S., & Kern, F. (2020). Zero carbon homes in the UK? Analysing the co-evolution of policy mix and socio-technical system. <i>Environmental innovation and societal transitions</i> , 35, 135-161. - Edmondson, D. L., Kern, F., & Rogge, K. S. (2019). The co-evolution of policy mixes and socio-technical systems: Towards a conceptual framework of policy mix feedback in sustainability transitions. <i>Research Policy</i> , 48(10), 103555.	Accepted. References were added to the section	Nikas Alexandros	National Technical University of Athens	Greece
7617	38	22	38	29	del Río (2014) shows that it is indeed highly illustrative and operative to classify the building blocks of policy mixes in a hierarchy of "1) Framework conditions (targets and policy stability); 2) Instruments (demand-pull, supply-push...) and 3) design elements" DEL RIO, P. (2014). On evaluating success in complex policy mixes: the case of renewable energy support schemes. <i>Policy Sciences</i> 47(3), 267-287	Accepted. The text has been modified to include the points raised in the comment	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
7615	38	26	38	28	I agree that the ones you mention are the important building block elements, but I miss a mention also to lower level of policy granularity (design elements or design features) since design elements have shown to play a role both in the success of instruments and in the success of combinations of instruments (del Río and Cerdá 2017) DEL RIO, P., CERDÁ, E. 2017. The missing link: The influence of instruments and design features on the interactions between climate and renewable electricity policies <i>Energy Research &amp; Social Science</i> 33, 49-58	Accepted. The text has been modified to include the points raised in the comment	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
15673	38	28	35	28	Referring to the reference (Rogge and Reichardt 2016), "instruments," should be changed into "instruments." It is better to delete"the policy processes that lead to the creation of such mix of policies." and "These elements are" need to be changed into "The content of these elements is"	See reply to comment 16695	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
16695	38	28	35	28	Referring to the reference (Rogge and Reichardt 2016), "instruments," should be changed into "instruments." It is better to delete "the policy processes that lead to the creation of such mix of policies." and "These elements are" need to be changed into "The content of these elements is"	Noted. The paragraph has been modified to include the suggestions, but also further edited to address other comments.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
52987	39	4	39	4	Missing ) at the end of the sentence	Accepted. The ")" has been included	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
10049	39	8		11	It'll be great to elaborate further on how to connect innovation policy with societal challenges for a just transition.	Noted. Due to space constraints, it was impossible to provide the necessary details to describe how to link innovation policy to the just transition. The reader is however referred to the relevant literature cited in the text. Also, Chapter 1 and Chapter 17 also speak to this point.	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
59515	39	11			Consider adding S. Jasanoff, Just transitions: A humble approach to global energy futures, Energy Res. Soc. Sci. 35 (2018) 11-14, <a href="https://doi.org/10.1016/j.erss.2017.11.025">https://doi.org/10.1016/j.erss.2017.11.025</a>	Accepted. The reference has been added	Government of United States of America	U.S. Department of State	United States of America
15675	39	13	39	17	Referring to the reference(Diercks et al 2019), "transformative innovative policy" and "Transformation innovation policy" should be changed into "transformative innovation policy".	See reply to comment 16697	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16697	39	13	39	17	Referring to the reference(Diercks et al 2019), "transformative innovative policy" and "Transformation innovation policy" should be changed into "transformative innovation policy".	Accepted. The changes have been implemented	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
23667	41	12	41	12	For this section we recommend a more balanced view is to explain that quantitative indicators such as public RD&D and patents have limitations, but are currently the best available indicators. these indicators can certainly be complemented by the systemic approach, and new quantitative indicators are needed	See reply to comment 20275	Government of France	Ministère de la Transition écologique et solidaire	France
60117	41	12	42	17	Qualitative frameworks include innovation systems, while quantitative indicators include patents, RD&D spending and scientific publication. It seems that regarding the quantitative evaluation in Chapter 16, there are many references to RD & D data as a whole, and it should be necessary to give concrete examples of innovation outcome indicators.	See reply to comment 20275	Eriko Kiriya	Tokyo Institute of Technology	Japan
20275	41	12			Section 16.4.5 usefully points to the importance of indicators to helpfully measure innovation performance. Some examples are provided by way of patents, energy RD&D spend etc. but these are sporadic and disjointed. Whilst p.44 line 23 makes references to some excellent innovation indicators frameworks, the reader is left without a clear sense of the coverage and structure of these frameworks. In particular, it's not clear what indicators these include, the data they demand and how efficacious these frameworks are.  Whilst a review of *all* frameworks is not realistic in the word limit, there is certainly scope to unpack one or more of these to help outline the types of indicators that could be used. I would recommend linking this back to the section on TIS and/or innovation chain (TRLs) by offering sight of frameworks that link to specific TIS functions (e.g. Miremedi et al. 2018; Bento and Wilson, 2016; Skea et. al 2019 (see earlier reference and Table 6.3 on p.170-171). The framework in Skea et al. (2019) usefully presents a framework that usefully reconciles indicators by their relevance to TIS function *and* TRL/innovation chain stage.  It would also help to point to the different sectoral studies that have applied these indicators frameworks to good effect. We applied the framework referenced above across a set of technology specific case studies, such as Chapter 9 on wave power. Another good case of energy innovation indicator application was Hu et al. (2019) for wind in China (already referenced as an indicator framework).  Moving away from specific technologies, there are a host of (inter-)national energy innovation indicator frameworks that have been developed to rank national performance at a global scale. One of the best known and most comprehensive is The Global Energy Innovation Index, pioneered by Colin Cunliff and David Hart. These types of frameworks are an important contribution to the energy innovation literature and should be acknowledged. The IEA's Tracking Clean Energy Innovation report also covers a host of fascinating national energy innovation indicators and would be worth making reference to.  - Cunliff & Hart (2019) The Global Energy Innovation Index: National Contributions to the Global Clean Energy Innovation System <a href="http://www2.itif.org/2019-global-energy-innovation-index.pdf?_ga=2.23574265.215665952.1615557839-776597594.1615557839">http://www2.itif.org/2019-global-energy-innovation-index.pdf?_ga=2.23574265.215665952.1615557839-776597594.1615557839</a> - IEA (2020) Tracking Clean Energy Innovation <a href="https://www.iea.org/reports/tracking-clean-energy-innovation">https://www.iea.org/reports/tracking-clean-energy-innovation</a>	Accepted. A Table on indicators, which as mistakenly been left out of the Second Order Draft, is now included. The table addresses the comment and builds on its suggestions.	Hannon Matthew	University of Strathclyde	United Kingdom (of Great Britain and Northern Ireland)
23669	41	25	41	27	in the sentence : "The European Patent Office (EPO) developed a special patent classification scheme for patents related to adaptation and mitigation technologies, known as Y02 class, which however include also improvements in the energy efficiency of fossil-based technologies", the Y02 class includes both carbon-free technologies and energy efficiency of fossil based technologies. researchers can focus on the subset that they are interested in. We suggest to remove the term "however".	Accepted. "However" has been removed	Government of France	Ministère de la Transition écologique et solidaire	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
23671	41	28	41	29	The end of the sentence seems to be missing. Furthermore, concerning the sentence "For this reason, researchers often rely on other methods, including keyword search and manual inspection, to select patents because the Y02 classes (for instance Persoon et al. (2020), Nemet (2012b) and Surana et al. (2020a))."  most papers use the Y02 classification (for good or for bad), this statement could give wrong impression	Accepted. We have modified the sentence to state that Y02 is often complemented by other methods	Government of France	Ministère de la Transition écologique et solidaire	France
59517	41	28	41	29	"... because the Y02 classes ...": Do what? Seems a phrase is missing.	Accepted. The sentence has been modified. It now states that Y02 is often complemented with other methods	Government of United States of America	U.S. Department of State	United States of America
71001	41	28	41	30	Something seems to be missing here.	See reply to comment 59517 and 23671	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
12409	41	29	41	29	"to select patents because the Y02 classes" ???	See reply to comment 59517 and 23671	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
15677	41	29	41	29	"because the Y02 classes" should be deleted to avoid duplication of meaning.	See reply to comment 59517 and 23671	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16699	41	29	41	29	"because the Y02 classes" should be deleted to avoid duplication of meaning.	See reply to comment 59517 and 23671	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
7619	41	29	41	29	unfinished sentence	See reply to comment 59517 and 23671	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
52989	41	29	41	34	Sentence not clear. Need rewording ('Alone' starts as a new sentence, while it should continue).	See reply to comment 59517 and 23671	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
37463	41	36	42	16	In order to present a more complete picture of the state of public R&D in energy technology innovation, the following points also need to be incorporated in Box 16.4. These draw from the IEA R&D database that is already used in Box 16.4 as well as IEA Clean Energy Innovation Report (2020): There has been a plateauing of low-carbon energy R&D investment in IEA member countries since 2012. Energy-related R&D investments, including low-carbon technologies, are not growing in their share of GDP in the major developed countries. They account for a declining share of total government R&D spending in IEA member nations and currently it is only about 4 per cent of all public R&D by these countries. Data shows that there has been a considerable decline in public R&D investment in renewable energy technologies since 2009-2010.	Noted. Due to reasons of space, the box had to be shortened. The references were included to point the reader to more detailed discussions. Thank you	Government of India	Ministry of Environment, Forests and Climate Change	India
80505	42	8	42	16	Please add a table in which the R&D efforts per energy technology are integrated over time to provide information on the cumulative R&D amounts so far spent on each technology (ideally since the second world war or when the IEA data starts)	Rejected. Space limits do not allow to implement this comment, unfortunately. We added a reference to publications providing this.	Moritz Riede	University of Oxford	United Kingdom (of Great Britain and Northern Ireland)
12411	42	9	42	10	"for 30 individual countries plus the European Union." è for 30 individual countries including those in the European Union	Rejected. The sentences was deleted, the comment is no longer relevant. However, please do note that the EU has a separate entry in the database, as funding concerns the EU budget which is different from the budget of member states.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
15679	42	20	42	21	Referring to the reference, "adopting an adaptive strategies" should be changed into "adopting an adaptive learning strategy". "supporting learning demonstration projects" would be changed into "focusing demonstration projects on learning" or "supporting learning through demonstration projects" as like lines 7&8 at page 52.	See reply to comment 16701	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16701	42	20	42	21	Referring to the reference, "adopting an adaptive strategies" should be changed into "adopting an adaptive learning strategy". "supporting learning demonstration projects" would be changed into "focusing demonstration projects on learning" or "supporting learning through demonstration projects" as like lines 7&8 at page 52.	Accepted. The wording has been changed	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
7621	42	22	42	22	typo: to assess the efficiency	Accepted. The typo has been corrected	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
71003	42	24	42	26	If this is still a research gap, providing a more recent reference would strengthen the point.	Accepted. Thank you. The paragraph was revised, and a more recent reference was added.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
59519	43	2	43	3	This box does not clearly connect with the innovation theme of the chapter. It provides an overview of how agricultural land use can contribute to GHG mitigation solutions, but it does not address how knowledge of these practices can be better disseminated or the means by which they are improved.	Noted. Knowledge of the practices and technology involved is mentioned directly in relation to the techniques involved, from high technologies to agroecological practices. The link is made more explicit in the text by mentioning innovation.	Government of United States of America	U.S. Department of State	United States of America
46421	43	2	44	22	It might be valuable for the reader to introduce the concept of nature-based solutions in Box 16.5 alongside agroecology and agroforestry, as it represents an overarching and innovative approach which can integrate biodiversity conservation, climate change mitigation and adaptation and sustainable development in the agricultural context (see e.g. Seddon et al. 2021; Cohen-Shacham et al. 2016). These concepts should all be introduced in ch7 and be referred to in ch. 16.	Accepted – text revised. We change it and reorientated.	Government of Germany	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety International Climate Policy	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
31693	43	13	43	14	"Emissions from agriculture and livestock have grown 163% since 1970 (May 2019)."- Please mention if this is global data or for Brazil/ South America	Taken into account - text revised. This is for Brazil, we will correct.	Shreya Some	Ahmedabad University	India
52991	43	15	43	16	Sentence not clear. Need rewording.	Taken into account - text revised. We will rewrite and condense the sentence.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
31695	43	15	43	16	Check sentence construction	Taken into account - text revised. We will rewrite and condense the sentence.	Shreya Some	Ahmedabad University	India
59521	43	15	43	16	Should read "... shape how to mitigate ..."	Taken into account - text revised. We will rectify it.	Government of United States of America	U.S. Department of State	United States of America
74147	43	20	43	22	please explain how the solutions differ significantly	Taken into account and explanation: Whether or not externalities are considered in economic calculations, the results and therefore the solutions differ substantially. For this reason, it is important to incorporate externalities, which changes the cost equation and in fact the incorporated technologies.	Leo Meyer	retired	Netherlands
23673	43	41	43	43	This assessment is a short one and would require further development, or a reference to the corresponding chapter.	Accepted – text revised. We will make the link with chapter 7.	Government of France	Ministère de la Transition écologique et solidaire	France
31697	43		44		In Box 16.5, one box in Chapter 5 WGII can be cross refered Box 5.10: Agroecology as a Transformative Climate Change Adaptation Approach	Accepted. We will cross both Box.	Shreya Some	Ahmedabad University	India
84461	44	1	63	5	The number of papers should be one of good indicators, however other indicators should also be discussed or mentioned, like magnitude of the effect of each paper.	Noted. The page number seems incorrectly stated, so we could not locate what this referred to and could not address the comment.	Kenji Tanaka	the University of Tokyo	Japan
51295	44	19			This is one of the few mentions of low-tech. Low-tech innovation should play a more substantial part in the entire chapter. Also referring to the possibility of re-discovering practices, such as old cultural practices in farming, that are 'innovative' (because we might have forgot them) but not technological.	Taken into account. The concept of frugal innovation is now introduced in 16.2 (new).	Stefanie Kunkel	Institute for Advanced Sustainability Studies (IASS), Potsdam	Germany
23675	44	23	44	23	in the sentence "In Table 16.7, a number of both quantitative and qualitative indicators for systemic innovation are outlined, using clean energy innovation...", is the reference to Table 16.7 correct ?	Accepted. A table was accidentally left out of the Second Order Draft. The original reference you point to was to a table which was included. The table has been included now (table 16.XXX). See reply to comment 20275	Government of France	Ministère de la Transition écologique et solidaire	France
