INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

Special Report on Renewable Energy Sources and Climate Change Mitigation

Voluntary Government Review of Chapter 9
Nov 24, 2010 – Dec 20, 2010

Chapter 9

[1] *see <<http://ipcc.ch/pdf/ipcc-principles/ipcc-principles-appendix-a.pdf>>, Section 4.1 and clarification in decision 8 on procedures taken at the 33rd Session of the Panel <<http://www.ipcc.ch/meetings/session33/ipcc_p33_decisions_taken_procedures.pdf>>*

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Klaus Radunsky (Umweltbundesamt)	9	0	-	-	-	-	-	-	"Chapter 9 should focus on ""renewable energy in the context of sustainable development"". However, text is included that is covering topics that are beyond the scope of the chapter and even beyond the scope of the Special Report. It is suggested to delete such text."	The chapter has been carefully revised with respect to the focus of the special report.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"In discussing the attributes of sustainability, some reference to efforts (even if mostly conceptual rather than empirical) at developing a measure of ""green GDP"" seems desirable. Hamilton's work on that topic is cited in the bibliography but does not appear to have been explored in the text."	Hamilton's work on green net national product is cited but space limitations do not allow for an extensive discussion on this.
Klaus Radunsky (Umweltbundesamt)	9	0	-	-	-	-	-	-	"It is noted that many parts of chapter 9 are very theoretical/academic. It would have been preferred to include more information that is relevant for decision makers and that is informed by example of the real world. It might have been a good choice to invite also some ""practitioners"", e.g. representatives from the finance sector and from energy sector in developed in developing countries to participate in the writing team."	Efforts have been made to focus less on academic discussions of strengths and caveats but be more explicit on the results.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"Make the baseline scenario explicit-- the chapter lacks a clear description of the counterfactual. As such, it is difficult to impossible to assess the validity of statements (such as that found in the ES, lines 9-10, ""..this literature suggests that socio-economic benefits are usually higher and environmental impacts lower with an increased use of renewables...."""). If increased use of renewables completely augment, rather than displace, their fossil substitutes, it is hard to see how this generalization could be true. If increased use of renewables displaces an energy equivalent amount of coal, it is probably an understatement. Chapter 11 is probably a better place to flesh out this issue, but Chapter 9 should at least acknowledge it."	The baseline scenario has been made explicit. Throughout section 9.3, RE technologies are compared to fossil fuel and nuclear energy technologies which dominate the current energy system. In Section 9.4 on the other hand, all mitigation scenarios have an implicit reference to a baseline scenario; this is explicitly mentioned in Section 9.1.1. . As such, both sections do provide a clear reference to the counterfactual.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"Overarching Chapter 9 Comments 2 of 10: Chapter Front-End. In general, the chapter beginning is long and unfocused. With the wandering text, the reader gets bogged down trying to find the important nuggets of information. Only SD concepts that are important to the chapter¿s logical development should be introduced, with an eye toward the ""synthesis"" (9.6) messages at the end. "	the chapter has been thoroughly edited to address this issue

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Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"Overarching Chapter 9 Comments 4 of 10: ""Weak-Strong Sustainability"". The bifurcation of weak and strong sustainability is a tangential discussion that diverts attention from the ¿three pillars¿ and ¿four goals¿ discussion, which sets up the main message(s) of the chapter. It offers a dense and obscure look at sustainable development (SD) and throws the reader off track when concepts are introduced early, only to taper off or never be used again in the rest of the chapter. The discussion should be deleted, or shortened to a small text box. "	The relevance of these concepts for decision making has been strengthened and is covered in Section 9.6.6.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"Overarching Chapter 9 Comments 6 of 10: Energy Security. The discussion of energy security lacks sophistication and is unduly oriented toward physical arguments. ""Imports"", for example, are not by themselves vulnerabilities. ""Availability of resources"" suggests the need for indigenous supplies, where most countries would be better served by ""access to energy markets"". ""Risk of disruption"" addresses a real concern, but would be better understood as ""reliability"" (electricity, gas) or ""reduced vulnerability to energy price shocks"" (world oil markets). ""Diversification"" is a concept that should focus on ""sources"" of energy supply, in addition to ¿types¿ of energy supply. ""Temporarily fluctuating sources"" seems to be RE-specific and would seem to overlap with the other three."	The section has been revised accordingly.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"Overarching Chapter 9 Comments 9 of 10: Normative Phrases. Normative phrases still appear in the revised draft. For example, the Brundtland definition of SD (p. 9) suggests that if clean use of fossil fuels can ""meet the needs of the present without compromising the ability of future generations to meet their own needs"", then such fuels cannot be excluded from the portfolio of sustainable energy solutions. It would be incorrect to label all fossil fuel solutions as ""not sustainable"". It is also misleading to label fossil fuels as a ""temporary"" solution, if clean uses can extend for centuries into the future. FE in its potential future forms may provide affordable pathways to a long-term SD."	Wording has been improved
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"Please add a detailed list of the acronyms encountered in the document. (e.g. Not everyone will recall when he/she first came across, the acronym ""IAM."")"	Done as suggested.

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Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"Regarding ways to reduce the length of the document, please take a hard look at the style of writing. Phrases such as ""In the context of¿. (p. 6) Or ""one of the key points that emerges from the literature is that..."" (p. 6) and ""In contrast to the foregoing section that focused on the impacts of current and developing RE systems on SD criteria (p. 66 line 1) need to get to the point faster. In addition, phases like sustainable development (SD) and renewable energy (RE) once introduced should be referred to by their acronyms. "	the chapter has been thoroughly edited to address this issue
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"Summary of U.S. Government Review of Chapter 9 Rewrite of the IPCC Special Report on Renewable Energy and Climate Change Mitigation (SRREN): Compared to the earlier draft (June 2010) of the SRREN¿s Chapter 9 (Renewable Energy in the Context of Sustainable Development), the IPCC¿s rewrite is generally responsive to earlier comments. It presents more information and supporting documentation. Its tone is factual, with less advocacy and use of normative terms, although some issues remain. The chapter¿s organization and style, however, offer opportunities for improvement. At 98 pages of text, excluding references, the chapter is too long and 30 pages over budget. The rewrite attempts to address too many topics, with inconsistent levels of depth. Its structure appears formulaic, giving rise to low-priority text and repetition. The chapter is designed to fill a topical gap in the overall SRREN by addressing non-technical, non-economic dimensions of RE, but its emphasis on physical metrics, with little context for the intra- and inter-temporal dynamics of markets, substitutions and innovation, suggest a lack of sophistication."	The chapter team disagrees on both points of the following argument: "... that the chapter is designed to fill a topical gap in in the overall SRREN by addressing non-technical, non-economic dimensions of RE, but its emphasis on physical metrics, with little context for the intra- and inter-temporal dynamics of markets, substitutions and innovation, suggest a lack of sophistication." First, the chapter is not designed to address non-technical and non-economic dimensions of RE; quite the opposite is the case, in particular following comments from the last expert review in which the purely qualitative nature of the assessment had been critised. Second, by focusing on integrated models and assessing their suitability to address SD and RE related questions, the intertemporal dynamics of markets etc. are explicitely addressed in the analysis.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"The chapter is very ""dense"". It contains much information and analysis that it is difficult for the reader to grasp the key points. The beginning of the chapter should have a short (<2 page) summary of the key points. This summary should clearly and concisely describe how RE supports the key RE measures discussed in the chapter. Avoid defensive language and simply state facts and points."	A throrough edit has improved readability and clarity. The synthesis section now clearly combines all the information collated throughout the chapter.