20277	44	34	44	35	I suggest the terms indicators is replaced for something else that emphasises the role of data in populating and thus mobilising these indicators.  The sentence currently reads:  "An important knowledge gap is that many of these indicators are not easily or globally available and/or comparable"  The below could be more appropriate:  "An important knowledge gap is that much of the data necessary to populate and mobilise these indicators is not easily or globally available and/or comparable"  For energy I would also make reference to poor access to Bloomberg New Energy Finance, which offers a detailed breakdown of energy RD&D spend by technology and country, not available through other energy innovation repositories like IEA or IRENA.  - BNEF - <a href="https://about.bnef.com/product/?tactic-page=443258">https://about.bnef.com/product/?tactic-page=443258</a> - IRENA innovation related data - <a href="https://www.irena.org/Statistics">https://www.irena.org/Statistics</a> - IEA RD&D data - <a href="https://www.iea.org/subscribe-to-data-services/energy-technology-rdd">https://www.iea.org/subscribe-to-data-services/energy-technology-rdd</a>	Accepted. The suggested phrasing has been added.	Hannon Matthew	University of Strathclyde	United Kingdom (of Great Britain and Northern Ireland)
71005	44	40	44	40	Maybe use "lacking" instead of "poor".	Accepted. The wording has been changed	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
15681	45	8	45	8	"instruments" may be deleted considering the section title.	Accepted. We have removed the word 'instruments'. Thank you for pointing out the disconnect between the terminology in the section title and in this part of the section.	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16703	45	8	45	8	"instruments" may be deleted considering the section title.	Accepted. We have removed the word 'instruments'. Thank you for pointing out the disconnect between the terminology in the section title and in this part of the section.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea



Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
71007	45	22	45	27	These sentences are not clear to me. What is a "more indirect focus when it comes to the competitiveness outcome"? What is a positive impact on innovation? Is it about driving an innovation or about its direction?	Accepted. We have removed the direct/indirect distinction and now talk about technology push and market pull (in addition to the policy instrument types). There was no need to keep the direct/indirect classification.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
31699	45	24	45	25	"Results show that indirect policy instruments had positive but also some negative impacts on outcomes in some instances on some aspects of competitiveness and distributional outcomes"- better if some references can be cited here	Accepted. The text has been changed to include a reference to a systematic review and indicate that the details are covered in the rest of the section.	Shreya Some	Ahmedabad University	India
53029	45	38	44	45	instruments need to be all inclusive as well as focus on technology and knowledge transfer	Accepted. We included the notion that market pull instruments can also incentivize technology transfer. The inclusive point is covered already in the distributional impacts discussion later in section 16.5	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
5621	45	43	45	43	Replace "Renewable" by low carbon sources. In major urban cities in developed countries, the electricity may come from nuclear units	No action taken. We cannot find the word 'renewable' as noted in page 45 line 43.	Michel SIMON	Retraité/ Pdt d'association	France
7623	46	3	46	3	What table 1? 16.1? 16.7?	Accepted. Thank you for pointing the numbering issue. This was referring to Table 16.7 in the SOD and has been corrected.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
71009	46	6	46	8	It is not clear how and why Section 16.5 focuses on these aspects. And how this is reflected in Table 16.7. E.g. border tax adjustments seem highly relevant for competitiveness but are not covered. Please elaborate!	Accepted. The text has been modified to note that the instruments covered in Section 16.5 are selected based on the available evidence of their impact on innovation outcomes. Previously it was confusing since it skipped innovation to just talk about competitiveness. The reviewer's question was very understandable and this has been resolved. The impact of carbon border adjustments on economic efficiency is part of Ch 13.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
74287	46	11	46	13	The section on Regulatory Policy Instrument Types should be modified to include Clean Energy Portfolio Standards. <a href="https://www.rff.org/publications/issue-briefs/clean-energy-standards/">https://www.rff.org/publications/issue-briefs/clean-energy-standards/</a>	Accepted. We have expanded the title of the Renewable portfolio standard category to include the Clean Energy Portfolio Standard. It now reads 'Renewable or Clean Energy Portfolio Standards'	Jeffrey Merrifield	Pillsbury Law Firm	United States of America
7625	46	12	46	13	Regarding subsidies for mitigation, your terminology in table 16.7 with respect to feed in tariffs (or premiums) and renewable energy auctions is misleading. The level of support under FITs or FIPs can be set administratively (i.e., a government decision) or in auctions. Therefore, I would replace "Feed-in tariffs (or premia)" by "Administratively-set feed-in tariffs (or premia)". I think that the plural of "premium" is "premia", not "premiums", but I may be wrong.	Accepted. We have replaced in Table 16.7 the word premiums by premia and added in brackets the point about 'administratively set'. To keep the text legible the rest of the chapter talks about FITs without adding the point about 'administratively set' every time.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
5597	46	12	46	13	Surprisingly, in table 16.7, financing of nuclear development does not appear. It's clearly missing, as public and/or private financing occurs in some projects like Terranova and Terrestrial Energy and others.	No action taken since Table 16.7 includes several policy instruments that do support nuclear power but not only nuclear power. For example, the 'Other public financing options' category includes loan guarantees and public investment, both of which are used to support nuclear energy projects among others. Same with government provision or procurement; it has also been used for nuclear power. For those two categories neither renewables, nor nuclear power are mentioned since the instrument has been used for a range of projects. In other words: when policy instruments have been used for a broad set of options the decision was taken to avoid naming the technologies supported to keep it concise.	Michel SIMON	Retraité/ Pdt d'association	France
71011	46	14	47	2	It is not explained what the figure is meant to show here at this point in the text. Please elaborate. I suppose it is meant to show the place of policies in the innovation stages. In my view, however, the right-hand side of the figure is a bit too simplistic and misses important factors. For instance, it is common nowadays to pre-determine the evolution of standards in the future. This has an important impact also on R&D in new technologies, as is highlighted in Section 16.5.4.5.	Accepted. The reviewer is correct that the figure was not properly introduced. The figure caption has been amended to refer to the impact of the regulatory policies on innovation and to specify that the only reason why the role on the latter stages is highlighted is descriptive in the sense that most regulatory policies are put in place at later stages of technology development. This is noted in the text and the caption. In addition, the box was extended to indicate this.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
5599	46	25	46	26	Public investment in nuclear R&D is ALWAYS associated with positive impacts on industrial development and jobs. Why do you reduce thi to renewable energies. Developing a lab, a prototype or a test station impacts heavily the economy of the region, whatever is the of energy concerned.	No action taken because the R&D discussion is about all climate related technologies, including nuclear. We do not specify renewables or nuclear. We have gone through the page indicated and it never specifies 'renewable'. We agree with the reviewer that R&D in general (not just nuclear, renewable energy or storage) is associated with positive ipmacts on innovation, competitiveness etc. But nothing in the text suggests that this is only about renewable technologies. The row in Table 16.7 regarding R&D investments points to Box 16.4 which clearly includes the nuclear R&D category, so it is explicitly including all of the energy R&D types in the IEA database.	Michel SIMON	Retraité/ Pdt d'association	France
71013	46		46		Table 16.7: The types of policy instruments seem not to be defined anywhere in the text. Please help the reader by adding an explaining sentence either here or in Sections 16.5.4.	Accepted. The third column in Table 16.7 now includes in the label a reference to the systematic review that includes a definition of all instruments. Unfortunately we do not have the word count for this. We also refer to Ch13 which has definitions of the policy instruments in the second column.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
52993	47	5	47	5	Figure is blurry. Not clear.	Accepted. We have added more explanatory text in the text and in the figure caption. As for the blurriness, it may be the grey, but it seems clear in our version.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
52995	47	22	47	24	Many papers considered using RE in the agricultural sector. This can be found easily with a quick search. Revise the sentence or wording to convey the correct message.	Accepted. The reviewer is correct that, with the previous wording, we made it sound like there was no research on renewable energy in agriculture. We were talking about the political science research on interest groups but now we have removed the part that was unclear. Thank you!	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
50005	47	22	47	24	There are, already, technologies for renewable energy and successfully reduce emissions from agriculture: the production of biomethane from manure, feed ingredients for cattle and slow release fertilizers are some of the most extended ones.	Accepted. Just like int eh previous comment, the previous wording made it sound like the chapter was saying that renewable energy had no role in agriculture or buidlings. The comment was about the literature on what goals drive support for innovation policies in climate related technoloiges, which includes abatement from agriculture. We have now deleted the confusing text and made a modification to clarity. Note that the role of some the technologies mentioned on emissions from agriculture is covered in the sectoral chapters.	Government of Spain	Area de Estrategias de Adaptacion - Oficina de Cambio Climatico - Ministerio de la Transicion Ecologica	Spain
71015	47	22	47	24	While research in this area is indeed limited, it is not true that it has been explored, see e.g. Wesche, J. P.; Negro, S. O.; Dütschke, E.; Raven, R.P.J.M.; Hekkert, M. P. (2019): Configurational innovation systems – Explaining the slow German heat transition. In: <i>Energy Research &amp; Social Science</i> 52, S. 99–113. DOI: 10.1016/j.erss.2018.12.015	Accepted. Thank you very much for the reference, which has been included, alongside with the required modification in the text.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
10883	47	22	47	24	"an area that has not been explored"? That may be true. However I suggest you broaden the field. Is some of the research carried on in order to find vaccines or medications against covid19 relevant for building efficiency? Probably not, but maybe yes! Has somebody looked into it?	Accepted. The language was unclear (see previous two comments) and this has been clarified. We were talking about the politics/interest groups dynamics. Note that we have not expanded the search here to covid vaccines since it is out of scope, particularly given word limitations.	Philippe Waldteufel	CNRS	France
28053	47	24	47	24	After "explored", add "and there is a need for proliferation of R&D and innovation in all sectors to develop the necessary technologies to reduce GHG emissions in an efficient and cost-effective manner".	Addressed. The sentence the reviewer was referring to was clarified. This part is not about innovation needs but rather about the role of different drivers in getting in place decarbonization policies shaping innovation. We have removed the 'explored' part. The suggested text does not fit here but is essentially touched upon elsewhere in the chapter.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
59523	47	25			Change "are becoming" to "become"	Accepted. Changed as suggested.	Government of United States of America	U.S. Department of State	United States of America
1459	47		47		figure 16.2 has no quality	Accepted. It reads well in Word. Need to check that the PDF conversion keeps the quality	Hamideh Dalaei	climatologist at Islamic Republic of IRAN Meteorological Organisation	Iran

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
3217	47		47		figure 16.2 has no quality to read.	Accepted. It reads well in Word. Need to check that the PDF conversion keeps the quality	Hamideh Dalaei	climatologist at Islamic Republic of IRAN Meteorological Organisation	Iran
50361	47		47		figure 16.2 has no quality to read.	Accepted. It reads well in Word. Need to check that the PDF conversion keeps the quality	Government of Iran	Islamic Republic of Iran Meteorological Organization (IRIMO)	Iran
43455	47		47		figure 16.2 has no quality to read.	Accepted. It reads well in Word. Need to check that the PDF conversion keeps the quality	sadegh zeyaeyan	Head of national center for forecasting and weather hazards management of Islamic Republic of Iran Meteorological Organization (IRIMO)	Iran
53031	48	14	48	22	technologies and ways of implementation to be unbiased , if there is a way to reduce emissions why not use it ? There needs to be an all inclusive approach, bearing in mind the national circumstances.	No action taken. We agree with the general statement but unclear how it relates to the particular point in the text. The current text in the chapter does not contradict this statement.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
71017	48	17	48	22	The role of the whole Section 16.5.3 remains unclear. Does it only present the indicators and these are assessed in the next subsection? This is not in line with the heading.	Accepted. We have changed the title of this section to clarify that the section is here to highlight the fact that assessing those outcomes is actually very difficult, that no indicator is perfect, and that different policy evaluations use different indicators. We have also made some changes to the text.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
7627	48	19	48	19	typo: and equity	Accepted. We removed the 'the'. Thank you.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Cientificas (CSIC)	Spain
15683	48		48		"for each indicator" in sentence in the second and far left box would be deleted.	Accepted. As per the answer to the previous comment, we have replaced 'indicator' by 'outcome'. The previous repetition in the sentence of the word 'indicator' was a mistake.	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16705	48		48		"for each indicator" in sentence in the second and far left box would be deleted.	Accepted. Thank you. We replaced the word indicator (which was a mistake) by 'outcome.'	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
71019	48		48		Table 16.8: It is a rather limited perspective to consider international equity based on mitigation burden per capita only, given the differing economic backgrounds and capabilities.	Accepted. We agreed that this suggested that no other indicators have been used. We have modified Table 16.8 both in the left column and the right column to indicate that this is just an example that has been used in the literature. It is not the only one that can be used as a proxy.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
10885	49	4	49	7	R&D tax credits are used in several nations (including USA, France, UK), for significant amounts; however this chapter does not comment the efficiency of this instrument. Does that mean that there has not been any interest of scholars in the impact of R&D tax credit in the domaine of mitigation?	Accepted. Thank you for the comment. We have added a note in the text explaining that we do not explore R&D tax credits because there is not much (or any) evidence on climate technologies. However we have added a reference to a recent review on R&D tax credits for all technologies and linked it to the evidence on R&D investments. We have also changed the title to reflect a broader coverage to show that there are more tools mentioned that incentivize R&D (prizes and tax credits)	Philippe Waldteufel	CNRS	France
71021	49	7	49	7	please insert cross-reference to Box 16.7, as no explanation of ARPA-E is provided here.	Accepted. Thank you. We have added a link to Box 16.7 in the text as requested.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
59525	49	8	49	9	It is unclear how this statement relates to Section 16.4.5, which suggests that R&D investments are not a robust indicator of innovation. See page 41, line 30.	Accepted. Clarification introduced but note that there is no clash, since section 16.4.5 just notes that RD&D investments, by themselves, are not enough to fully understand what is happening in terms of innovation.	Government of United States of America	U.S. Department of State	United States of America
10051	49	8		10	Are there any findings/evidences regarding the impact of public RD&D investments in non-industrialized (developing) countries? Or can we say that public RD&D in non-industrialized countries is not found to have positive impact?	Accepted. We have now clarified that it is not that there is no impact, but rather that there is no evidence studying energy R&D funding in developing countries.	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
12415	49	17	49	18	The formulation is not fully logical.	Accepted. We have rephrased for clarity. Thank you.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
71023	49		50		There is no link to Box 16.6 in the text. So its role remains unclear.	Accepted. We have added a link to the box, which is about highlighting a novel procurement policy focussed on green technologies.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
7633	50	41	52	17	In general, a lot of focus is put on public R&D, not on private R&D, despite its relevance.	Accepted. The focus of this section is on policies, which is why we focus on public R&D. But we now highlight further that impact on private R&D (an indicator of innovation) is important.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
7629	50	42	50	43	Your mention that "the ability of a given R&D policy instrument to impact innovation depends to some extent on policy design features" is crucial, but I would also extend it to deployment (demand-pull) support instruments. Some authors have shown that the design elements in administratively-set feed-in tariffs (see del Río 2011) and in auctions (see Kiefer and del Río 2021) can have an important influence on innovation. I68DEL RÍO, P., KIEFER, C. 2021. Analysing the effects of auctions on technological innovation. Report D4.2 of the EU-funded project. Available at <a href="http://aures2project.eu/">http://aures2project.eu/</a>	Accepted. This is already covered in the right section. We agree that the same applies but it is already discussed in the market pull section. The paper is cited in the right section. 16.5.4.4.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
12417	51	4	51	4	Please check the use of "mediated"	Accepted. We agree that the language was confusing and we have clarified it.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
7631	51	9	51	12	please, rephrase, it is difficult to understand in my view.	Accepted. Rephrased.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
71025	51	9	51	12	It is not clear what "researchers of a 'high status' competitive" and "higher novelty lower status researchers" meant. Please consider revising.	Accepted. We have clarified the meaning of the terms in the paper cited.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
82993	51	14	51	14	The other institution that gets a lot of interest is Fraunhofer. Their Konigstein (?) formual for public funding leveraged by private support, not the other way round is striking (and successful).	Accepted. We added a note next to the introduction of ARPA E in section 16.5.4.1, but we cannot add another box.	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
12419	51	21	51	29	Please consider reformulating in a more precise, informative, and clearer way, possibly along the lines of NBER WP 24674, DOI 10.3386/w24674 , in particular p.15	Accepted. We have expanded and clarified the text using additional material from the noted reference (which we were already referencing).	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
59527	51	22			The word "energy" appears to be referring to "energy funding", correct?	Accepted. Clarified. Thank you.	Government of United States of America	U.S. Department of State	United States of America
23677	52	19	52	20	This section relies mostly on one survey paper Penasco et al. (2020). A more extensive literature review is needed. Also the underlying mechanisms that are not explained: we suggest a clarification on why a given instrument fosters or is detrimental to green innovation	Noted but no action taken. This section relies on three systematic reviews, not just one: Penasco et al (2021), Lilliestam et al 2020, and Grubb et al 2021. In addition, other papers are highlighted throughout. Those three papers are systematic reviews and recent and include all the relevant papers. They are reproducible and transparent. We would welcome papers not covered by those reviews. Right now manual attempts to expand this are unlikely to yield many results and they would not be systematic.	Government of France	Ministère de la Transition écologique et solidaire	France
31707	52	19	55	25	Section 16.5.4.4: The language is very sloppy.	Accepted. We have corrected the sloppy language. There were some words that were repeated, etc.	Shreya Some	Ahmedabad University	India
15685	52	20	52	20	"direct" should be deleted.	Accepted. Deleted. Thank you.	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16707	52	20	52	20	"direct" should be deleted.	Accepted. Deleted. Thank you.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
7635	52	23	52	23	There is a grammatical problem with this sentence, which should be rephrased.	Accepted. Deleted. Thank you.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
12423	52	23	52	24	Please check the sentence	Accepted. Deleted. Thank you.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
31701	52	31	52	32	Please put only one level of agreement: either medium or high	Noted. No action taken. It is in between. The previous characterization is correct.	Shreya Some	Ahmedabad University	India

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
23679	52	37	52	38	concerning the sentence "Another review focussed only on empirical studies (mainly quantitative but also qualitative), covered a slightly longer period and identified 19 studies (15 using quantitative methods) (Lilliestam et al. 2020)", the interpretation of the literature findings in Lilliestam et al 2020 is clearly biased.  1. Most of the articles reviewed are looking at a period when the ETS price was not "comparatively high". It is important to acknowledge this. 2. The EU ETS does not apply to all firms, so it is not fair to say that although covered firms may have had a strong response, overall it contributed little to innovation-driven decarbonization. For example, Cael and Dechezleprêtre (2016) find a very strong and rapid effect of the EU ETS on innovation: +36% low-carbon patent filings in 5 years, but of course the effect is limited to the 8,000 companies regulated by the EU ETS. Because these 8000 companies represent only a small share of low-carbon patented innovation in Europe, the effect of the EU ETS at the European level is only about +2%, but this is mechanical effect of multiplying +36% by the small share of ETS-covered firms (that said, even +2% is not bad for a policy that only increased energy prices in Europe by about 5%). The authors then conclude that the paper finds a weak effect of the EU ETS, which is clearly incorrect. 3. Innovation and its effects occur with a lag, so it's not terribly realistic to expect a 10-year old emissions pricing system to have generated strong innovation and decarbonization already 4. In the Swedish case, Sweden already had a much bigger carbon price, so it is not surprising the low-price ETS had little effect. 5. Nobody is arguing that carbon pricing alone – especially at politically feasible levels – is enough. But it certainly helps.	Accepted. We added additional discussion on low prices, time, and actor coverage. We cannot do much more because of word limits but hopefully the current discussion is more balanced and nuanced.	Government of France	Ministère de la Transition écologique et solidaire	France
12425	52	41	52	43	How does this sentence precisely relate to the previous?	Accepted. Text added to clarify.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
7637	52	41	52	43	Maybe you should mention why the ETS did not encourage innovation (it was an issue of design of the instrument, rather than the instrument as such, leading to very low CO2 prices)	Accepted. Text added to clarify. This is also linked to the previous comment on the EU ETS. Now policy design is mentioned (in particular coverage and price)	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
53033	52	44	52	47	more focus should be shed on the implications of carbon and environmental taxes on developing countries.	Accepted. We noted that the evidence comes from industrialized countries.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
10053	52				(sub cahapter 16.5.4.4) It is suggested to provide more information that the policies assessed in this section is by nature not intended to foster innovation, thus the "little/small contribution to innovation" is normal and for countries without such policies, this assessment should not become a rationale to belittle considering those policies.	Accepted. Added a comment at the end of the intro to 16.5.4.4	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
52997	53	3	53	12	It is important to mention what the carbon tax value is. Arriving at the 'right' carbon tax is difficult. If too high or too low, the tax will not reap its intended benefits.	Accepted. The discussion of carbon taxes and ETS mentions the importance of policy design and price.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
71027	53	10	53	10	Do you mean "found the existence of some NEGATIVE distributional impacts"? Please be more explicit here.	Accepted. Corrected. Thank you.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
12427	53	11	53	11	"stems from" è parallel differences in	Accepted. Corrected the tense. Thank you.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
7639	53	13	54	2	In this page (FITs) two main aspects should be stressed: 1) the issue of technology-diversity vs. technology specificity and its impacts on innovation (better technology specificity in this regard, especially for less mature technologies). 2) The influence of design element choices in FITs on the impact of FITs on innovation (DEL RIO, P. (2012). The dynamic efficiency of feed-in tariffs: The impact of different design elements. Energy Policy 41, 139-151).	Accepted. Added the citation and mentioned specificity.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
23681	53	21	53	21	Regarding the sentence "This means that 20% of the evaluations identified some negative impacts" it is surprising to hear that some studies have found a negative impact of FIT on green innovation, or is it 'innovation' in general including on 'brown technologies'? We suggest a clarification on which mechanism could explain this result.	Accepted. Than kyou for the comment. This means compared to the other policy investigated. We have clarified.	Government of France	Ministère de la Transition écologique et solidaire	France
52999	53	24	53	35	It is important to link the FIT to the maturity of technology. FITs applied in Germany in 2002 will have a different effect than those applied in 2020. We cannot treat all FITs to be doing the same thing. Where the technology is in terms of maturity and evolution is important to consider.	Accepted. We have now noted that FITs specificity, for instance, may be more useful at earlier stages of technology maturity. Very good point, thank you.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
23683	53	27	53	29	Regarding the statement "which may hinder innovation of competing alternatives in infancy (Meckling et al. 2017)." the counterfactual should be no FIT which does not favor those competing alternatives (and not another policy that would support those alternatives)	Accepted. Even used the same language. This was absolutely what the statement meant but the reviewer is correct that without the clarification it could be misunderstood.	Government of France	Ministère de la Transition écologique et solidaire	France
59529	53	27			Change "perovskites" to read "and perovskites"	Accepted. Than kyou for the comment. This means compared to the other policy investigated. We have clarified.	Government of United States of America	U.S. Department of State	United States of America
5601	53	41	53	41	You may delete the word renewable. The statement is true for other types of energies.	Accepted. Thank you. We deleted the word.	Michel SIMON	Retraité/ Pdt d'association	France

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
7645	54	4	54	17	I miss a mention that, as it is the case with FITs, the impact of auctions on innovation is likely to be mediated by the choice of design elements, as proposed by del Río and Kiefer (2021).Del Río, P., Kiefer, C. 2021. Analysing the effects of auctions on technological innovation. Report D4.2 of the EU-funded project. Available at <a href="http://aures2project.eu/">http://aures2project.eu/</a>	Accepted. Added a sentence and the reference	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
7647	54	5	54	5	typo: three of them identify...	Accepted. Corrected. Thank you.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
31703	54	5	54	6	Check sentense construction	Accepted. Same as above. Thank you.	Shreya Some	Ahmedabad University	India
7641	54	10	54	17	Those papers (Toke, Wigand, Mastropietro) DO NOT focus on the effects of auctions on innovation but on deployment.	Accepted. Clarified this.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
31705	54	16	54	17	"Only two studies investigated distributional outcomes and both were negative, with one study being theoretical and the other qualitative"Message not clear. What is the implication?	Accepted. We took out the point about quant and qual since it was not adding much relevant information. Thank you.	Shreya Some	Ahmedabad University	India
7643	54	17	54	17	A recent report by del Río and Kiefer (2021) focuses explicitly on the innovation effects of deployment instruments, with a special focus on auctions. It provides an in-depth review of the literature on the innovation effects of demand-pull instruments specifically in the renewable energy technology area, where an explicit comparison between administratively-set FITs and renewable auctions is provided. The authors end up with 28 papers on the impact of deployment instruments on innovation. 17 of them have used econometric modeling, whereas the rest are either theoretical or use qualitative analysis, including case studies. However, only 6 papers specifically focus on auctions and only 4 provide a comparative analysis of the impact of auctions with respect to the other instruments. Their review of the literature leads to the conclusion that those four papers show that administratively-set FIT induces innovation to a larger extent than auctions. See Del Río, P., Kiefer, C. 2021. Analysing the effects of auctions on technological innovation. Report D4.2 of the EU-funded project. Available at <a href="http://aures2project.eu/">http://aures2project.eu/</a>	Accepted. This paper has now been cited and a sentence introduced. Thank you.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
9001	54	27	54	27	obtaining international economic helps for developing clean energy for developing countries including Iran.	Noted but no action taken. The remit of this chapter is on innovation outcomes and we have not found papers on this. We agree that this funding is important for deployment specifically but have not found literature on innovation.	Behzad Layeghi	IRIMO	Iran
7717	54	27	55	28	Obtaining international economic helps for developing clean energy for developing countries including Iran.	Noted but no action taken. The remit of this chapter is on innovation outcomes and we have not found papers on this. We agree that this funding is important for deployment specifically but have not found literature on innovation.	Leila Rashidian	Meteorological	Iran
15687	54	29	54	30	"seven" should be changed into "eleven" considering the numbers in line 30.	Accepted. Thank you!	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16709	54	29	54	30	"seven" should be changed into "eleven" considering the numbers in line 30.	Accepted. Thank you for the catch.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
59531	54	29			Amend to read "... and competitiveness ..."	Accepted. Thank you!	Government of United States of America	U.S. Department of State	United States of America
59533	54	36			Replace "study" with "studies"	Accepted. Thank you!	Government of United States of America	U.S. Department of State	United States of America
8909	54	39	54	48	Given the volume of solar and wind gigawatts that have been deployed due to RPSs, and given the role of scale in contributing to learning-by-doing cost declines, I have a hard time understanding how these policies can be considered to have a negligible/small impact on innovation.	Accepted. This is just the evidence available. It could be the innovation indicators used (the evaluations of those policies mainly focussed on patents and private R&D). We have noted this.	Seth Dunn	ServiceMax	United States of America
74289	54	39	54	48	The report should include a parallel paragraph on the use of Clean Energy Portfolio Standards. <a href="https://www.rff.org/publications/issue-briefs/clean-energy-standards/">https://www.rff.org/publications/issue-briefs/clean-energy-standards/</a> Also, the impact of Renewable Portfolio Standards has had a significant impact in some areas: <a href="https://www.eia.gov/state/analysis.php?sid=NC">https://www.eia.gov/state/analysis.php?sid=NC</a>	Accepted. We have changed the title to reflect both. Also added a sentence	Jeffrey Merrifield	Pillsbury Law Firm	United States of America
15689	55	8	55	8	"11" should be changed into "eleven".	No action taken. The norm is that when numbers are more than 10 one can write the number.	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16711	55	8	55	8	"11" should be changed into "eleven".	No action taken. The norm is that when numbers are more than 10 one can write the number.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12429	55	17	55	19	The sentence is obscure	Accepted. Rephrased for clarity.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
9005	55	27	55	27	International monitoring on performance and efficiency of national projects about clean energy.	No action taken. Not sure what this means and how to address it.	Behzad Layeghi	IRIMO	Iran
7721	55	27			International monitoring on performance and efficiency of national projects about clean energy.	No action taken. Not sure what this means and how to address it.	Leila Rashidian	Meteorological	Iran

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
23685	55	29	55	29	Please name the "regulation" mentioned : tax and tradable emission permits?	Addressed. Thank you . We clarified what was meant. It was mainly efficiency standards.	Government of France	Ministère de la Transition écologique et solidaire	France