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Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"The self-standing ""Technical Summary"" seems unnecessary, while the 3-page Executive Summary seems to short to support a hefty message. Would it make sense to consolidate the two?"	This is according to IPCC procedure and cannot be changed. The TS has been revised.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"The structure of the Chapter's discussion is organized around the four ""criteria"" (p. 12). This framework appears to be useful in moderation, but it also sets up a formulaic approach to every text section, adding length and repetition. Perhaps, these themes could be introduced, elaborated upon to the extent necessary in the early sections, but then revisited in following sections with brief text, adding only new information. "	the chapter has been thoroughly edited to address this issue
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"There are three places where the authors could possibly improve the missing aspect of a critical economic framework while keeping this thing manageable: Third, in the Synthesis, please discuss the need for better economic data. Economic impacts of RE integration in developing nations is difficult to quantify; as economic data there is sparse."	The synthesis has been revised.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"There is little discussion of siting and zoning. The authors note there is little literature linking those land use issues to IAMs. There are detailed discussions on land use changes regarding biofuels and conversion of forests to crop lands. Another land use issue is the mushy, but emerging issue of ""smart growth,"" which refers to, among other things, land use development and siting infrastructure near public transportation. It also includes developing or redeveloping areas with density in mind. U.S. EPA and U.S. DOT have done lots of work on this. This should fall into the general sustainability discussion-- even if its not considered sustainable development in the traditional sense. Perhaps these are areas that need to be further studied in the future as well."	Chapter 2 is dealing with these issues. A cross reference to the discussions there has been provided.

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Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	0	-	-	-	-	-	-	"This chapter assesses the knowledge in a relatively difficult field, sustainable development. The authors tries hard to find metrics and to describe methods, mostly IAM and LCA, to calculate various aspects of SD. However, sustainable development, as acknowledged by the authors several times in the chapter, is more complex than what is currently captured in single metrics. In general, the chapter puts too much weight on finding global metrics and too little focus on describing the local and regional context in which most aspects of sustinable development could be seen. There is also a lack of describing the necessessity and examples of providing sensible policy context for ensuring sustainable development in the context of renewable energy, e.g. sustainable land use policies for biofuel development or workers rights in the mining industry for accessing rare metals used for PVs e.t.c. This assessment seems tilted towards engineering and economic studies (that is what IAM is regardsless of what you try to include into the models) and ignore the field of sociology, political science, general development studies and the new field of ""sustianability science"". Most facts (especially climate and environmental effects e.t.c.) presented in this chapter could be found better described in other chapters of this report and this chapter merely repeat the issues in some cases. However, this said, the chapter still provides some good points and useful insights in a difficult field. "	The chapter has been drafted in order to provide some quantitative assessments for aspects that are often only described in a qualitative manner. The comment is accepted in so far that section 9.5 has been improved to provide more regional detail and country specific examples. The need for SD management practices in the context of bioenergy is also emphasised in Section 9.3.4.1 and clear references for an in-depth discussion of this topic in Chapter 2 are provided. Also redundancies with other chapters have been reduced.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	"While, in the nature of things, it is not easy for an IPCC document to stray far into geopolitical phenomena, the energy security discussion would benefit from at least trying to get as close as possible to such concerns as is diplomatically possible. It may be that the document's reliance on traditional energy security markers ¿ e.g., import dependence, concentration of resources and reserves ¿ which, in turn, justify anxiety about the exercise of market power, need to be complemented by some awareness of resource/environmental strategies motivated by political factors. Australia's cultivating a greener image by shifting from domestic coal consumption to large-scale coal exports to China ""balanced"" by coal-intensive manufactured exports back to Australia (and elsewhere) is just one illustration of such a situation."	Sentence has been added in Section 9.3.1.1

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David Warrilow (Department of Energy and Climate Change)	9	0	-	-	-	-	-	-	A firm edit could probably reduce the size of this document by at least 20% without losing impact. For example there are a number of boxed out case studies at 1 page length which could easily be haled in length.	Chapter has been thoroughly edited to address this issue.
David Warrilow (Department of Energy and Climate Change)	9	0	-	-	-	-	-	-	A key purpose of this chapter from the developed country Government perspective would be to inform decision making on aid, where it relates to supporting energy infrastructure in developing countries and how this supports climate change mitigation. The chapter could perhaps improve its focus with this in mind and therefore reduce its word length. Key questions that would need answering would be: what is the rationale for renewables over fossil fuels? How do you assess the costs benefits (including what are the tools for doing so)?. Developing Country Governments, however, are likely to to want to know what influence renewable energy is likely to have on their development, what options are available and how to implement them. Although many of these points have been made, they could be much snappier and concise. There is currently also substantial repetition, which if removed could shorten the chapter significantly.	Synthesis section 9.6 has been completely redrafted to address this issue
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	An issue not raised that seems important for assessing the feasibility and sustainability of renewable energy is transmission from point of generation (e.g. does this constrain where electricity can be generated or does it imply figuring out how to transmit solar and wind energy some distance to the point of generation?) and transportation of fuels to where they are to be used (e.g. pipelines). This is particularly important when scaling up to larger units - micro units can only take a country so far in meeting its energy demand, which means that these issues and the types of environmental effects that result will also be important. This seems like an important omission from the report.	This issue is covered in CH8; several links to the discussion are included in the seciton.
Klaus Radunsky (Umweltbundesamt)	9	0	-	-	-	-	-	-	Chapter 9 is well above the length it should have. It is noted that there is significant repetition between various subchapters. In order to shorten the text it is suggested to avoid any of such repetition but to make more frequent use of references within the chapter.	Chapter has been thoroughly edited to address this issue.
Petteri Taalas (Finnish Meteorological Institute)	9	0	-	-	-	-	-	-	Coordination of references and results with techological chapters should be done	Chapter has been thoroughly edited to address this issue.

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Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	In addition, the USG Chapter 9 review team synthesized a number of general or overarching comments pertaining to Chapter 9. These comments, while critical in nature, highlight ways to both improve the clarity of the chapter and shorten the chapter, as requested by the TSU. The general comments are communicated here to draw attention to overarching concerns or omissions, strengthen and improve the balance, accuracy, and utility of the next draft, and advance the broad interests of all nations in maintaining and enhancing the credibility and authoritative reputation of the IPCC.	Accepted
Tormod Schei (SRREN ch 5)	9	0	-	-	-	-	-	-	in general ch 9 is quite good!	Thanks.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	It would be helpful if the data shown in the figures were also shown in tabular form, perhaps in the appendices. Having the minimum, median, maximum, standard deviation, and number of samples for each data point in the figures would make this report a more useful long-term resource.	will consider to include data in Methods Annex, but might not be feasible
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	Keep in mind the fossil energy supply that the world has can be used in certain contexts cleanly.	CCS is discussed in the Chapter.
David Warrilow (Department of Energy and Climate Change)	9	0	-	-	-	-	-	-	Land Use Change has been taken out of the equation.¿ We know that this is a prudent thing to do scientifically, since the evidence base is weak, but the impact of LUC is potentially so large that the implications should be discussed.¿ This reinforces the impression that this is largely an academic treatise.	the importance of LUC is being elevated in the revision to this Chapter. It has always had its own, lengthy box, but is now being increasingly integrated into the other sections.