31709	55	29	55	31	"There is strong evidence that the introduction of flexible, performance-based environmental regulation in general can stimulate innovative responses in firms (Ambec et al. 2013; Popp 2019) (medium evidence, high agreement)."- The line starts with strong evidence but in braces it says medium, please check	Addressed. Thank you. Changed it to medium evidence for consistency.	Shreya Some	Ahmedabad University	India
59535	55	29	55	31	An important finding, but there is a mismatch between the text ("strong evidence") and the certainty evaluation ("medium evidence").	Addressed. Thank you. Changed it to medium evidence for consistency.	Government of United States of America	U.S. Department of State	United States of America
30611	56	3	56	4	If there is literature to support the sentence "green QE program to stimulate a structural redirection of economic recovery towards a low-carbon transition might have greater practice and precedence than commonly appreciated", it would be desirable to add. In the whole paragraph of "green quantitative easing", it seems that quoted literature green QE, especially numerical analysis is not enough.	No action taken. This instrument is not covered because it is even more indirectly focussed on innovaiton. It may be for the finance chapter. Also, not aware of research showing that.	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
28055	56	12	56	12	Bearing in mind the lack of evidence from all countries, after "industrialised countries", add "while there is a need to collect and assess data from developing countries to reach an overall factual conclusion on this matter".	Addressed. It was not really essential but made the point more explicit.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
15691	56	29	56	42	To keep the consistency, "Distribution and competitiveness" should be changed into "Compretitiveness and distributional". According to the change of order of words, the order of two sentences need to be changed.	Addressed. Thank you	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16713	56	29	56	42	To keep the consistency, "Distribution and competitiveness" should be changed into "Compretitiveness and distributional". According to the change of order of words, the order of two sentences need to be changed.	Addressed. Thank you	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
31711	56	31	56	32	"Minimum energy performance standards and appliance standards have been known to result in negativem distributional impacts (limited evidence, medium/high agreement)."- Please put only one level of agreement: either medium or high	No action taken. This is our best assessment	Shreya Some	Ahmedabad University	India
71029	56	40	56	40	Explain the Porter effect or reformulate.	Accepted. Explained the effect and removed the 'Porter' terminology	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
82995	57	9	57	9	Wasn't my experience from labels/standards activity.	Addressed. This was a specific review and relies also on Grubb et al. It is clear that the evidence is limited, so it is not conclusive. This has now been highlighted	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
71031	58	8	58	8	Please improve wording here, as this statement can be misleading in the sense that it may be seen to call for preferring voluntary to regulatory approaches. However, the findings focus only on adopters of voluntary measures only. Moreover, the use of EMAS is partly mandatory today.	Accepted. Thank you. Made both changes. The reviewer is correct.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
15693	58	15	58	15	"firm's" should be changed into "firms". "EMS" should be spelled out as "environmental management system (EMS)".	Accepted. Both. Thank you!	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16715	58	15	58	15	"firm's" should be changed into "firms". "EMS" should be spelled out as "environmental management system (EMS)".	Accepted. Both. Thank you!	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
59537	58	26			The terms "... assess competitiveness find ..." should be "assessing competitiveness" or "assess competitiveness and find". Clarify the sentence.	Accepted. Thank you.	Government of United States of America	U.S. Department of State	United States of America
59539	58	46			Capitalize "Five ... "	Accepted. Thank you.	Government of United States of America	U.S. Department of State	United States of America
7649	59	14	59	14	(TGCs), building codes AND auctions.	Accepted. Thank you	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Cientificas (CSIC)	Spain
7651	59	18	59	23	Shouldn't this be part of Figure 16.3 (as a note)?	Accepted. Thank you.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Cientificas (CSIC)	Spain
12431	59	20	59	21	Please correct: negative impact (in orange)	Accepted. Thank you.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
15695	59	20	59	21	"blue" should be changed into "in blue". "in blue" should be replaced by "in red".	Accepted. Thank you.	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16717	59	20	59	21	"blue" should be changed into "in blue". "in blue" should be replaced by "in red".	Accepted. Thank you.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
53001	59	21	59	21	Negative impact should be in 'orange'.	Accepted. Thank you.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
12433	59	22	59	22	"and additional studies identified as part of these review studies" è and additional studies identified in these reviews ???	Accepted. Thank you.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
71033	59		59		Figure 16.3: the figure caption should make clear that the direction of the assessment refers to innovation. Moreover, there are no evaluations shown for building codes, while Section 16.5.4.4 mentions two evaluations.	Accepted. Thank you	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
23687	60	6	60	6	"Student" seems mistaken for "Study"	Accepted. Thank you.	Government of France	Ministère de la Transition écologique et solidaire	France
15697	60	6	60	6	"student" should be changed into "study".	Accepted. Thank you	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16719	60	6	60	6	"student" should be changed into "study".	Accepted. Thank you.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
53003	60	6	60	6	A recent 'student'? Do you mean: A recent 'study'?	Accepted. Thank you.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
59541	60	10			Change "improve" to "improved"	Accepted. Thank you	Government of United States of America	U.S. Department of State	United States of America
82997	60	18	60	18	It would be great to get a figure with trends in patenting activity for the EPTO Y02 (?) class climate technology v fossil fuel related and general patenting activity. There's a graph like that in Skea et al (2019). Analogous to the IEA RD&D data earlier in the chapter.	Noted	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
10887	60	18	62	19	There is nothing wrong with this 16.5.6 section except that it devotes a non negligible part of the chapter main body (2,6%) to a quite general, didactic description of the patent system. The presence of such a description might be justified by the need to support section 16.6.3.3. which deals with the role of patents as far as international transfers of technology for climate mitigation are concerned; however, when looking at this section, it is found that such a detailed support is not needed.	Noted but no action taken. While 16.5.6 indeed offers a description of the patent system, we believe that it also offers the necessary insights (including disagreement whether such systems promote innovation or hinder transfer) that are key to interpreting later sections in the chapter.	Philippe Waldteufel	CNRS	France
31715	60	25	60	27	Please use high agreement instead of "strong" as per IPCC Uncertainty guidelines	Accepted. Comment processed as suggested	Shreya Some	Ahmedabad University	India
12435	60	32	60	33	"some of the stages of innovation outlined in section 16.3". Please consider deleting as confusing and useless.	Accepted. Comment processed as suggested	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
30613	60	43	60	46	" the proliferation of patents also discourages innovation (medium evidence, medium agreement) " sounds strange because the author says "The degree to which patent systems actually promote innovation is subject to debate". This means "no agreement" about this issue. In addition, the literature referred to is outdated and does not reflect the latest findings. In 2019 China surpassed the U.S. as the top source of international patent applications filed with WIPO and the landscape and discussion over patents has changed dramatically in recent years, but this section doesn't provide updated information.	Accepted. Has been changed into ". While patents seem to promote innovation in selected areas like pharmaceuticals, there is an increasing body of theoretical and empirical literature that suggests that the proliferation of patents also discourages innovation (medium evidence, low agreement)". Concerning the second comment, it is true that China surpassed other countries in terms of patent applications, yet the commentator does not link that empirical fact to the topic covered in this section. Having that said, some more recent literature was added (such as Maskus, 2019).	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
28057	61	12	61	12	Delete "use".	Accepted. Comment processed as suggested	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
53005	61	45	62	10	FRAND appears in page 61 before it is defined. It is defined in page 62.	Accepted. Full term is now written out the first time the abbreviation FRAND is mentioned	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
59543	61	46			Define "FRAND"	Accepted. Full term is now written out the first time the abbreviation FRAND is mentioned	Government of United States of America	U.S. Department of State	United States of America
82101	62	17	62	18	Isn't it already part of the Community Patent: Article 8 of Regulation 1257/2012?	Accepted. The somewhat more open phrasing was chosen because there are still hurdles into introducing the Community Patent, but LOR is indeed part of it. Text updated to "While not all national patent systems feature this regime, it is a feature present in the new European Community patent (EPO 2017)"	Sofia Rosero Abad	University	Netherlands
59545	63	3			Capitalize "NYSERDA"	Accepted.	Government of United States of America	U.S. Department of State	United States of America



Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
12781	63	4	63	6	(Suggestion) The sentence in line 4 in p.63 says "There is a general paucity of metrics on innovation and competitiveness for systematic assessments ...". I suggest two things: first, the wording of "metrics on innovation and competitiveness" can be changed to "metrics on innovation, competitiveness, and emission reduction"; Second, at the end of this sentence, I suggest the insertion of Gonsalves and Rogerson (2019).  <Reference> Gonsalves, M. and Roberson, J.M. (2019). Business incubators and green technology: The Gauteng Climate Innovation Centre, South Africa. <i>Urbani izziv</i> , 30, 212-224.	Noted but no action taken on the first point since this chapter is on innovation not emissions reduction. Accepted in the second point (reference included since relevant)	Chaewoon Oh	Green Technology Center	Republic of Korea
7653	63	19	63	21	please, rephrase, it is difficult to understand in my view.	Accepted. Text clarified.	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
7655	63	25	63	25	neutral, nor neural	Accepted. Corrected	DEL RIO GONZÁLEZ PABLO	Consejo Superior de Investigaciones Científicas (CSIC)	Spain
10889	63	31	63	34	Changes advocated by Otto et al are not so small! However changes indicated by Farmer et al are not so large; hence the point is at least partially made.	Noted. Our understanding is that this suggests that the current text is OK.	Philippe Waldteufel	CNRS	France
71035	63	40	63	43	The links to the literature on technology transfer are not clear: one is from R&D in firms/universities to the market, "the other in the context of climate change". Something seems to be missing for the second strand.	Accepted. We have modified the section to streamline it and focus on technology transfer and cooperation in the climate context.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
16739	63	40	63	44	(Question: Two strands?) The author divided literature on technology transfer into two strands: one on the transfer of technologies from firms' or universities' R&D departments to the market, and the other, in the context of climate change. The author mentioned that the focus of this section is laid on the latter. Regarding this, first, I would like to ask what is the main criterion to divided the current literature into two. Technology cycle (R&D vs technology transfer)? Actors (firms & universities vs rest of actors)? Context (the context of market-orientedness vs the context of climate change)? Nature of transaction (commercialized transactions vs technology cooperation)? My second question is what exactly indicates 'the other' strand? More clarification on this seems to be in need.	Accepted. We have modified the section to streamline it and focus on technology transfer and cooperation in the climate context.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12735	63	40	63	44	(Question: Two strands?) The author divided literature on technology transfer into two strands: one on the transfer of technologies from firms' or universities' R&D departments to the market, and the other, in the context of climate change. The author mentioned that the focus of this section is laid on the latter. Regarding this, first, I would like to ask what is the main criterion to divided the current literature into two. Technology cycle (R&D vs technology transfer)? Actors (firms & universities vs rest of actors)? Context (the context of market-orientedness vs the context of climate change)? Nature of transaction (commercialized transactions vs technology cooperation)? My second question is what exactly indicates 'the other' strand? More clarification on this seems to be in need.	Accepted. We have modified the section to streamline it and focus on technology transfer and cooperation in the climate context.	Chaewoon Oh	Green Technology Center	Republic of Korea
16741	64	7	4	7	(Question) Section 16.6.1 is titled as 'current state and recent developments in global innovation processes', and section 16.6.2 is titled as 'Objectives and functions of international technology transfer and cooperation'. What leads the author to divide this section into these two sub-sections? This question relates to the question that I made on the section 16.6 in p.63 above.	Accepted. Section 16.6.1 has been retitled as has section 16.6.2	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12737	64	7	4	7	(Question) Section 16.6.1 is titled as 'current state and recent developments in global innovation processes', and section 16.6.2 is titled as 'Objectives and functions of international technology transfer and cooperation'. What leads the author to divide this section into these two sub-sections? This question relates to the question that I made on the section 16.6 in p.63 above.	Accepted. Section 16.6.1 has been retitled as has section 16.6.2	Chaewoon Oh	Green Technology Center	Republic of Korea
53007	64	13	64	13	The same also applies for the PV industry. USA was the 'manufacturer' of innovation and ideas, while China was the manufacturer of the physical modules. For comprehensiveness, this report is to be cited as it explains this point very well: Deutch, J. M., & Steinfeld, E. S. (2013). A duel in the sun: The solar photovoltaics: Technology conflict between China and the United States. <i>Massachusetts Institute of Technology</i> .	Accepted, with thanks. Now cited. See also Box 16.4.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
71037	64	13	64	13	While the green global division of labour is certainly an important issue, the issues of regional lead markets in the field of sustainable development and how regional lead markets are determined by regulatory advantages, demand advantages and technological advantages is certainly also worth a discussion, as they trigger competition in developing innovative sustainable technologies and the frame in which they develop (see Sebastian Losacker, Ingo Liefner, Regional lead markets for environmental innovation, <i>Environmental Innovation and Societal Transitions</i> , Volume 37, 2020, Pages 120-139, ISSN 2210-4224, <a href="https://doi.org/10.1016/j.eist.2020.08.003">https://doi.org/10.1016/j.eist.2020.08.003</a> . ( <a href="http://www.sciencedirect.com/science/article/pii/S2210422420301064">http://www.sciencedirect.com/science/article/pii/S2210422420301064</a> ))	Noted, and interesting reference. However, this is beyond the scope of this section.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
28059	64	15	64	15	Replace "not all countries" with "developing countries do not".	Accepted. This point has been addressed in the revised text.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
28061	64	21	64	21	After "2017", add "while it is not replacing but is only supplementary to the transfer of technology and know-how from North to the South".	Accepted. This point has been addressed in the revised text.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
12437	64	22	64	23	What do you mean precisely?	Accepted. The revised formulation is more limited and hopefully clearer.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
16743	64	28	64	28	(Suggestion on title change) This section on 16.6.2 is titled as 'Objectives and functions of international technology transfer and cooperation'. I am not sure whether the term of 'functions' is appropriate. I think should be changed to "role" or "effects". It is because this section deals with technology cooperation can play the role that spans from emission reductions to technology deployment, capacity-building, and enhanced RD&D.	Accepted. Title has been modified.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
12739	64	28	64	28	(Suggestion on title change) This section on 16.6.2 is titled as 'Objectives and functions of international technology transfer and cooperation'. I am not sure whether the term of 'functions' is appropriate. I think should be changed to "role" or "effects". It is because this section deals with technology cooperation can play the role that spans from emission reductions to technology deployment, capacity-building, and enhanced RD&D.	Accepted. Title has been modified.	Chaewoon Oh	Green Technology Center	Republic of Korea
11143	64	28	66	29	Especially since this is a new IPCC chapter, it would be REALLY helpful to clarify what "technology transfer" actually is, with some concrete examples. In my experience, so many people describe tech transfer as something that is good, but few are clear as to what it actually means in practice.	Accept, the term is now introduced in 16.2.1.3.	Anthony Patt	ETH Zürich	Switzerland
16745	64	29	65	8	(Suggestion) In this section, paragraph of line 33-42 deals with 'motives, determinants and modes' of international efforts for technology transfer. However, the description is not comprehensive. Motives and determinants are slightly dealt with, but there is no description on modes. I think this paragraph does not seem to show much relevance. I suggest that each of three sentences can be moved to another sections.	Accepted, text has been revised to include the modes.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12741	64	29	65	8	(Suggestion) In this section, paragraph of line 33-42 deals with 'motives, determinants and modes' of international efforts for technology transfer. However, the description is not comprehensive. Motives and determinants are slightly dealt with, but there is no description on modes. I think this paragraph does not seem to show much relevance. I suggest that each of three sentences can be moved to another sections.	Accepted, text has been revised to include the modes.	Chaewoon Oh	Green Technology Center	Republic of Korea
A	64	34	64	35	All countries should promote domestic industry not only developed countries. Therefore, the sentence should be rephrased.	Accepted, sentence has been rephrased accordingly, while also maintaining consistency with the cited source.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
71039	64	37	64	39	On capacity for Green Innovation, see Walz, R., Eichhammer, W. Benchmarking green innovation. Miner Econ 24, 79–101 (2012). <a href="https://doi.org/10.1007/s13563-012-0016-y">https://doi.org/10.1007/s13563-012-0016-y</a>	Noted. This section is focused on technology transfer rather than building innovation capacity. For the section on that, more recent references have been included.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
53009	64	37	67	6	CDM is mentioned without definition. The abbreviation is defined much later in the chapter in page 67.	Accepted, with thanks. The abbreviation is now defined at the first point of use.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
12439	64	42	64	42	"for this" ?????	Accepted, with thanks. Corrected.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
16747	64	43	65	8	(Suggestoin) Paragraph from line 43 in p.64 to line 4 in p.65 deals with whether technology cooperation through the channel of Market Mechanism can have effect on emission reductions, and the analyses show bifurcated results. Meanwhile, paragraph in line 5-8 in p.64 indicates the possible roles in or effects on technology deployment, capacity-building, and RD&D enhancement. These two paras are related, but they are written without much link. Therefore, I suggest that linking these two paras can be considered. The linking point can be made in a way that technology cooperation can be aimed at resulting in emission reduction through mitigation projects; but not all cooperative actions can generate mitigation outcomes; technology cooperation can have other aims of i) enhanced climate technology deployment, ii) capacity-building, and iii) enhanced RD&D.	Taken into account, with thanks. We have drawn upon this very helpful formulation in the revised text.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12743	64	43	65	8	(Suggestoin) Paragraph from line 43 in p.64 to line 4 in p.65 deals with whether technology cooperation through the channel of Market Mechanism can have effect on emission reductions, and the analyses show bifurcated results. Meanwhile, paragraph in line 5-8 in p.64 indicates the possible roles in or effects on technology deployment, capacity-building, and RD&D enhancement. These two paras are related, but they are written without much link. Therefore, I suggest that linking these two paras can be considered. The linking point can be made in a way that technology cooperation can be aimed at resulting in emission reduction through mitigation projects; but not all cooperative actions can generate mitigation outcomes; technology cooperation can have other aims of i) enhanced climate technology deployment, ii) capacity-building, and iii) enhanced RD&D.	Taken into account, with thanks. We have drawn upon this very helpful formulation in the revised text.	Chaewoon Oh	Green Technology Center	Republic of Korea
16749	65	9	65	9	(Suggestion for clarity) I hope that the section 16.6.2.1 can be re-written. There two two paragraphs, but it seems a bit difficult to understand what is intended in each paragraph. Current decription is about things that help or block the deploiment of climate technologies in developing countries. If so, the first paragraph needs to indicate the 'enablers/enabling conditions for technology deployment in developing countries', and the second paragraph needs to indicate the barriers that retards deployment.	Accepted, this section has now been rewritten and hopefully clarified.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12745	65	9	65	9	(Suggestion for clarity) I hope that the section 16.6.2.1 can be re-written. There two two paragraphs, but it seems a bit difficult to understand what is intended in each paragraph. Current decription is about things that help or block the deploiment of climate technologies in developing countries. If so, the first paragraph needs to indicate the 'enablers/enabling conditions for technology deployment in developing countries', and the second paragraph needs to indicate the barriers that retards deployment.	Accepted, this section has now been rewritten and hopefully clarified.	Chaewoon Oh	Green Technology Center	Republic of Korea
71041	65	9	65	31	The section may also discuss more prominently the barriers related to existing interests and employment in the field of fossil fuel production in developing countries and the need to organise structural change in conjunction with the transfer of sustainable technologies. (e.g. Ordonez, J., Stekkel, J.C. and Jakob, M.: Coal, power and coal-powered politics in Indonesia. Forthcoming. // Ira Irina Dorband, Michael Jakob, Jan Christoph Steckel, Unraveling the political economy of coal: Insights from Vietnam, Energy Policy, Volume 147, 2020, 111860, ISSN 0301-4215, <a href="https://doi.org/10.1016/j.enpol.2020.111860">https://doi.org/10.1016/j.enpol.2020.111860</a> . ( <a href="http://www.sciencedirect.com/science/article/pii/S0301421520305772">http://www.sciencedirect.com/science/article/pii/S0301421520305772</a> )	Accepted. The topic In general is addressed in the new section "Enhancing low-emission technology uptake in developing countries". Thanks for the useful references!	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
28065	65	16	65	16	After "that", add "developing countries, including" least-developed ....	Accepted, revised accodingly.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
16751	65	17	65	19	(Question) It is difficult for me to understand what it means by the sentence in line 17-19.	Accepted, revised to convey meaning in clearer form.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12747	65	17	65	19	(Question) It is difficult for me to understand what it means by the sentence in line 17-19.	Accepted, revised to convey meaning in clearer form.	Chaewoon Oh	Green Technology Center	Republic of Korea
59547	65	17			Change "this due" to "this is due"	Accepted, revised accordingly.	Government of United States of America	U.S. Department of State	United States of America
28067	65	19	65	19	Replace "low-carbon" with "low-emission" to address all necessary technologies.	Accepted, revised accordingly.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
53011	65	20	65	31	There is also the issue of reliability. In the power sector for example, and no matter how cheap wind or solar become, they will always be intermittent. It is very difficult to compete with coal for example. So, developing (less developing) countries face the dilemma of economic growth 'cheaply' and being environmentally-friendly at a high cost.	Taken into account, it is a broad topic addressed in chapter 6 primarily. Actually, innovation can be important here as through demand-side management some of the variability issues can be addressed.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
16753	65	24	65	24	(Question) What does it mean by "both national and international engagement" in line 24 in p.65? What engagement? Engagement of whom?	Taken into account; revised to convey meaning in clearer form.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12749	65	24	65	24	(Question) What does it mean by "both national and international engagement" in line 24 in p.65? What engagement? Engagement of whom?	Taken into account; revised to convey meaning in clearer form.	Chaewoon Oh	Green Technology Center	Republic of Korea
59549	65	30			Change "a terms" to "a term"	Taken into account. In fact, this part of the sentence was removed.	Government of United States of America	U.S. Department of State	United States of America
16755	65	32	65	32	(Suggestion on section overlapping) This section on 16.6.2.2 is titled as 'capabilities for innovation, integrated planning and implementation'. Now, this section makes me puzzled. In the previous section of 16.6.2.1, there are some references dealing with capacities (development of the specific types of capacity in line 12, entrepreneurial capabilities in line 26). The dividing line between section 16.6.2.1 and section 16.6.2.2 gets fuzzy. I hope the author can consider this overlapping and re-writing.	Accepted, with thanks! We have merged the sections to avoid the confusion of the kind that you have pointed out.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12751	65	32	65	32	(Suggestion on section overlapping) This section on 16.6.2.2 is titled as 'capabilities for innovation, integrated planning and implementation'. Now, this section makes me puzzled. In the previous section of 16.6.2.1, there are some references dealing with capacities (development of the specific types of capacity in line 12, entrepreneurial capabilities in line 26). The dividing line between section 16.6.2.1 and section 16.6.2.2 gets fuzzy. I hope the author can consider this overlapping and re-writing.	Accepted, with thanks! We have merged the sections to avoid the confusion of the kind that you have pointed out.	Chaewoon Oh	Green Technology Center	Republic of Korea
53013	65	35	65	35	And the infrastructure already existing in the country	Accepted, thanks. Included.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
10891	65	41	66	13	SDG#4 is particularly relevant in this context.	Taken into account. We discuss the links to SD more systematically in what is now 16.6	Philippe Waldeufel	CNRS	France
63445	66	0	67	0	Would be relevant to see a discussion in section 16.6.3 of the benefits of greater alignment between the capacity building work of the technology mechanism (specifically CTCN) and the financial strategies of the UNCCC (i.e., GCF). COP has been calling for greater collaboration between these two bodies, and there is still a lot of potential to better align the approaches to enable capacity building work to set the stage for the financial supports.	Noted. We looked for literature on this topic, but could not find much, which we have cited. We can only reflect what the literature says.	Government of Canada	Environment and Climate Change Canada	Canada
15699	66	9	66	9	"the absence of inadequacy" should be changed into "the absence or inadequacy".	Accepted, thanks. Corrected.	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16721	66	9	66	9	"the absence of inadequacy" should be changed into "the absence or inadequacy".	Accepted, thanks. Corrected.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
59551	66	25			Change "that the" to "that"	Accepted, thanks. Corrected.	Government of United States of America	U.S. Department of State	United States of America
82999	66	31	66	31	This could be an area of great interest for developing countries. There's a lot of material in Chapter 14 (at least as much as here). Could look at that and build on (or borrow)?	Taken into account. We have divided tasks on this with chapter 14.	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
30615	66	31	67	46	While the author provides a case study of the CDM under the Kyoto Protocol, the author does not examine the technology mechanisms and other initiatives under the Paris Agreement. The authors claim that there is "a gap remains, in the coverage of activities, the amount of committed funding, and the effectiveness." based on (Brook et al. 2016) , but this is a misunderstanding of the purpose of the paper. This paper was published online before Paris Agreement was adapted, and proposed a technology component as a part of the new agreement. They do not cover at all the efforts of the Technology Mechanism after the Paris Agreement. The technical mechanism provides technical assistance based on requests from developing countries. If the support were insufficient, the number of non-supported requests would pile up, but so far the support has been provided without delay. An independent review of the CTCN was conducted by a third party under the UNFCCC (FCCC/CP/2017/3). According to the report, there was no indication of a lack of support, rather the need to improve the efficiency of technical assistance was noted. The parties concluded that there is a need to improve the capacity of NDEs of the developing countries (FCCC/SBI/2018/L.15/Add.1).	Taken into account. The report of the independent review noted that "the lack of predictability and security over financial resources significantly affected the CTCN's ability to deliver services at the expected level." For the remainder, there are very few independent and peer-reviewed studies looking at the performance of the Technology Mechanism or the Paris Agreement's technology article.	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
16757	66	39	66	40	(Change) (before) The implementation of "Technology Needs Assessments" was the first mechanism used by the UNFCCC, and has undergone different cycles of learning. --> (Change) The support on "Technology Needs Assessment" to developing countries was the first major action undertaken by the UNFCCC, and has undergone different cycles of learning. (Reason) Technology needs assessment is not up to the level to be called as a 'mechanism'. That is an activity/action of the UNFCCC as one of the thematic areas to be undertaken.	Accepted, thanks - very helpful. Have replaced with suggested text.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12753	66	39	66	40	(Change) (before) The implementation of "Technology Needs Assessments" was the first mechanism used by the UNFCCC, and has undergone different cycles of learning. --> (Change) The support on "Technology Needs Assessment" to developing countries was the first major action undertaken by the UNFCCC, and has undergone different cycles of learning. (Reason) Technology needs assessment is not up to the level to be called as a 'mechanism'. That is an activity/action of the UNFCCC as one of the thematic areas to be undertaken.	Accepted, thanks - very helpful. Have replaced with suggested text.	Chaewoon Oh	Green Technology Center	Republic of Korea
16759	66	42	66	44	(Change) (before) the technology mechanism in line 42 and line 44 --> (Change) the Technology Mechanism (Reason) The Technology Mechanism is the proper noun.	Accepted, revised.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12755	66	42	66	44	(Change) (before) the technology mechanism in line 42 and line 44 --> (Change) the Technology Mechanism (Reason) The Technology Mechanism is the proper noun.	Accepted, revised.	Chaewoon Oh	Green Technology Center	Republic of Korea
16761	66	45	66	48	(Suggestion) The description does not correspond to the reference of Oh (2020). The description in the sentence (line 45-48) is the content of manuscript that is under review (not published). I hope that the author can check this again.	Accepted, the revised language better reflects the views presented in the Oh (2020) article.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12757	66	45	66	48	(Suggestion) The description does not correspond to the reference of Oh (2020). The description in the sentence (line 45-48) is the content of manuscript that is under review (not published). I hope that the author can check this again.	Accepted, the revised language better reflects the views presented in the Oh (2020) article.	Chaewoon Oh	Green Technology Center	Republic of Korea
51843	66	46	66	48	Also confirmed by the first independent review of the CTCN, available at: <a href="https://unfccc.int/resource/docs/2017/cop23/eng/03.pdf">https://unfccc.int/resource/docs/2017/cop23/eng/03.pdf</a>	Accepted, thanks. Now cited.	Florin Vladu	UNFCCC Secretariat	Germany
63443	66	47	66	47	Need further clarity on what "challenges in terms of institutional requirements" means. Is it challenges related to meeting the institutional requirements (as implied by the statement on modest funding)?	Taken into account, the revised language should clarify.	Government of Canada	Environment and Climate Change Canada	Canada
16763	67	2	67	2	(Change) (before) Article 10 is fully devoted to technology --> (change) Article 10 is fully devoted to technology development and transfer. (Reason) Article 10 of the Paris Agreement regards technology development and transfer.	Accepted, and revised	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12759	67	2	67	2	(Change) (before) Article 10 is fully devoted to technology --> (change) Article 10 is fully devoted to technology development and transfer. (Reason) Article 10 of the Paris Agreement regards technology development and transfer.	Accepted, and revised	Chaewoon Oh	Green Technology Center	Republic of Korea