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Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	Overall this draft is a vast improvement over the previous draft. Much better written and devoid of normative comments and points of advocacy. This draft does a better job of cross-referencing to other chapters within the SRREN, but it would benefit with even more such referencing. The paper also does a much better job in its citations of the literature. The draft also is extremely good at acknowledging the limitations of the existing knowledge base and the methodological weakness of current models. However, it is on this issue that lies the draft's greatest defect. While the remit of the study and the intention of the paper was to review the technical literature on the top (Chapter 9: RE and SD), the focus was far too reliant on and shackled to the extant econometric and broader energy models that the report repeatedly and quite accurately acknowledges to be found wanting on this topic. That assessment of the rather anemic state of knowledge, based on current modeling assumptions and cognitive frameworks is important in and of itself. However, by the report not going beyond the current bounds of traditional energy models, and failing to capture the rich literature of the broader social sciences, such as anthropology, sociology, and geography that address, to a certain extent the methodological shortcomings of current models, reifies the impoverished state of knowledge and diminishes the value of the paper. Additionally, there remains redundancies of treatment of the various subthemes in this draft, notably: energy security, economic development and environmental degradation. It is much better than the previous draft, but several sections could be combined and/or paired down.	Concerning the structure: Repetitions and redundancies have been reduced. See also answer to comment 519/4

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Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	Overarching Chapter 9 Comments 1 of 10: Chapter Purpose. According to a key phrase early on (p.7), the purpose of Chapter 9 is to explore dimensions of SD that are not traditionally addressed in economic, LCA or IAM analyses. Later (p.91), there is a concluding statement that technological and the economic analyses of renewable energy (RE) need to be embedded in the broader context of sustainable development. In some ways, both goals are compromised. The augmentations address some non-traditional aspects of resource economics, but do not address literature from the social sciences, such as anthropology, sociology, geography, etc. The discussions of SD that are addressed lack embedded frameworks of economics that lead to syntheses of the literature.	Concerning the literature, a detailed discussion in social sciences on sustainable development and renewable energy as claimed by the reviewer did not prove true after significant efforts to track it.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	Overarching Chapter 9 Comments 10 of 10: Model Apologetics. The text speaks about the models, but then repeatedly places caveats (and notes of failings) of the models. Caveats are important reminders of the limits of modeling, but too many caveats undercut confidence in key messages and do little expand the horizon of knowledge on this topic. Why spend so much time on the models in this paper if they aren¿t useful?	We think that models are useful and intend to be explicit on their caveats at the same time. However, we agree that the text was too defenisive and a focus has been put on results, rather than on caveats.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	Overarching Chapter 9 Comments 3 of 10: Edit and Restructure. Consider restructuring the sections to reduce redundancies, and reworking text to make more efficient. Sections 9.1, 9.2, and 9.3 could be shortened 30-40%. Discussions of water, biofuels, and transportation could be pared down. If possible, details on individual technologies could go into boxes or tables. The later sections are better written, but the early sections lack purposeful structure and are overburdened by unnecessary content.	the chapter has been thoroughly edited to address this issue

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Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	Overarching Chapter 9 Comments 5 of 10: Lack of Economic Context. Although Chapter 9 is not supposed to address technical or economic aspects of RE (since other chapters do this), at times the text on SD in isolation is awkward without a reference to a larger economic or policy context. For example, the chapter mentions how RE will benefit off-grid populations and help poor or developing countries, but it does not suggest how this will happen, how much it will cost, or who will pay. As such, the reader is challenged to understand whether RE in the context of SD is fundamentally good or bad, or even under what circumstances such outcomes would be clear.	Better cross-references to other Chapters (in particular 10 and 11) have been provided. Also a new Section 9.3.1.4 on Financing RE has been included.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	Overarching Chapter 9 Comments 7 of 10: Food Security. Chapter 9 (p.81, lines 26-29) briefly touches on food security, but considering its implications it would be worth adding content on this topic earlier in the document. In the context of SD food security is a huge issue ¿ looking toward the future and considering the uncertainty of climate change, there will be a competing need for both food and fuel. As such, food security would seem to be an essential element to any discussion of RE in the context of SD.	The importance of food security is certainly clear and the comment is therefore accepted. However, Chapter 2 of the SRREN already provides a detailed discussion on the issue, explaining the drivers that lead to the competition between food and fuels. Chapter 9 will thererfore not repeat this discussion but provides a clear link to the respective chapter section instead.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	Overarching Chapter 9 Comments 8 of 10: Other Country Data. The chapter focuses on references and data from China, OECD countries, U.S., and Europe. Their applicability to SD in developing countries may be debatable. If possible, the discussion should be expanded include more focus on and data from more poor and developing countries.	Focus was broadened to include more developing countries
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	Policy approach matters--how renewables use is encouraged can be even more important, to environmental quality and sustainable development, than the level of renewables use. This may be an issue best developed in Chapter 11, but is worth mentioning in Chapter 9. Chapter 9 as drafted includes sufficient raw material to demonstrate that, within a particular policy and economic context, increased RE use also improves environmental quality and is consistent with SD. It would be unfortunate if the readers generalized from this that any and all increases in RE necessarily have unambiguously positive environmental and SD effects.	The importance of policy approaches is mentioned in section 9.5 and throughout section 9.3.4; the positive and negative impacts from RE use are clearly outlined and where appropriapte clear links to other chapters (such as Chapter 2) are provided.

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Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	Reducing the size of the chapter from 98 to 68 pages will require significant cuts and will not be easy to achieve. An approach to consider is to condense the existing text (e.g., paragraphs may need to be converted into bullets, certain discussions shortened, some references omitted, etc.). The Technical Summary is a good example in this direction.	the chapter has been thoroughly edited to address this issue
Trigg Talley (U.S. Department of State)	Annex	0	-	-	-	-	-	-	The accompanying Methods Annex and Technical Summary seem to largely repeat information already included in the chapter. If the expectation is that there will continue to be a separate methods and technical summary, this may offer one path forward for cutting text from the main chapter. It doesn't seem necessary to have it in both places.	text has been removed and is now only addressed in the methods annex
Trigg Talley (U.S. Department of State)	TS	0	-	-	-	-	-	-	The accompanying Methods Annex and Technical Summary seem to largely repeat information already included in the chapter. If the expectation is that there will continue to be a separate methods and technical summary, this may offer one path forward for cutting text from the main chapter. It doesn't seem necessary to have it in both places.	text has been removed and is now only addressed in the methods annex
Brian Gray (Environment Canada)	9	0	-	-	-	-	-	-	The Chapter appears biased toward the use of biomass for liquid biofuel production used in transportation and for direct electricity production, and could pay more attention to direct heat generation for heating, or to combined heat and power (CHP). These are tasks for which biomass in general, and forest biomass in particular, is well suited with only minimal processing (See 2010 Manomet Center report, http://www.manomet.org/sites/manomet.org/files/Manomet_Biomass_Report_Full_LoRez.pdf). This is where the large substitution benefits lie, particularly in cold countries.	The use of biomass from forest residues and their advantages with respect avoided LUC have been highlighted in both SPM and Section 9.3.4.1.
Klaus Radunsky (Umweltbundesamt)	9	0	-	-	-	-	-	-	The quality of the subchapters differs considerably with regard to the clarity of language. Chapters 9.5, 9.6 and 9.7 are written very well. It is suggested to enhance at least the quality of the Executive Summary to the same level.	Chapter has been thoroughly edited to address this issue.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	The text of the chapter includes a lot of references, which is generally good but occasionally it makes the reading difficult. Consider omitting some of the less important references in the text, especially when multiple references are made on the same point, to allow for easier reading.	number of references to back certain statements has been reduced

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Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	The U.S. Government¿s (USG¿s) technical review of the rewrite of Chapter 9, and its associated Technical Summary and Methods Annex, took place over an 18-day period from November 23 through December 10, 2010. Twenty (20) technical experts were invited to review and comment ¿ including five (5) who had participated in the June-July 2010 review of Chapter 9. Thirteen (13) experts provided comments. All comments were subsequently deliberated by a subset panel of reviewers in a workshop session. From these deliberations, more than 200 comments were put forward. These will be submitted separately by the U.S. Department of State for further IPCC consideration.	Accepted
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	There are three places where the authors could possibly improve the missing aspect of a critical economic framework while keeping this thing manageable: First, with respect to energy access, provide a comparison of how an RE future would improve the economic productivity of developing nations via improved energy access - as opposed to a BAU baseline.	Point is valid but litterature is not found to base this on apart from case studies (some quoted) and expanding further the section wiht cases is not feasible. For future pathways, i.e. scenarios, the information is not sufficiently covered by the literature as also discussed in the section.
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	There are three places where the authors could possibly improve the missing aspect of a critical economic framework while keeping this thing manageable: Second, with respect to energy security, provide the same - but for developed nations. However, since energy security is such a nebulous concept, pick a single measure. For example, discuss how improved diversity of supply could alter the elasticity of GDP w.r.t. fossil fuel prices in developed nations - that would be really valuable.	We agree, that would be very valuable. But, the information is not sufficiently covered in the literature as also discussed in the section.

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Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	This chapter de-emphasizes a key tradeoff for RE & SD: Because conventional energy systems are still typically lower-cost than RE systems (excepting the important case of rural/remote areas, which was mentioned), low-income countries face a dilemma between investing in conventional energy to reduce energy poverty and increase economic growth in the shorter term (which could put them in a better position to make mitigation investments later on), versus investing in RE systems, which will likely make a smaller contribution to reducing energy poverty and increasing growth due to their higher cost. It is not at all clear that RE systems are a better choice for the poor and for women compared to conventional systems if the latter can be accessed at lower cost. This chapter provides little guidance for assessing this tradeoff.	This trade-off has been addressed as far as possible but no clear-cut answers for this problem are provided in the current scientific literature
Trigg Talley (U.S. Department of State)	9	0	-	-	-	-	-	-	This chapter does a very good job at addressing the role of RE in sustainable development. It is very comprehensive and covers all of the most important aspects in a thorough manner.	Accepted
Brian Gray (Environment Canada)	9	0	-	-	-	-	-	-	Throughout Chapter 9, there seems to be an assumption that biomass for bioenergy is from dedicated production systems such as palm oil and sugar cane. However, there is a sizeable amount of biomass that can be produced sustainably from managed forests in the form of harvest residues, with minimal consequences on environmental values, on leakage through land use change or on water consumption. Although it is currently mostly relevant to developed, forest-rich countries, bioenergy from harvest residues in sustainably managed forests should increasingly be generated as a result of REDD+ projects in developing countries. Afforestation or reduced forest degradation under these circumstances also has a number of co-benefits in terms of other ecosystem services. Nuances could be introduced throughout chapter 9 to capture the distinction between dedicated biomass production systems (often under an agricultural model), and biomass from forest harvest and agricultural residues.	residues are an important resource and have already been mentioned, but will upon revision receive greater attention

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Brian Gray (Environment Canada)	TS	0	-	-	-	-	-	-	Throughout the Chapter 9 section of the TS, there is frequent reference to the objectives or types of information covered in of individual sections of the underlying chapter (see for example, pg 2, lines 5-7 or pg. 3, lines 32-33). This takes away from the presentation of the actual findings of the chapter and is not consistent how other SRREN chapters are presented in the TS. Suggest reviewing throughout to ensure that main focus of TS remains on chapter findings.	Noted
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	0	-	-	-	-	-	-	Throughout the Chapter, there is no discussion of sustainable potentials of the different renewable energy technologies- could this be integrated?	The issue is extensively covered in the technology chapters 2-7.
David Warrilow (Department of Energy and Climate Change)	9	0	-	-	-	-	-	-	While the text is an impressive review of the literature, the synthesis into a set of narrative themes or conclusions is weaker.¿ The main messages are that sustainable development and energy policy are not well integrated, that there is limited agreement on how to do this practically and that there are large research gaps in the underlying data if those are the messages that are intended, this is a solid peice of work. If other messages are intended, they need to be more compelling and drawn from the analysis.	Synthesis section 9.6 has been completely redrafted to address this issue
Brian Gray (Environment Canada)	TS	2	23	2	23	-	-	-	"Suggest that ""increased energy access"" be replaced with ""energy access"" or ""reliable energy access"" in order to better reflect that there are some communities that already have reliable energy access and would not necessarily require increased access. "	Editorial. Replace by "increased (and reliable) energy access"
Klaus Radunsky (Umweltbundesamt)	TS	2	18	2	20	-	-	-	Sustainable development is considered from the point of view of the three pillars: Economy, Society and Environment. Within this framework two philosophies of sustainability are identified, referred to as weak and strong sustainability. Weak sustainability allows for substitution between capital created in the economic and societal spheres, and natural capital from the environment sphere. Strong sustainability makes the assertion that the potential for substitution from the environment is limited and presents a fundamental, biophysical boundary condition for growth of the societal and economic spheres.	Noted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Klaus Radunsky (Umweltbundesamt)	TS	2	16	2	17	-	-	-	The following wording is suggested: .., inequalities witin and across societies, institutional setting, and current infrastructure, as well as on the understanding of sustainability.	Noted
Taro Kawasato (Ministry of the Environment, Japan)	TS	2	2	-	7	9.1	-	-	It should be noted in the introduction that this chapter evaluates the SD potential of RE in a more policy-oriented context.	Noted
Brian Gray (Environment Canada)	TS	2	27	2	30	-	TS 9.1	-	"Figure is difficult to understand and figure caption is not sufficiently descriptive. The terminology used in the figure and caption is also inconsistent with the text above creating confusion while reading (e.g., criterion in diagram is ""economic development"" whereas criterion listed in text is ""social and economic development""; figure caption refers to ""evaluative criteria"" whereas text refers to cross-cutting goals"", etc). Suggest that new model to represent this information be considered. "	Check with 9.2 authors
David Warrilow (Department of Energy and Climate Change)	TS	2	-	-	-	-	TS 9.1	-	Both this figure, and the one in the body of the chapter, are completely uninterpretable. The text is much more informative. As the figure currently stands, it confuses the reader more than it organises thinking.	Check with 9.2 authors
Christian Bauer (Paul Scherrer Institut)	TS	2	27	-	30	-	TS 9.1	-	I'm not sure this figure helps in understanding, especially the meaning of the arrows is confusing	Check with 9.2 authors
Brian Gray (Environment Canada)	TS	3	4	3	4	-	-	-	"Suggest that ""intertemporal"" be defined here to ensure clear comparison relative to the term ""intra-generational"" that is used in the preceding sentence. "	Check with 9.2 authors
Trigg Talley (U.S. Department of State)	TS	3	0	-	-	-	-	-	Address the pro's and con's of the approach outlined here.	Check with 9.2 authors
Brian Gray (Environment Canada)	TS	3	19	3	23	-	-	-	Suggest that this sentence be simplified as it is difficult to follow.	Noted
Klaus Radunsky (Umweltbundesamt)	TS	4	18	4	18	-	-	-	"Either explain the term ""formal economy"" or delete ""formal""."	Clear enough
Trigg Talley (U.S. Department of State)	9	4	43	-	-	-	-	-	"How is actively promoting structural change in the economy an incentive for developed countries to adopt RE? Living in the U.S., ""strengthening our economy"""""and ""enhancing wealth"" are strong incentives. However, ""promoting structural change"" is something that would tend to frighten about 2/3rd of our population. Consider removing and using more neutral terms."	term is technically correct, the wording suggested refers to politically acceptable terminology in the US and is therefore not applicable in this context