16765	67	2	67	5	(Question) The reference of Olhoff(2015) deals with 'adaptation'. I think this reference does not seem to be fit here.	Accepted, text adjusted and reference replaced with the correct article.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12761	67	2	67	5	(Question) The reference of Olhoff(2015) deals with 'adaptation'. I think this reference does not seem to be fit here.	Accepted, text adjusted and reference replaced with the correct article.	Chaewoon Oh	Green Technology Center	Republic of Korea
63447	67	4	67	4	It is not clear why this line states that the Technology mechanism and the Framework have been assessed as predominantly focussed on hardware for adaptation. There is significant attention paid to mitigation solutions under the Framework. Also the statement that the contribution of the Framework has been limited in scope is based on a 2017 paper, (de Coninck and Sagar 2017) which was before the Framework was finalized.	Accepted, have added a line to indicate subsequent broadening of scope.	Government of Canada	Environment and Climate Change Canada	Canada
51845	67	4			The workplans of the TEC and the CTCN focus on supporting hardware, software and orgware to support action in adaptation and mitigation. This is in accordance with their original mandates as spelled out in the Cancun Agreements and the overall guidance provided by the technology framework to the Technology Mechanism. This seems to contradict the findings of Olhoff.	Accepted, reflected in the revised text.	Florin Vladu	UNFCCC Secretariat	Germany
28069	67	13	67	13	Before "technology", add "know-how and".	Rejected, not necessary here.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
16767	67	24	67	36	(Suggestion) I think this paragraph (line 24-36) seems to be redundant. I think description on the technology-related work of the Financial Mechanism seems to be more needed in this section.	Partially accepted; suitable text added.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12763	67	24	67	36	(Suggestion) I think this paragraph (line 24-36) seems to be redundant. I think description on the technology-related work of the Financial Mechanism seems to be more needed in this section. I hope that leading authors can consider the description of activities of the GEF and the GCF, which are the operating entities of the Financial Mechanism under the UNFCCC. If this paragraph is going to be re-written at the center of the Financial Mechanism, I hope that following sentence can be inserted: "The GCF is planning to establish the Climate Innovation Facility as a way to operate incubator/accelerator program for entrepreneurs in developing countries in order to support and accelerate early-stage innovations and climate technologies" (CTCN 2020).  <Reference> GCF. (2020). GCF Support to Climate Technologies: 16th Meeting of the Advisory Board of the CTCN. <a href="https://www.ctc-n.org/sites/www.ctc-n.org/files/Agenda%204.3_Green%20Climate%20Fund.pdf">https://www.ctc-n.org/sites/www.ctc-n.org/files/Agenda%204.3_Green%20Climate%20Fund.pdf</a> . Accessed on March 10, 2021.	Accepted, thanks for pointing out the GCF presentation. Suitable text added.	Chaewoon Oh	Green Technology Center	Republic of Korea
59553	67	31	67	36	This sentence is awkwardly phrased. Edit it for clarity.	Accepted, text is revised.	Government of United States of America	U.S. Department of State	United States of America

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
51847	67	40	67	41	On the effectiveness, this seems to contradict the earlier findings on page 66, lines 46-48 regarding the effectiveness of the CTCTN. IN addition, various reviews have assessed the CTCTN positively in term of its effectiveness, including the independent review of the CTCTN referred to above.	Accepted, text is revised.	Florin Vladu	UNFCCC Secretariat	Germany
16769	67	40	67	46	(Suggestion) (1) Before the sentence starting with "However, a gap remains", I suggest a new sentence to be inserted as follows: "Particularlry, the Climate Technology Centre & Network (CTCN), which is the implementing organization of the Technology Mechanism under the UNFCCC, has taken a successful role of matchmaker for climate technology transfer to developing countries in view of open innovation since its inception in 2013 (Lee and Mwebaza 2020)".  (2) Regarding the sentence starting with "Sepcifically, the UNFCCC mechanisms for technology...", I suggest that "Specifically" can be changed to "Notwithstanding".  <Reference> Lee, W. and Mwebaza, R. (2020). The Role of the Climate Technology Centre and Network as a climate technology and innovation matchmaker for developing countries. Sustainability, 20. doi:10.3390/su12197956.	Taken into account. This perspective on the role of CTCTN has been added earlier in this section, where it fits better.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
63449	67	40	67	46	The statement that there is a gap in the coverage of activities, funding and effectiveness of the UNFCCC mechanisms is based upon research from 2016 (Brook et al. 2016) and 2015 (de Coninck and Puig 2015; Ockwell et al. 2015) which were both published prior to the complete negotiation and implementation of the Technlogy Framework and its additional measures. In addition, any discussion of gap of funding should also provide a more quantitative assessment of what the current situation is, studies pointing to what it should be, and what is not being supported as a result.	Taken into account, this text has been modified.	Government of Canada	Environment and Climate Change Canada	Canada
12765	67	40	67	46	(Suggestion) (1) Before the sentence starting with "However, a gap remains", I suggest a new sentence to be inserted as follows: "Particularlry, the Climate Technology Centre & Network (CTCN), which is the implementing organization of the Technology Mechanism under the UNFCCC, has taken a successful role of matchmaker for climate technology transfer to developing countries in view of open innovation since its inception in 2013 (Lee and Mwebaza 2020)".  (2) Regarding the sentence starting with "Sepcifically, the UNFCCC mechanisms for technology...", I suggest that "Specifically" can be changed to "Notwithstanding".  <Reference> Lee, W. and Mwebaza, R. (2020). The Role of the Climate Technology Centre and Network as a climate technology and innovation matchmaker for developing countries. Sustainability, 20. doi:10.3390/su12197956.	Taken into account. This perspective on the role of CTCTN has been added earlier in this section, where it fits better.	Chaewoon Oh	Green Technology Center	Republic of Korea
15715	67	41	67	42	The reference (Brook et al. 2016) proposed that an international "Low-Emissions Technology Commitment" should be incorporated into the UNFCCC negotiation process to accelerate research, development and demonstration of low-emissions energy technologies in the paris Agreement. To support this proposal, the authors (Brook et al) wrote that the Technology Mechanism and the associated TEC have focused on financing and supporting technology transfer and boosting the innovation capacity of developing states rather than on actions aimed at driving energy innovation more generally. It is appropriate to delete this sentence because this sentence can mislead readers that technology mechanism is not doing the mandate properly. But, the authors' main focus is to eastablish spcifically a mechanism for research, development and demonstration of low emissions energy technologies and if anyone looks at a specific body from own respect, it could make biased opinion. The sentence also is to used to overemphasize the need for the RD&D for energy technology. At the earlier sentences, it is written that international cooperation and technology trabsfer and capacity building have been enhanced since the Paris Agreement. The reference was published in 2016. There is also an issue of timing (This report will be publised in 2021). So, it is good to delete this sentence to make smooth contextual flow also.	Accepted, this text has been modified accordingly.	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16737	67	41	67	42	The reference (Brook et al. 2016) proposed that an international "Low-Emissions Technology Commitment" should be incorporated into the UNFCCC negotiation process to accelerate research, development and demonstration of low-emissions energy technologies in the paris Agreement. To support this proposal, the authors (Brook et al) wrote that the Technology Mechanism and the associated TEC have focused on financing and supporting technology transfer and boosting the innovation capacity of developing states rather than on actions aimed at driving energy innovation more generally. It is appropriate to delete this sentence because this sentence can mislead readers that technology mechanism is not doing the mandate properly. But, the authors' main focus is to eastablish spcifically a mechanism for research, development and demonstration of low emissions energy technologies and if anyone looks at a specific body from own respect, it could make biased opinion. The sentence also is to used to overemphasize the need for the RD&D for energy technology. At the earlier sentences, it is written that international cooperation and technology trabsfer and capacity building have been enhanced since the Paris Agreement. The reference was published in 2016. There is also an issue of timing (This report will be publised in 2021). So, it is good to delete this sentence to make smooth contextual flow also.	Accepted, this text has been modified accordingly.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
51849	67	41	67	42	This statement is based upon a study which was done in 2016. Things have evolved since then, including the adoption of the technology framework. Would you have more recent evidence to back up this statement?	See comment 16737 and the response.	Florin Vladu	UNFCCC Secretariat	Germany
16771	67	42	67	43	(Question) In the sentence starting with 'An assessment', the description of "An assessment of UNFCCC instruments specifically for technology transfer" is ambiguous. What are the UNFCCC instruments specifically for technology transfer?	Accepted, sentence has been deleted.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
12767	67	42	67	43	(Question) In the sentence starting with 'An assessment', the description of "An assessment of UNFCCC instruments specifically for technology transfer" is ambiguous. What are the UNFCCC instruments specifically for technology transfer?	Accepted, sentence has been deleted.	Chaewoon Oh	Green Technology Center	Republic of Korea
59555	67	42			Needs of technologies, or needs of countries? This sentence is awkwardly phrased. Edit for clarity.	Taken into account, sentence has been deleted.	Government of United States of America	U.S. Department of State	United States of America
16775	67	46	67	46	(Suggestion) At the end of this paragraph, I would like to suggest the insertion of the following sentence: "For the operation of the CTCN, the lack of financial sustainability has been a recurring issue under the UNFCCC. In order to solve this financial instability, the way of linkage between the Technology Mechanism and the Financial Mechanism has been discussed, formulated and implemented since 2015. Still, the way to solve financial instability of the CTCN needs to be explored, including the furthering the current linkage (Oh 2020)".  <Reference> Oh, C. (2020). Contestations over the financial linkages between the UNFCCC's Technology and Financial Mechanism: using the lens of institutional interaction. International Environmental Agreements: Politics, Law and Economics, 20(3), 559–575.	Taken into account. This perspective is now reflected earlier in the section, where it fits better.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12779	67	46	67	46	(Suggestion) At the end of this paragraph, I would like to suggest the insertion of the following sentence: "For the operation of the CTCN, the lack of financial sustainability has been a recurring issue under the UNFCCC. In order to solve this financial instability, the way of linkage between the Technology Mechanism and the Financial Mechanism has been discussed, formulated and implemented since 2015. Still, the way to solve financial instability of the CTCN needs to be explored, including the furthering the current linkage (Oh 2020)".  <Reference> Oh, C. (2020). Contestations over the financial linkages between the UNFCCC's Technology and Financial Mechanism: using the lens of institutional interaction. International Environmental Agreements: Politics, Law and Economics, 20(3), 559–575.	Taken into account. This perspective is now reflected earlier in the section, where it fits better.	Chaewoon Oh	Green Technology Center	Republic of Korea
84517	68	3	68	4	The emphasis on "mission-oriented innovation policy" that is also emphasized in Chapter 4 (line 25 page 78) may be emphasized earlier in the chapter with possible connections to sustainability-oriented innovation systems.	Accepted, this is now introduced in section 16.3.1.	Siir KILKIS	The Scientific and Technological Research Council of Turkey	Turkey
12441	68	6	68	6	"of members" Delete?	Accepted. Thanks. Revised.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
53015	68	16	68	16	Commercially - not commercial	Accepted. Thanks. Revised.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
53017	68	25	68	25	This box deals with how to 'expect' the problem - how to 'forecast' the problem. However, it does not deal with the core of the problem which is how to reduce emissions. This point has to be clear. There is a difference between dealing with the problem or dealing with the implications of the problem.	Noted. The point of this box is to indicate how capacity building and innovation may work. We were explicitly requested to also look at adaptation and SIDS in our outline.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia
23689	68	25	68	26	We recommend to revise this box 16.9. The experience of vanuatu shows that local populations have long known climate variability and have adapted to it. When these adaptations are effective and efficient, they should be preserved (eg traditional shelter in Tanna Rey T, Le De L, Leone F, David G. "An integrative approach to understand vulnerability and resilience post-disaster. The 2015 Pam Cyclone in urban Vanuatu as case study. Disaster Prevention and Management .. 2017. Vol 26 issue 3, pp. 259-275.	Noted. The point is not whether local populations are not aware of climate variability and able to respond, but what capacity they have to respond to conditions that are outside of the normal amplitude. The point that the local community can be resilient is also made in the box.	Government of France	Ministère de la Transition écologique et solidaire	France
83001	68	25	69	13	This box is very adaptation oriented. How relevant for WG III?	Rejected. In our outline, we were explicitly requested to look at adaptation and SIDS as well.	Jim Skea	Imperial College London	United Kingdom (of Great Britain and Northern Ireland)
30617	69	14	70	19	The author discusses only the patent regime, but the main focus should be on how to widely disseminate climate technologies to mitigate climate change, and it is necessary to discuss a wide range of barriers to technology deployment. For example, Gillingham and Sweeney (2012) explores the barriers to the adoption of these technologies to reduce carbon dioxide emissions, and IP is not treated as a barrier. Gillingham, Kenneth, and James Sweeney. "Barriers to implementing low-carbon technologies." Climate Change Economics 3.04 (2012): 1250019.	Noted but no action taken. While we agree that all relevant barriers should be addressed in the IPCC report, this specific section is about patents as possible facilitator or barrier.	Government of Japan	Climate Change Division - Ministry of Foreign Affairs	Japan
51851	69	14			This seems to be a narrow perspective on the role of IPR in light of the topic of this chapter on innovation, technology development and transfer. What about the roles of IPR in spurring innovation?	Accepted. This subsection is about the role of patents in technology transfer, whereas the earlier sub-sections 16.5.6 discusses the role of the patent system for innovation and acknowledges its role in spurring innovation. A new bridge sentence is added to the beginning of 16.5.6 to make this more clear. Moreover, some recent literature on the role of patents in spurring innovation was added to sub-section 16.5.6.	Florin Vladu	UNFCCC Secretariat	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
12443	69	17	69	17	"evidence of non-availability" ????	Accepted. This paragraph has been re-written to be clearer.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
23691	69	17	69	19	concerning "there is also evidence from modelling or empirical studies that patents hinder the technology transfer of climate mitigation technologies (Dechezleprêtre et al. 2011..." Dechezlepretre et al 2011 does not provide evidence that patents hinder technology transfer of climate change mitigation technologies. Dechezleprêtre et al 2013 ( Environmental & Resource Economics, 54(2): 161 – 178) provide strong evidence that lax Intellectual Property regimes have a strong and negative impact on the international diffusion of patented knowledge	Taken into account. This has been addressed. In their 2012 paper Dechezleprêtre et al wrote "Whether a stronger IPR regime can foster the transfer of climate-mitigation technology to developing countries is a controversial issue". Yet, in 2013 he took a somewhat difference stance, and concludes that "lax Intellectual Property regimes have a strong and negative impact on the international diffusion of patented knowledge." The text has been updated to properly reflect the content of these papers.	Government of France	Ministère de la Transition écologique et solidaire	France
59557	69	29	69	34	Suggest deletion. This suggests that transfer of technologies should not be on a voluntary basis and on mutually agreed terms. The UNFCCC cannot dictate how Parties manage their technologies and IPRs.	Noted but no action taken. The paragraph the commentor refers to summarizes the content of the cited papers, which are relevant to this topic. We do not take position or endorse the content of these papers, or suggestion a position UNFCCC or others should take. In the paragraph directly following this one, we equally discuss a number of papers that come to opposite conclusions, without endorsing these either.	Government of United States of America	U.S. Department of State	United States of America