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Yun Gao (China Meteorological Administration)	9	4	10	4	10	-	-	-	"Insert ""negative impacts"" before the first ""and"". The reason is that the negative impacts are lower, not benefits lower. "	Executive Summary has been redrafted
Brian Gray (Environment Canada)	TS	4	15	4	15	-	-	-	"Please define or spell out ""toe/cap"" measurement unit."	Editorial
Taro Kawasato (Ministry of the Environment, Japan)	TS	4	22	-	24	-	-	-	"Reference to a ""Global Green New Deal,"" or increased employment opportunities through the promotion of RE - not explicitly mentioned in the previous version - is very welcome."	Noted
Yun Gao (China Meteorological Administration)	9	4	33	4	43	-	-	-	"Replace ""different incentives"" with ""different driving forces"". It seems that the reasons for developing countries are convincing. Concerning the energy supply, the renewable energy resources are more expensive and less reliable for the poor. In general, they have limited resources to develop reliable energy supply but resort to less reliable renewables. For low cost and quality supply of energy, fossil fuels seem to be more competitive than renewables. Therefore, the reasons for the poor to use renewable energy are not true. On the contrary, developing countries have less capability and they often resort to low cost fossil fuels for their growth of the economy and urbanization. I would rather change the message in this paragraph to: countries at different levels of development have different capabilities to use renewable energy. "	Executive Summary has been redrafted
Brian Gray (Environment Canada)	TS	4	45	4	45	-	-	-	"Suggest clarifying what ""singled out"" means (e.g., does it mean the impacts on women are greater or simply that they are better studied?). This is also not explained in the underlying chapter. "	Noted
Brian Gray (Environment Canada)	TS	4	7	4	8	-	-	-	"Suggest removing ""fundamental determinants"" as this term is not needed in sentence and hinders clarity. "	Editorial. Remove
Brian Gray (Environment Canada)	9	4	34	4	34	-	-	-	"Suggest that ""goal"" be replaced with ""opportunity"" to more accurately reflect how leapfrogging was assessed in this chapter. "	Executive Summary has been redrafted
Trigg Talley (U.S. Department of State)	9	4	12	-	-	-	-	-	"The acronym ""IAM"" is not defined in the chapter when it is first used (it is not defined until p. 7), please define all acronyms at their first use."	has been adjusted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	4	9	4	10	-	-	-	"The literature cited in the chapter has not effectively demonstrated that ""socio-economic benefits [of RE] are usually higher [than conventional energy]¿"" Although the following statement that ""environmental impacts are lower"" is generally true, a megawatt hour of electricity confers the same benefits to consumers regardless of the energy sources."	Executive Summary has been redrafted
Klaus Radunsky (Umweltbundesamt)	9	4	33	4	38	-	-	-	"This text is confusing. Furthermore this text cannot be underpinned by the main body of the chapter. What can be found is that ""for many developing countries the definition of energy security specifically includes the provision of adequate and affordable access to all parts of the population and thus exhibits strong links to energy access aspects.""""	Executive Summary has been redrafted
Trigg Talley (U.S. Department of State)	9	4	1	6	35	-	-	-	"With regards to shortening the chapter, consider deleting the current ""Executive Summary"" (pages 4-6). Make what is currently the ""Introduction"" (p. 7- 9 [up to Line 8]) the ""Executive Summary"" and move from it directly to what is currently denoted section 9.2 (starts on p. 9, Line 10)-- In other words, have no ""Introduction"" section, as such a section is unnecessary and omitting it out saves needed space. The content of the current ""Executive Summary"" is not needed, and in addition, the current ""Introduction"" is more useful as a summary than the current summary is. "	The Executive Summary has to remain ist own integral component of the chapter. This is mandatory according to IPCC procedures.
Roxana Bojariu (Meteo Romania)	9	4	12	4	12	-	-	-	Acronym IAM is not defined	acronym is defined upon first use
Marianne Lillieskold (Swedish Environmental Protection Agency)	9	4	41	4	43	-	-	-	Among the incentives for industrialized countries environmental benefits (in addition to GHG) could be mentioned with reference to section 9.3.4.	Executive Summary has been redrafted
Trigg Talley (U.S. Department of State)	9	4	2	4	3	-	-	-	Consider striking the first sentence and replacing with a clearer statement of what this Chapter covers and what conclusions it reaches.	Executive Summary has been redrafted
Klaus Radunsky (Umweltbundesamt)	9	4	-	6	-	-	-	-	Improve clarity and flow of language. Build on language included in chapters 9.5, 9.6 and 9.7 which just need to be shortened from 18 to 3 pages.	Executive Summary has been redrafted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Klaus Radunsky (Umweltbundesamt)	9	4	18	4	32	-	-	-	It is stated that attempts to amalgamate various indicators did not work. Why mention this in the executive summary? This information fits better in the main text.	Executive Summary has been redrafted
David Warrilow (Department of Energy and Climate Change)	9	4	33	-	-	-	-	-	Need to say something about affordability of high fixed cost infrastructure? At present discussion seems to assume primacy of centralised energy systems as 'most appropriate' option	has been included in Section 9.5.1.
Yun Gao (China Meteorological Administration)	9	4	12	4	12	-	-	-	Replace IAM with its full name.	acronym is defined upon first use
Brian Gray (Environment Canada)	TS	4	17	4	24	-	-	-	Suggest inclusion of a connecting sentence between the list of countries' incentives to advance RE and next two sentences that focus specifically on employment.	Noted
Brian Gray (Environment Canada)	9	4	1	17	-	-	-	-	The discussion of indicators in pages 1-17 is extensive and could be shortened. Some of the more detailed information in these pages may fit better in the later sections of the chapter where they are applied. It is also important to ensure that all indicators are clearly related to RE (in the context of SD).	Chapter has been thoroughly edited to address this issue.
Trigg Talley (U.S. Department of State)	9	4	12	-	-	-	-	-	The draft is too casual with acronyms. Even when previously defined, they are used too frequently.	Chapter has been thoroughly edited, upon first usage acronyms are introduced. This is the standard for using acronyms
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	4	11	-	-	-	-	-	The word 'exeptions' here suggests that some types of REs have lower benefits than fossil energy, I would refer to 'local circumstances and conditions to consider'	Executive Summary has been redrafted
Klaus Radunsky (Umweltbundesamt)	TS	4	7	4	16	-	-	-	This clause can be interpreted that countries should destroy the current life of indigenous poeple and it is in contradiction with the wise words on page 2, lines 14 to 17. Therefore the following wording is suggested: Access to clean and reliable energy CAN constitute an important	There can be multiple interpretations
Trigg Talley (U.S. Department of State)	9	4	18	4	32	-	-	-	This paragraph is too intellectually fuzzy and difficult to comprehend.	Executive Summary has been redrafted
Brian Gray (Environment Canada)	TS	4	39	4	41	-	-	-	This sentence is an almost direct repetition of the sentence in the section above (pg. 4, lines 9-10). Suggest it could be deleted here.	Noted
Klaus Radunsky (Umweltbundesamt)	9	4	18	4	32	-	-	-	Whereas impacts of RE are addressed in chapter 9.3 the concept of aspects of RE remains unclear.	Executive Summary has been redrafted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Christian Bauer (Paul Scherrer Institut)	9	5	5	-	-	-	-	-	"""¿less than those from non-renewable resources."" Nuclear power is non-renewable, but has low GHG emissions like renewables. This exception should be mentioned explicitly"	Executive Summary has been redrafted
Taro Kawasato (Ministry of the Environment, Japan)	TS	5	33	-	37	-	-	-	"It should be noted that ""appropriate technical solutions"" often require additional costs. "	Implicit
Petteri Taalas (Finnish Meteorological Institute)	9	5	14	-	-	-	-	-	"Please specify ""except biomass in some cases""; what is meant by saying this"	Executive Summary has been redrafted
Yun Gao (China Meteorological Administration)	9	5	1	5	2	-	-	-	"Replace the sentence ""Environmental impacts are usually lower with the use of renewables, but there are important exceptions to consider"" with ""The use of renewables usually generates net reductions of greenhouse gas emissions, but it can be associated with some other types of negative environmental impacts."" It is necessary to specify the impact of GHG mitigation."	Executive Summary has been redrafted
Petteri Taalas (Finnish Meteorological Institute)	9	5	5	5	7	-	-	-	"Suggest to rewrite: ""For transportation fuels, studies suggest that if land use impacts are excluded most existing and next-generation biofuels have lower GHG emissions compared to fossil fuels, although with wide ranges and depending on the emissions from biomass production (e.g. N2O from fertilisers)."	see response to 519/42, 519/43
Trigg Talley (U.S. Department of State)	9	5	5	5	7	-	-	-	"Technically, this is not true. A number of studies suggest that corn-ethanol processed at a coal-fired power plant has higher lifecycle emissions than gasoline. Change this to ""most biofuels have a lower lifecycle GHG emissions than fossil fuels"". In general more care needs to be taken with discussions of biofuels in general."	This is correct that direct coal-fired corn mills have been reported to have higher GHG emissions than gasoline. In section 9.3.4.1, to address this comment, we have clarified that the ranges of LC GHG emissions for existing biofuels represent state-of-the-art technologies and projections of near-term technological improvements. Recently-built and projected future corn dry mills are virtually all natural gas fired, or use natural gas, biomass, and coal CHP (combined heat and power) systems. But here, and in other summary statements, increased attention will be paid to the caveats and exceptions to the general trends for bioenergy.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Roxana Bojariu (Meteo Romania)	9	5	41	5	41	-	-	-	Acronym CCS is not defined	acronym is defined upon first use
Roxana Bojariu (Meteo Romania)	9	5	13	5	13	-	-	-	Acronym RET is not defined	acronym is defined upon first use
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	5	5	5	7	-	-	-	As a general statement, this is not ok. There are examples for biofuels with larger emissions than fossil fuels, see e.g. Fargione, J., Hill, J. K., Tilman, D., Polasky, S. und Hawthorne, P. (2008): Land clearing and the biofuel carbon debt. Science 319, 1235¿1238.	see response to 519/42
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	5	25	-	-	-	-	-	Differently from the case of climate change, the consequences of air pollution cannot be referred to as 'expected'.	Executive Summary has been redrafted
Klaus Radunsky (Umweltbundesamt)	TS	5	21	5	23	-	-	-	Improve/shorten language: First, increased use of renewables permits to substitute fossil fuels, resulting in less rapid depletion of the reserves of fossil fuels and in shifting their exhaustion farther into the future.	Noted
Trigg Talley (U.S. Department of State)	TS	5	33	5	37	-	-	-	Specify some of the key drawbacks of RE w.r.t. energy security	Noted
David Warrilow (Department of Energy and Climate Change)	9	5	1	5	25	-	-	-	The later section on environmental impact is much too detailed and has a low focus on 'sustainable development'	To discuss the environmental impacts has been a mandate to this chapter on SD and RE (see title of Section 9.3)
Trigg Talley (U.S. Department of State)	9	5	41	-	-	-	-	-	The linkage between biomass for transportation and CCS is not explained, neither here nor further below in the text.	Executive Summary has been redrafted
Klaus Radunsky (Umweltbundesamt)	9	5	1	5	2	-	-	-	The text needs greater clarity: environmental impacts are usually lower with the use of renewables - compared to what? Suggest to add: compared to the use of fossil and nuclear energy.	Executive Summary has been redrafted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	5	6	5	7	-	-	-	The text states that for transportation fuels existing and new generation biofuels have lower GHG emissions that fossil-based fuels. As stated, this is not true (e.g., palm oil) but as later discussed in the chapter - excluding considerations of land use change - this could be true but only in a very narrow sense. This important limiting factor for this statement should be noted wherever such statements are made. It is recommended, however, to have a detailed discussion of land use change effects and try to include them directly in the estimates. This would also allow for a discussion of the key challenges in quantifying them and the role of various assumptions (for example in EPA's RFS2 analysis assumptions about discount rates and the time frame for evaluating emissions matter).	see response to 519/42. In addition, greater attention to uncertainties will be added to section 9.3.4.1. The box on LUC has also been enhanced in its representation of the evidence, remaining uncertainties and challenges and impact on conclusions that can be drawn from comparisons of conventional energy to bioenergy systems.
David Warrilow (Department of Energy and Climate Change)	9	5	26	6	6	-	-	-	This is much too long to sit in what is effectivley an executive summary	Executive Summary has been redrafted
Brian Gray (Environment Canada)	TS	5	38	5	48	-	-	-	This paragraph makes an initial link between energy security and energy access, but then goes on in detail about issues related to energy access. Suggest revising to ensure focus remains on energy security and/or shifting some of this information into the energy access section.	Noted
David Warrilow (Department of Energy and Climate Change)	TS	5	15	5	48	Also 9.3.3	-	-	The current discussion makes much of the ability of RE to be available across the globe in more geographically disperse ways than fossil fuels. This isn't strictly true for any one RE source, but a case can be made for each region having at least access to one or more RE sources, even if the particular sources vary around the globe. This distinction should simply be made more apparent in Section 9.3.3 and in the Technical Summary.	Current wording does not imply that all RE sources are available in all countries.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
David Warrilow (Department of Energy and Climate Change)	TS	5	15	5	48	Also 9.3.3	-	-	The discussion of enhanced energy security, both in the Technical Summary and in Section.9.3.3, focuses too strongly on how RE can improve security. While security can be enhanced through having a diverse portfolio of energy systems, especially ones that don't rely on grid power, it is unlikely energy investors will be willing to fund redundant systems. Absent this redundancy, most of the RE sources have problems associated with their intermittant nature. This fluctuation in energy generation is itself a problem of reduced energy security that must be addressed better in the section, or at least linked better to energy storage solutions.	Energy security definition has been expanded to clearly address the issue of intermittency in both Sections 9.3.3 and 9.4.3; also better links to Chapter 8 on Integration are provided.
IPCC WGI TSU (University of Bern)	9	5	24	-	25	ES	-	-	Please replace 'expected consequences' with 'possible consequences'.	Executive Summary has been redrafted
Petteri Taalas (Finnish Meteorological Institute)	TS	6	13	-	14	-	-	-	"""GHG emissions are generally well covered, and can therefore be compared across technologies"" Can this really be claimed for biomass based RE as well? Because of the direct and indirect land use and land use change (N2O, terrestrial C stocks), the ultimate GHG emissions and climate impacts remain widely uncertain"	Addressed in Chapter
Brian Gray (Environment Canada)	TS	6	8	6	8	-	-	-	"Meaning of ""incommensurate metrics and methods"" is unclear as the sentence does not describe in what way they are incommensurate. Suggest selecting a different word to clarify. "	Sentence has been reworded
Marianne Lilliesköld (Swedish Environmental Protection Agency)	TS	6	-	-	-	-	-	-	"Reduced environmental impact ""As no large-scale technology deployment will come without environmental tradeoffs, environmental interventions and impacts of RE technologies should be evaluated and compared to conventional alternatives prior to their concerted deployment"". This is very important and it should be highlighted. Conventional alternatives could be clarified. As an example, increased unconventional oil production can be an alternative to RE. It is unclear if this comparison is included."	Addressed in Chapter
Petteri Taalas (Finnish Meteorological Institute)	9	6	23	6	35	-	-	-	Competition on biomass resources between different uses is a significant reason that makes sustainability of bioenergy is especially complicated. This fact should be mentioned here	Executive Summary has been redrafted
Christian Bauer (Paul Scherrer Institut)	TS	6	38	-	41	-	-	-	It should be explicitly mentioned that nuclear power, among the non-renewables, is an exception, i.e. also shows very low GHG emissions, at a comparable level to renewables.	Addressed in Chapter

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	6	7	6	22	-	-	-	This is an excellent paragraph, which should be highlighted as opposed to paragraph on p. 4 line 18.	Executive Summary has been redrafted
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	6	7	6	22	-	-	-	This paragraph is a bit too fuzzy and delivers an unclear message. Unfortunately this is a problem for the entire section 9.5.	Section 9.5 had been completely redrafted
Klaus Radunsky (Umweltbundesamt)	9	6	23	6	25	-	-	-	This sentence conveys the wrong message because already current knowledge allows to take well informed decisions. We cannot afford to wait for the perfect knowledge - we will never achieve it. Chapter 9.3 clearly shows that already today there exists a rich knowledge and good understanding of the impacts and aspects of RE underpinned by huge investments in RE in many countries and regions worldwide. It would have been great to provide some statistics on this including some information on underlying benchmarks (e.g. time for return of investment, specific costs per energy unit, employment aspects).	Executive Summary has been redrafted
Trigg Talley (U.S. Department of State)	9	7	40	7	42	-	-	-	"Clarify text regarding purpose of Chapter 9, as follows: ""Accordingly, Chapter 9 provides an overview of the scientific literature on sustainable development (SD), distills SD concepts relevant to renewable energy, identifies and charts related metrics or meaningful proxies from available information sources, and discusses the boundary conditions that SD concepts place on the longer-term deployment of renewable, fossil, and nuclear energy technologies."	Text has been clarified
Trigg Talley (U.S. Department of State)	9	7	37	7	39	-	-	-	"Clarify text, as follows: ""Sustainable development of a future energy system, however, encompasses a number of additional concepts that are not typically included in, for example, life-cycle assessments (LCA) or integrated assessment models (IAMs). The purpose of Chapter 9 is to explore these concepts within established literature and point to the need for additional metrics that go beyond the purely technical-economic indicators that are used in the other chapters of this report. "	Similar language is now included
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	7	37	7	39	-	-	-	"Other Ch (2-7) do include the discussion of some elements of DS in relation to their specific RET, and do not focus on purely technical-economic issue; however, in Ch 9 SD indicators are employed in a more systematic and comprehensive way."	This part has been deleted for reasons of brevity.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	7	29	7	34	-	-	-	"Start Section 9.1 with these first 3 sentences from line 29. Modify lines 31 or 32, by noting that it is ""clear"" that RE will play a ""contributing"" role; or alternatively, it is ""likely"" that RE will play a ""central"" role. It is not necessarily ""clear"" that RE will play a ""central"" role. "	Language has been changed
Petteri Taalas (Finnish Meteorological Institute)	TS	7	21	7	23	-	-	-	"This a strange sentence. To put residues and waste to landfill cannot be considered BAU (e.g. in Europe). Artificial ""avoided"" emissions!"	Noted
Trigg Talley (U.S. Department of State)	9	7	2	7	28	-	-	-	Delete entire 1st paragraph, and Figure 9.1.1. Text in following two paragraphs (as modified below on other p. 7 comments) state the purpose of Chapter 9 and its differentiation from the other Chapters more clearly and succinctly.	Done
Christian Bauer (Paul Scherrer Institut)	TS	7	23	8	2	-	-	-	It should be mentioned, whether LUC is included in the references used if figure TS 9.1 and 9.2	Accepted
Taro Kawasato (Ministry of the Environment, Japan)	9	7	1	-	-	-	-	-	It should be noted in the Introduction that this chapter evaluates the SD potential of RE in a more policy-oriented context.	this is not the case
David Warrilow (Department of Energy and Climate Change)	9	7	-	9	-	-	-	-	The description of what the chapter covers could probably be cut down a lot and parts could be merged with the Executive Summary.	Discussion has been shortened
Petteri Taalas (Finnish Meteorological Institute)	TS	7	21	-	23	-	-	-	The issue (avoided emissions) is this straightforward only if the timing of the GHG release in combustion (instant) compared to decomposition in i.e. landfill (slower process) is rapid. For many feedstocks and situations this is not the case (e.g. woody residues).	Noted
David Warrilow (Department of Energy and Climate Change)	9	7	1	9	8	-	-	-	This preamble could be considerably shortened for the final, integrated, document	Has been shortened
Brian Gray (Environment Canada)	9	7	2	7	27	-	-	-	This text and diagram seem repetitious. This could be improved by focusing the text on generally describing the integrative nature of Chapter 9 (e.g., beginning with line 8), while focusing the diagram on illustrating where information from other chapters is being brought in (e.g., incorporating parts of lines 3-8 into diagram).	Diagram has been eliminated
Roxana Bojariu (Meteo Romania)	9	7	-	-	-	-	9.1.1	-	This figure may be removed to save space. A few words may replace it as well.	Removed