19529	69	35	69	35	The "in contrast, other studies find the opposite", would be useful to develop, to provide the full picture including references, compared to the paragraph just above. (What follows would seem to be about results that are common to all studies?)	Noted. We have revised this section in light of space constraints.	Markku Rummukainen	Lund University	Sweden
12445	69	39	69	40	There appears to be a contradiction her. Where numerous alternatives exist, there should be no restrictions.	Accepted. Although this part of the sentence literally comes from the source (Maskus 2010:3), it is now removed to prevent confusion.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
23693	69	43	69	43	Concerning the reference "Dechezleprêtre et al (2011)" is this Dechezlepretre et al 2013?	Accepted. The text we refer here is from Dechezleprêtre (2011, page 125, line 14). But in the new version we do now also cite Dechezleprêtre (2013) elsewhere in the chapter.	Government of France	Ministère de la Transition écologique et solidaire	France
12447	69	43	69	43	"some evidence. Likewise" Some evidence for what? Check the use of "likewise".	Accepted. This has been resolved with the reworking of the section.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
28071	70	5	70	7	There is a need for more evidence on whether the patent system will facilitate technology transfer or it rather hinders transfer of technology and know-how to developing countries. The sentence should be revised to become more factual.	Noted but no action taken. Whether the patent facilitate or hinders technology transfer is not a question one can factually answer; it is probably both, and on the basis of current evidence it is impossible to make one single, unambiguous claim to any direction. This sentence say "may facilitate' and does refer to two papers that argue so, so we feel the sentence is appropriate.	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
15701	70	7	70	9	In the reference (Maskus 2010), the sentence is "Further, the evidence that patents do not seem to limit access to ESTs, at least in the middle-income economies with significant production and technological bases, does not imply that the patent system as it exists today is the most appropriate vehicle for encouraging innovation international access". I think that this sentence does not consider LDCs. So, the sentence would be rewritten. "Capacity for technology R&D to diffusion" need to be revised to deliver clear message.	Identical to comment 16723, see response to that comment.	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16723	70	7	70	9	In the reference (Maskus 2010), the sentence is "Further, the evidence that patents do not seem to limit access to ESTs, at least in the middle-income economies with significant production and technological bases, does not imply that the patent system as it exists today is the most appropriate vehicle for encouraging innovation international access". I think that this sentence does not consider LDCs. So, the sentence would be rewritten. "Capacity for technology R&D to diffusion" need to be revised to deliver clear message.	Noted. This text is based in a series of *three* sentences in Maskus (2010): "the evidence that patents do not seem to limit access to ESTs, at least in the middle-income economies with significant production and technological bases, does not imply that the patent system as it exists today is the most appropriate vehicle for encouraging innovation international access. After all, the fact that a patent is not taken out in a particular poor country in essence signifies that the patent holder does not intend to transfer the technology there. If that country does not have the technical capacity to copy the technology the absence of patent protection is not particularly helpful and resort to compulsory licenses is meaningless." While the first sentence relates to middle-income countries, the following sentences then make statements about what this means for developing economies. Taken these three sentences together, I think the text in the draft is appropriate.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
59559	70	11			Explain the acronym IPR. Is this meant to mean "IP" rights. Define the acronyms.	Accepted. Both "IP" and "IPR" are now defined in the beginning of the relevant subsection.	Government of United States of America	U.S. Department of State	United States of America
51853	70	18			On a case by case basis was also one of the key messages of the TEC in this context, see para 35 of <a href="https://unfccc.int/resource/docs/2012/sb/eng/02.pdf">https://unfccc.int/resource/docs/2012/sb/eng/02.pdf</a>	Accepted. Has been added.	Florin Vladu	UNFCCC Secretariat	Germany
16773	70	19	70	19	(Suggestion) In line 19 in p.70, I hope that this can be additionally inserted: "In addition to the compulsory licensing through the TRIPS agreement or the policies for enabling environment for IPR protection, third ways were explored. One is to establish an IPR-protective institution complementary to an insufficient domestic IPR regime in developing countries in a manner to reduce behavioral uncertainty and to provide information. This institution can work as a brokerage platform that facilitates the transaction of technology transfer and deployment. The other is to establish public patent pooling which is an IPR-providing or -sharing institution without any sacrifice of the TRIPS Agreement (Oh and Matsuoka 2016)."  <Reference> Oh, C. and Matsuoka, S. (2016). Complementary approaches to discursive contestation on the effects of the IPR regime on technology transfer in the face of climate change. <i>Journal of Cleaner Production</i> , 128 (2016), 168-177.	Taken into account. Thanks. Have included reference and some relevant text.	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12769	70	19	70	19	(Suggestion) In line 19 in p.70, I hope that this can be additionally inserted: "In addition to the compulsory licensing through the TRIPS agreement or the policies for enabling environment for IPR protection, third ways were explored. One is to establish an IPR-protective institution complementary to an insufficient domestic IPR regime in developing countries in a manner to reduce behavioral uncertainty and to provide information. This institution can work as a brokerage platform that facilitates the transaction of technology transfer and deployment. The other is to establish public patent pooling which is an IPR-providing or -sharing institution without any sacrifice of the TRIPS Agreement (Oh and Matsuoka 2016)."  <Reference> Oh, C. and Matsuoka, S. (2016). Complementary approaches to discursive contestation on the effects of the IPR regime on technology transfer in the face of climate change. <i>Journal of Cleaner Production</i> , 128 (2016), 168-177.	Taken into account. Thanks. Have included reference and some relevant text.	Chaewoon Oh	Green Technology Center	Republic of Korea
71043	70	21	71	6	The section could more strongly differentiate Technology Readiness Levels (TRL) in Technology Transfer and present approaches differentiated for lower and higher TRL levels. For higher TRL levels, import instruments such as Carbon Contracts for Difference have emerged to spur low-carbon industrial processes or the hydrogen economy, including also technology transfer elements (see for example the H2 Global project launched by GIZ and DWV ( <a href="https://www.cleanenergywire.org/news/new-development-cooperation-project-lay-foundations-german-hydrogen-imports">https://www.cleanenergywire.org/news/new-development-cooperation-project-lay-foundations-german-hydrogen-imports</a> ))	Noted. We distinguish between higher and lower TRLs in the titles of the sections.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
71045	70	21	71	6	Section rather strongly focussed on technology transfer alone. Transfer of important instruments (in particular Emission Trading ETS in conjunction with Innovation Funds to spur low-carbon solutions notably in industries of developing countries is not discussed. See example of Innovation Fund introduced in the EU. ( <a href="https://ec.europa.eu/clima/policies/innovation-fund_en">https://ec.europa.eu/clima/policies/innovation-fund_en</a> ). Such a frame could contribute to develop innovative low carbon technologies in transition countries, e.g China, India, Indonesia etc.	Noted. This section is focused on technology transfer rather than ways to spur innovation.	Philippe Tulkens	European Union (EU) - DG Research & Innovation	Belgium
12449	70	27	70	27	"which implies a hierarchy"???	Accepted, revised	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
12451	70	27	70	31	You use a the comparative form ... without indicating what you are comparing with.	Accepted, revised	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
59561	70	29			Change "be clearly defined" to "to clearly define"	Accepted, revised	Government of United States of America	U.S. Department of State	United States of America
15703	70	33	70	33	Referring the reference, "Technology Mechanism" would be added after "the UNFCCC" to clarify the actor.	Accepted, revised	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16725	70	33	70	33	Referring the reference, "Technology Mechanism" would be added after "the UNFCCC" to clarify the actor.	Accepted, revised	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
15705	70	33	70	34	Referring the reference, "(CRIBs)" would be inserted after "climate relevant innovation system builders"."develop capabilities" would be changed into "develop technological capabilities".	Accepted, revised	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16727	70	33	70	34	Referring the reference, "(CRIBs)" would be inserted after "climate relevant innovation system builders"."develop capabilities" would be changed into "develop technological capabilities".	Accepted, revised	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
12453	70	37	70	38	Please check the formulation	Taken into account, checked and revised.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
53019	70	44	70	46	There is a challenge here. If a manufacturing facility achieves energy/efficiency savings (i.e. reduce cost), there is no motive to share this innovation with other facilities/countries because sharing this innovation means that the other countries will also be able to save. The facility wants to reduce cost and be competitive. So in this regard, facilities and selfish and compete. They will not simply share their innovation without return. This brings us back to the licensing discussion earlier in the chapter. Include this in the discussion.	Noted. Collaboration between industry in a highly competitive environment, where every (cost) advantage counts, is indeed challenging. This makes an already complicated collective action problem even more challenging. This is noted by Oberthuer et al and discussed.	Government of Saudi Arabia	Sustainability Advisor to the Minister Ministry of Petroleum and Mineral Resources	Saudi Arabia



Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
61173	71	7	71	11	Recommended change in bracket. In the column on "International climate technology transfer objectives: the section on "build capacity for implementation and integrated planning [and evaluation and learning]"	Reject. It is a good point, but evaluation and learning is part of integrated planning. We also want to keep the figure, which is already wordy, as simple as possible.	Andrea Cristina Ruiz	Abdul Latif Jameel Poverty Action Lab and Member of Committee on Extreme Weather and Climate Change Adaptation Transportation Review Board-National Academy of Science	United States of America
59563	71	14	71	16	Section 16.7 would be improved by a more expansive introductory paragraph outlining the key thoughts to be developed in the ensuing section narrative.	Taken into account. A more expansive intro was included	Government of United States of America	U.S. Department of State	United States of America
59565	71	17	71	18	Given the declarative nature of this statement, the authors should consider providing a reference or provide further information to support the statement.	Taken into account: the statement was softened to indicate that the statement is related to the literature assessed	Government of United States of America	U.S. Department of State	United States of America
23695	71	18	71	19	This review would have benefited from considering economic geography (Jaglin, Verdeil, 2013; Rateau, Jaglin, 2020), anthropology of technics (Heilbron, Leliveld, Knorringa, 2017 ; Meagher 2018), and development studies (Dolan, Rajak, 2018). These disciplines draw a complete and exciting portrait of innovation in and for developing countries. For more than ten years, in many African and Asian countries, research has highlighted new dynamics in innovation emergence and adoption in vulnerability contexts.	Noted, this is more of a comment for the whole chapter than for the knowledge gap section. Full references are not provided.	Government of France	Ministère de la Transition écologique et solidaire	France
12455	71	30	71	30	Consider replacing "that" with "mitigation"	Accepted	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
12457	71	30	72	1	???	Accepted: The sentence was revised	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
15707	71		71		"Climate Related Innovation" would be changed into "Climate Relevant Innovation".	Taken into account: the figure was removed	Suil Kang	Gwangju Institute of Science and Technology	Republic of Korea
16729	71		71		"Climate Related Innovation" would be changed into "Climate Relevant Innovation".	Taken into account: the figure was removed	Government of Republic of Korea	Korea Meteorological Administration (KMA)	Republic of Korea
61171	72	10	72	10	In addition to the gaps identified in this paragraph, evaluations of how effective technologies are in the real world are essential. Economic, behavioral, and other barriers can impede take up, adoption, implementation, among others. Policy evaluation on technological implementation, just like technological innovation, is vital for confronting climate change. It can help build the case for policy action and ensure that good technologies achieve their ultimate goals. The link has an example of technological innovation that was not effective because of behavioral issues. Evaluations like the ones summarized in the link help inform the effectiveness of policy. <a href="https://www.povertyactionlab.org/policy-insight/encouraging-residential-energy-efficiency">https://www.povertyactionlab.org/policy-insight/encouraging-residential-energy-efficiency</a>	Taken into account, innovation policy implementation added to the text.	Andrea Cristina Ruiz	Abdul Latif Jameel Poverty Action Lab and Member of Committee on Extreme Weather and Climate Change Adaptation Transportation Review Board-National Academy of Science	United States of America
8911	72	25	72	31	Agree that more research is needed on the interplay of digitalisation and decarbonisation in line with V. Sivaram, ed., Digital Decarbonization: Promoting Digital Innovations to Advance Clean Energy Systems, Council on Foreign Relations, June 2018.	Thank you.	Seth Dunn	ServiceMax	United States of America
51855	72	32	72	34	Under the UNFCCC, work on the Enhanced Transparency Framework for action and support is ongoing work. In addition, the first periodic assessment of the Technology Mechanism is scheduled to be initiated at COP 26 (2021).	Taken into account: references to the Transparency framework and the assessment of the TM were included	Florin Vladu	UNFCCC Secretariat	Germany
28073	72	36	72	36	After "key mitigation", add "and adaptation" sectors.	Taken into account: the sentence was deleted	Eleni Kaditi	Organization of the Petroleum Exporting Countries, OPEC	Austria
59567	72	39	72	40	This section needs to be revised to remove instances of "will be needed" or similar phrasing that implies policy requirements. Better phrasing is "will likely be needed" or similar. Even better is "Technological changes will be more effective when combined with policy and behavioural changes and changes in the financial system." (from page 73, line 1).	Accepted. The section has been revised accordingly	Government of United States of America	U.S. Department of State	United States of America
9395	72	39	73	18	Can you be more precise about the "Paris Agreement objectives" in this FAQ, please? Is this a reference to the warming limits or what else is included here?	Taken into account: PA objectives refer to mitigation objectives	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
9399	72	39	73	18	In case you would like to highlight the holistic approach and the multiple systems transitions, you could also consider rephrasing the question to "How can innovation and technological changes support meeting objectives from the Paris Agreement?" or "What is the context for innovation and technological changes sufficient to meet objectives from the Paris Agreement?" Otherwise people might wonder if the question is aimed at the sheer amount/rate of innovation (but it's the context that counts as well, I understand?).	Taken into account. The paragraph was rephrased.	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
9397	72	42	72	43	What do you mean by "business-as-usual innovation"? The term sounds confusing at least to me, because how can something be "as usual" and innovative at the same time? Where is the difference between "as usual" and "fast" (technological change)?	Taken into account: the adjective business-as-usual was removed	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
51303	73	3			There are few mentions of low-tech (e. g. p. 44, line 19). Low-tech innovation should play a more substantial part in the entire chapter, instead of focusing on the development of more technology that is only fit for specific contexts. Also referring to the possibility of re-discovering practices, such as old cultural practices in farming, that are 'innovative' (because we might have forgot them) but not technological.	Taken into account. the role of low-tech innovation was emphasized across the entire chapter. See, for instance, Box on Agriculture and section 16.6.	Stefanie Kunkel	Institute for Advanced Sustainability Studies (IASS), Potsdam	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
59569	73	9			Consider changing "holistic approaches are needed" to "holistic approaches are much more effective"	Taken into account: the para was rephrased	Government of United States of America	U.S. Department of State	United States of America
9401	73	19	73	20	I might like to suggest using a stronger term than "promote" in this context, for example "advance" or "accelerate". The latter might also better reflect the speed that is referred to in the answer - if it is worth highlighting.	Taken into account: the para was rephrased	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
59571	74	1			Replace "would" with "was required to"	Taken into account: the para was rephrased	Government of United States of America	U.S. Department of State	United States of America
9403	74	2	74	2	I wonder if "climate response" is the right term here? I often see it being used in the meaning of "the climate responding to something" (e.g. greenhouse gas emissions). But here it means "response to climate change", I think? Would "climate change mitigation and adaptation" be appropriate?	Taken into account: The whole paragraph was revised.	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
59573	74	4			Consider changing from "poor countries are able" to "it enables less developed countries"	Accepted	Government of United States of America	U.S. Department of State	United States of America
59575	74	7			Consider changing from "participate fully in" to "participate fully in, and contribute to,"	Taken into account: The whole paragraph was revised	Government of United States of America	U.S. Department of State	United States of America
9405	74	11	74	12	Does the Paris Agreement also consider that developing countries might not always be able to adopt technologies from developing countries, but create their own ones? Is there any evidence that co-produced solutions are sometimes more useful than a unidirectional technology and knowledge transfer? Partnership and collaboration are mentioned in the next paragraph, but it is unclear if this includes developing and developed countries.	Noted. Yes, that is what the previous paragraph is all about.	Maike Nicolai	Helmholtz Centre Geesthacht	Germany
23697	75	19	75	21	the reference : " A. Dechezleprêtre, D. Hemous, R. Martin, and J. M. Van Reenen, 2013: Carbon Taxes, Path Dependency and Directed Technical Change: Evidence from the Auto Industry. SSRN Electron. J., 124, 1–51, <a href="https://doi.org/10.2139/ssrn.2202047">https://doi.org/10.2139/ssrn.2202047</a> ." has been published in 2016 in Journal of Political Economy 124(1), 1–51	Accept, this will be changed.	Government of France	Ministère de la Transition écologique et solidaire	France
29823	110	16	110	18	Please consider adding the following hyperlink ( <a href="https://www.resourcepanel.org/reports/assessing-global-land-use">https://www.resourcepanel.org/reports/assessing-global-land-use</a> ) at the end of the reference to the report by the International Resource Panel, referred to in the list of literature as: UNEP, 2013: Assessing Global Land Use: Balancing Consumption with Sustainable Supply. A Report of the Working Group on Land and Soils of the International Resource Panel. S. Bringezu et al., Eds. UN Environment, 46 pp.	Accept, that is an improvement	Government of Norway	Norwegian Environment Agency	Norway
85615	110	19	110	29	First author name is missing. There are many other references missing the first author.	Reject. The dash means that it's the same author (in these cases, publishing institution) as the previous reference.	San Win	Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation	Myanmar
10055					There should be a section to address innovation in non-industrialized countries, e.g. challenges, reasonable scope (considering their limitations), improvement strategies, etc.	Noted. We have carefully considered this suggestion. Common practice is that developing countries are not singled out but that in different areas, the specific challenges are highlighted. Information on this will be found throughout the chapter, highlighting in particular the challenges in institutional capacity and R&D funding levels.	Government of Indonesia	Ministry of Environment and Forestry	Indonesia
12361					Table 16. 1 The table uses several concepts and ideas that cannot be understood and remain perplexing without further extensive digression. I therefore suggest (a) changing "Main disciplinary home" to "Main discipline"; (b) Deleting "Minimum inputs", (c) Deleting "Compromise in competition", (d) Deleting "Maximum realization".	Accept. This table has been removed completely and its messages have been included in the new text of 16.6 (what used to be 16.2).	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
12401					Table 16.6 p 34 Please check the formulation of the "Empirical sub-categories", particularly under "Hard institutions2 and "Market constraints". They are impossible to understand out of context and arguably wrong at places.	Noted. The table is based on the reference (Negro et al 2012) and is a representation of that meta-study. There is more explanation in the text, also based on a broader set of references.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
12413					Box 16.4 Fig 1. The figure is hard to read. In particular, the light yellow "unallocated" is indiscernible.	Noted. The quality has been improved. The 'unallocated' is very small and therefore hard to see.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
12421					Box 16 7 is less well formulated than others	Taken into account. We checked the language.	Christophe Deissenberg	Institute for Non-Linear Dynamic Inference	Luxembourg
51305					Ideas of social innovations, not market-driven innovations, including alternative economy concepts could be discussed.	Taken into account. Social innovation and non-market-driven innovation is included in section 16.6 (the old 16.2) but social innovation in particular in chapter 5. Alternative economy concepts are not in the scope of this chapter.	Stefanie Kunkel	Institute for Advanced Sustainability Studies (IASS), Potsdam	Germany

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
4059					Innovation and technology have been identified as one of the six elements needed to face climate change and sustainable development. In my perception, the authors have focused constructed the chapter based on the definitive aspect of those innovations and technological advances related to primary production and energy generation. This approach, mainly oriented by a mitigation perspective, have masked, to some extent, the available direct evidence of innovation and technology on informatics as quintessential tool in i) identifying trends, not only about hydrological and meteorological variables at different spatial and temporal scales; but also, on ii) quantifying the effects of climate change on different systems; including iii) the monitoring of the provision of key regulatory ecosystem services; and iv) technological innovations in the generation of early warnings, guiding the decision-making process at different scales. The last defines the concept of climate services.	Noted. The important elements highlighted are mainly addressed in the WGII part of the AR6. We have made some reference to it in Box 16.8, and chapter 14 discusses international cooperation on science and monitoring. For the remainder, it is not in the scope of chapter 16.	Hugo Mantilla-Meluk	Universidad del Quindío	Colombia
4063					It is also necessary to reinforce the idea of innovation as a byproduct of transdisciplinary frameworks and organizational schemes. That is why the generation of think tanks has been an important strategy in yielding innovative technological advances. There is also necessary to stress that there are fundamental differences between the interdisciplinary and the transdisciplinary approaches. Within the first one, the collaborative efforts are additive but not necessarily fused, a condition required within the second one, increasing the opportunity for intersecting points that may lead to new methods and concepts.	Taken into account. References to transdisciplinary and interdisciplinary research are all over the chapter. The reference has also been highlighted in section 16.6 (which is heavily rewritten). The role of think tanks (or, some would call the CRIBS) are highlighted in section 16.5 on international cooperation, and also extensively in 16.4.	Hugo Mantilla-Meluk	Universidad del Quindío	Colombia
4065					To reinforce the already included in the chapter idea on the relationship that exists between ICT's and SDG's, I suggest reviewing these references: EITO. (2002). The impact of ICT on sustainable development. Retrieved February 15, 2017, from <a href="http://homepage.cs.latrobe.edu.au/sloke/greenIT/eito_forum_2002.pdf">http://homepage.cs.latrobe.edu.au/sloke/greenIT/eito_forum_2002.pdf</a> Jones, P., M. Wynn, D. Hillier, and D. Comfort. 2017. The Sustainable Development Goals and Information and Communication Technologies. Indonesian Journal of Sustainability Accounting and Management, 1(1): 1–15.	Taken into account, the references have been reviewed. EITO 2002 gives an interesting framework but is also outdated, in particular since ICT has gone through unimaginable development in the past 20 years. Jones et al 2017 gives a (self-admitted) preliminary assessment, which by now has been complemented with more empirical work.	Hugo Mantilla-Meluk	Universidad del Quindío	Colombia
20273					The whole chapter usefully covers off the various drivers (and associated barriers) of innovation in Section 16.3.2. The chapter then offers an overview of the systemic approaches to diagnosing the performance of innovation in Section 16.4, focusing in on the innovation systems framework.  There are however a number of important aspects of the Technology Innovation System framework that is overlooked.  1. Core ingredients of a TIS  The core tenets of a TIS can be defined as: actors, networks, institutions and technology/infrastructure (see Hekkert et al., 2011; Jacobsson and Karltorp, 2013). Again this is referenced in Chapter 6 of 'Skea J. et al. (2019) Energy Innovation for the Twenty-First Century. Edward Elgar Publishing', and links to seminal papers with in-text references. These 'key ingredients' of a TIS (and innovation systems more broadly) ought to be made clear, as it is changes to these dimensions that ultimately impact upon the performance of TIS functions and the extent to which the system does or does not support innovation. It is therefore an important means of highlighting where government or industry may focus interventions.  - Hekkert, M.P., Negro, S.O., Heimeriks, G. and Harmsen, R. (2011) Technological Innovation System Analysis: A Manual for Analysts. Utrecht: Utrecht University - Jacobsson, S. and Karltorp, K. (2013) Mechanisms blocking the dynamics of the European offshore wind energy innovation system: Challenges for policy intervention. Energy Policy. 63, 1182–1195, doi: 10.1016/j.enpol.2013.08.077.  2. Blocking or inducement mechanisms of TIS functions.  Linked to the above point about the four key tenets of a TIS, are the blocking or inducement mechanisms that link these four dimensions to TIS function performance. Chapter 6 of 'Skea J. et al. (2019) Energy Innovation for the Twenty-First Century. Edward Elgar Publishing; 2019. Accessed March 12, 2021.', offers an explanation below of their value:  "Fulfilled or unfulfilled system functions are associated with the presence and/or quality of structural elements (Wieczorek and Hekkert, 2012), known as inducement or blocking mechanisms (Bergek et al., 2008b; Jacobsson and Karltorp, 2013; Patana et al., 2013)." (p.159)	Noted. The comment, with a rich array of references that are mostly used in chapter 16, essentially suggests a more exclusive focus on TIS as an organising framework. We discuss TIS, including the structural components, in section 16.3 (the old 16.4). The blocking and inducement mechanisms (which is specific language in the TIS-world) are indirectly discussed in section 16.4 (the old 16.5), and 16.5 (for international issues). The interaction and feedback loops are discussed in a new CCB 12 on transition dynamics. We have to review a number of frameworks in the literature, and, although we find TIS useful, cannot constrain ourselves to that framing alone.	Hannon Matthew	University of Strathclyde	United Kingdom (of Great Britain and Northern Ireland)

Comment Id	From Page	From Line	To Page	To Line	Comment	Response	Reviewer name	Reviewer Affiliation	Reviewer Country
20279					<p>I welcome the focus on sub-national innovation policies in Section 16.5.7. Much of what is in here is valuable. However, one important missing piece of the discussion is how local and regional policy making is situated within a multi-level policy (and more broadly governance) framework. I note this is covered in Section 17 to some extent, with reference to policy mixes for sustainability transitions. The point here however is much more specific to innovation policy.</p> <p>Taking the case of UK we have policy making responsibilities sitting at local, devolved administrations (e.g. Scotland), national and (to a much lesser extent since Brexit) supra-national levels. Powers that are either devolved to sub-national entities or reserved by national entities. What we do know is how powers are dispersed and the extent to which they form a 'coherent whole' is important to innovation. The policy mix (as you reference in Section 17 and pioneered by authors like Rogge, Kivimaa, Kern etc.) must be 'joined up' and work in the same direction, with a shared goal. It's important to avoid a uncoherent, messy innovation policy mix, with policies duplicating effort, or worse yet, working in opposite directions.</p> <p>- K.S. Rogge, K. Reichardt, Policy mixes for sustainability transitions: An extended concept and framework for analysis, Res. Policy. 45 (2016) 1620–1635. <a href="https://doi.org/10.1016/j.respol.2016.04.004">https://doi.org/10.1016/j.respol.2016.04.004</a>.</p> <p>- P. Kivimaa, F. Kern, Creative destruction or mere niche support? Innovation policy mixes for sustainability transitions, Res. Policy. 45 (2016) 205–217. <a href="https://doi.org/10.1016/j.respol.2015.09.008">https://doi.org/10.1016/j.respol.2015.09.008</a>.</p> <p>The case of UK wave power (see Hannon et al. 2017 - <a href="https://doi.org/10.17868/62210">https://doi.org/10.17868/62210</a>) deals with the issue of multi-level policymaking for innovation. First, on Fig 5 on p.24 and Fig 7 on p.31 illustrates the multi-level nature of policy making. Second, the lack of co-ordination across these levels led to a lack of a coherent strategy, whereby policy was all moving in the same direction: "There are still significant opportunities to improve the degree of co-ordination of wave energy RD&amp;D support both within and across different levels of government" (p.109) and on p.111 how "devolution has led to a complex, multi-level energy innovation governance framework that has created difficulties in terms of co-ordination and policy landscape navigation". It also meant that there was a duplication of effort and potential wastage of funds, whereby similar policies were implemented by different governmental units, operating at different scales:</p> <p>"The weakest area was cross-government coordination, which led to the duplication of funds that had a negative impact on resource mobilisation (F5) and the lack of a single, unified RD&amp;D strategy across different funding bodies and layers of government, undermining the guidance of the search (F4)" p.94</p>	<p>Taken into account. Not only in section 16.5 (now 16.4), but also in other sections, the aspect of government coordination is extensively discussed. The references suggested have been included in the reference (or were already there). The area of multi-level governance and institutional coordination is mostly discussed in chapter 13 and also 14 (where international cooperation is included).</p>	Hannon Matthew	University of Strathclyde	United Kingdom (of Great Britain and Northern Ireland)
7713					International community's action about climate change and opposing reactions must be free of any politic and must be only environmental.	Noted. We work on the basis of non-politicised assessment of the literature.	Leila Rashidian	Meteorological	Iran
7715					Iran have high potential of clean energies and renewable energies because if it's geographical location.	Noted.	Leila Rashidian	Meteorological	Iran
86087					It is surprising that there is no mention of social contagion in the adoption of clean technologies (see Carattini, Levin, Tavoni REEP 2019 for a review) and in particular for hybrid cars (Narayan and Nair 2013; Heutel and Muehlegger 2015) and solar PV (e.g. Bollinger and Gillingham 2012; Graziano and Gillingham 2016; Rode and Weber JEEM 2016; Baranzini, Carattini, and Péclat GRI WP 2017). It is also surprising that there is no discussion of visibility (and lack thereof), see Carattini, Levin, Tavoni (REEP 2019) and Carattini, Gosnell, Tavoni (World Development 2020) and on how to bring non-normative behaviors to normative (e.g. Spencer, Carattini, Howarth RBE 2019). One would expect clean cookstoves (e.g. Srinivasan and Carattini EE 2020) and other technologies relevant to developing countries to also be covered.	Noted. Social contagion is covered in chapter 5. On cook stoves, we had to make a choice on which specific technologies to focus on in the illustrative boxes. Chapter 6 covers clean cooking already.	Carattini Stefano	Georgia State University	United States of America
59577					There are several problematic references to technology transfer. Prefer the terminology "technology development and transfer". This section has a bias in favor of developing countries and should not suggest that transfer of technologies should occur in a manner than isn't voluntary and on mutually agreed terms.	Accept. We have reviewed the terminology. Sometimes, technology transfers is specifically meant, so it is referred to as such.	Government of United States of America	U.S. Department of State	United States of America