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Christian Bauer (Paul Scherrer Institut)	TS	7	2	-	-	-	TS 9.1	-	that's the 2nd figure in the TS and should therefore be figure TS 9.2	Editorial
Petteri Taalas (Finnish Meteorological Institute)	TS	8	11	-	-	-	-	-	"Add sentence: ""Temporarily the emissions from LUC could be multifold compared with those shown in Fig. TS 9.2.""""	Technical Summary has been redrafted
Petteri Taalas (Finnish Meteorological Institute)	TS	8	2	-	-	-	-	-	"Add the following sentences here or somewhere else and also in the main text of Chapter 9: ""Bioenergy is a part of the terrestrial C cycle. Bioenergy itself causes carbondioxide emissions which are balanced by re-growth of new biomass. Even without any LUC these two fluxes are not in temporal balance with each other (e.g. in long rotation forestry) causing GHG impacts."" "	Accepted
Trigg Talley (U.S. Department of State)	TS	8	7	8	11	-	-	-	Corn-ethanol from coal-fired refineries has higher LCA GHG's than gasoline	discussed in text, and in ch 2, but not included in figure because data base does not have this estimate. Also, ch 2 discusses these issues more in detail, there is limited space in ch 9 for all configurations.
Trigg Talley (U.S. Department of State)	9	8	6	9	8	-	-	-	Shorten summaries of Sections 9.2, 9.3, 9.4, and 9.5. The reader will soon see these Sections. This will help the Chapter avoid excessive repetition.	Overlapping discussions have been streamlined and coordinated
Trigg Talley (U.S. Department of State)	9	8	12	8	14	-	-	-	Tautological statement, i.e., SD defined by sustainable social and economic development.	Changed title
Petteri Taalas (Finnish Meteorological Institute)	TS	8	12	8	27	-	-	-	The clarity of Fig. TS 9.2 can be questioned... (See comments on the same figure in the Chapter 9 main text)	Accepted
Trigg Talley (U.S. Department of State)	9	8	38	8	41	-	-	-	The focus is on the negative and the lack of gaps defined by the assumptions of the reigning methodological paradigms. Yet, other intellectual and analytic disciplines have insights to contribute in the space of SD and RE.	Also very good point. There is huge literature from human geography for example, which is not reviewed at all. We should acknowledge that.
Roxana Bojariu (Meteo Romania)	9	8	6	9	8	-	-	-	This brief presentation of the next section can be shorted without losing information.	Done

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Brian Gray (Environment Canada)	9	8	6	9	8	-	-	-	This is an extensive description of what is found in the following sections and could be shortened to focus only on main topics/objectives. This will also help to reduce repetition throughout Chapter 9 as the each of the introductory paragraphs for the following sections also include overviews of what information is assessed (e.g., see pg 9, lines 25-8). Attention should also be paid to consistency with the introduction formats of other chapters throughout the SRREN - a glace through the SOD suggests that there is wide variation.	Shortened
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	8	24	8	24	-	-	-	Why is there no comparison to currently dominant energy technologies in sub-sections 9.3.1-9.3.3 as it is done in 9.3.4?	Sections 9.3.1, 9.3.2, 9.3.3 all address other dominant energy sources and technologies as well.
Christian Bauer (Paul Scherrer Institut)	TS	8	14	-	-	-	TS 9.2	-	that's the 3rd figure in the TS and should therefore be figure TS 9.3	Editorial
Christian Bauer (Paul Scherrer Institut)	TS	8	12	-	-	-	TS 9.2	-	the quality of the figure is not sufficient	Accepted
Trigg Talley (U.S. Department of State)	9	9	34	11	28	-	-	-	"Delete entire discussion of ""strong"" and ""weak"" sustainability from main text; reduce to succinct discussion as a side-bar or text box. The ""strong-weak"" discussion is not central to the organizing principles of the chapter. Rather, it is a long and confusing distraction from a clean line of argumentation. Start Section 9.2.1 with discussion of ""Brundltland"" and then move to the ""Three Pillar Model"", as introduced on p.11, line 29. "	The discussion has not been eliminated, but rather shortened and integrated better
Christian Bauer (Paul Scherrer Institut)	TS	9	30	-	31	-	-	-	"I doubt that the statement ""¿, but the upstream emissions from fuel production might be significantly reduced"" is supported by the content of chapter 9.3.4.4"	will be revised
Klaus Radunsky (Umweltbundesamt)	TS	9	31	9	32	-	-	-	"It is suggested to add at the last sentence: ""..upstream and downstream emissions of air pollutants"" for the sake of greater clarity and to avoid misinterpretation."	Accepted
Klaus Radunsky (Umweltbundesamt)	9	9	31	-	-	-	-	-	"The following wording is suggested: SRREN follows the Brundtland definition according to which ""sustainable development meets the needs ¿."	Note: Now this sentence is in the first paragraph of 9.1.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
David Warrilow (Department of Energy and Climate Change)	9	9	-	10	-	-	-	-	Bearing the comment above in mind, the chapter could be more practical and less theoretical. Such a detailed description/ discussion of Sustainable Development seems unnecessary. Whilst it is good to set the chapter in context, giving this so much attention detracts from the key messages.	Has been shortened
David Warrilow (Department of Energy and Climate Change)	9	9	30	10	40	-	-	-	Do we need this degree of academic review , especially as several of the references are used many times over?	Shortened
Taro Kawasato (Ministry of the Environment, Japan)	TS	9	36	-	-	-	-	-	Reference to human health effects from agrochemicals used in biomass production could be included.	Accepted
Brian Gray (Environment Canada)	9	9	11	9	24	-	-	-	Some of this background is very general and could be condensed or cut in light of space constraints	Agreed. The paragraphs are moved to the very introduction and are shortened.
Trigg Talley (U.S. Department of State)	9	9	35	9	37	-	-	-	This construct of weak and strong sustainability does not really illuminate or clarify the issue, and in fact only makes an important matter even more opaque.	While we agree that other conceptualizations are possible, we think that this spans an important dimension. However, we shortened this paragraphs and tried to clarify the relationship to subsequent chapters.
IPCC WGI TSU (University of Bern)	9	9	16	-	-	9.2	-	-	Please: IPPC -> IPCC	Changed
Roxana Bojariu (Meteo Romania)	9	9	-	-	-	9.2.1	-	-	"I think the definition and description of SD are too theoretical; pragmatical approach is preferable."	We have rearranged the discussion to separate out the more theoretical parts and to shorten this material
David Warrilow (Department of Energy and Climate Change)	9	9	37	10	4	9.2.1	-	-	Suggest looking for more on capital substitution rules through Daly ¿ e.g. Costanza, R. and Daly, H.E. (1992) ¿Natural Capital and Sustainable Development¿, Conservation Biology Volume 6, No. 1, March 1992. http://www.jstor.org/stable/2385849	We have shortened the entire discussion rather than including more
David Warrilow (Department of Energy and Climate Change)	9	9	-	10	-	9.2.1	-	-	This text relies heavily on literature that goes back 20 years, and will have already been cited in previous IPCC reports, as well as being long. It would be good to use some more updated literature and make this discussion more concise.	Newer literature is cited and discussion shortened
Klaus Radunsky (Umweltbundesamt)	TS	10	20	10	22	-	-	-	"Either the sentence on additional risks (""However, it is important to assess ¿"") is underpinned by literature and concrete examples in the main text or if not it is suggested to be deleted."	Noted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Brian Gray (Environment Canada)	TS	10	25	10	26	-	-	-	"It is not clear what ""pathways"" are being referred to this this section. The section introduction (lines 25-26) suggests that renewable energy deployment pathways are assessed for their implications on SD, while the heading for the section (line 23) suggests that SD pathways are assessed for their implications for renewable energy. Please clarify wording with respect to the interrelation. "	The introduction of the section and the chapter has been revised to make this point clearer.
Petteri Taalas (Finnish Meteorological Institute)	9	10	39	10	39	-	-	-	"The concepts of weak and strong sustainability are not described clearly. For this reason there is a need to put one additional qualification in oder to understand the use of the concepts. Thus, replace ""two"" by ""three"" "	Discussion has been shortened, moved and clarified
Trigg Talley (U.S. Department of State)	9	10	15	10	18	-	-	-	"The statement: ""... Are often justified or motivated by non-linearities, discontinuities, non-smoothness and non-convexities."" is confusing. Technical readers may understand this, but many policy makers will not."	Statement has been removed.
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	10	38	11	9	-	-	-	"This part of the text is unclear in many regards and specifically the (2) qualifications. RE can reduce the environmental impact of energy production even if it is only a complement to non-RE production; RETs must be evaluated in relation to their contribution to SD (and not only environmental sust.) either from a weak or strong sustainability perspective."	Language has been clarified
Taro Kawasato (Ministry of the Environment, Japan)	TS	10	22	-	-	-	-	-	9.3.4.6 should be 9.3.4.7	Editorial
Taro Kawasato (Ministry of the Environment, Japan)	TS	10	9	-	22	-	-	-	The comparison to nuclear energy seems very sudden.	Noted
Yun Gao (China Meteorological Administration)	9	10	29	10	32	-	-	-	This part can be deleted as it discusses the general concept of sustainable development.	The section is about SD; we felt it important to at least mention the need for spatial and geographical differentiation
IPCC WGI TSU (University of Bern)	9	10	11	-	12	9.2.1	-	-	Confused by the use of 'sink' in this context, funny concept from a natural scientists point of view to think about the atmosphere as a sink of CO2 emissions!	I think, "sink" is the appropriate term here.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
David Warrilow (Department of Energy and Climate Change)	TS	10	9	-	22	Also 9.3.4.6	-	-	The risks from RE are very poorly quantified at present. The problem is that these risks tend to be associated more with deployment (installation and maintenance) rather than with operation. They are more akin to job-related accidents than system accidents (e.g. nuclear reactor excursions). In addition, the health risks of manufacturing RE components is in its infancy, in contrast to the much better developed data on traditional energy systems (coal, nuclear, etc). There is nothing incorrect in the qualitative statements of the TS or the section in body of the report, but the data backing any quantitative statements of relative or comparative human health risks from accidents is simply not available at present to make firm quantitative claims.	Rejected.
David Warrilow (Department of Energy and Climate Change)	TS	10	24	-	44	Also 9.4	-	-	The wording throughout this area of the report seems to point towards future work to be completed, and then inserted into the section. This is evident from the use of future-tense verbs.	Noted
Petteri Taalas (Finnish Meteorological Institute)	9	11	10	-	-	-	-	-	"Add the third qualification: ""The life cycle GHG emissions caused by a renewable energy technology can exceed a threshold value related to the life cycle GHG emissions caused by fossil fuels. For example, the RES directive of EU has a requirement that at least the 35% reduction of life cycle GHG emissions in the biofuels of transportation should be achieved compared to the GHG emissions of fossil fuels. In the case of exceedance, the use of renewable technology is not not acceptable although the economic and social benefits of the renewable energy are better compared to those caused by the use of fossil fuels. Thus, the concept of strong sustainability is applied and bad result in one important criterion (e.g. GHG emissions) cannot be compensated by good values in other criteria. "	Although not in exactly these words, a further discussion has been added about potential trade-offs
Klaus Radunsky (Umweltbundesamt)	TS	11	22	11	22	-	-	-	"It is suggested to substitute ""mitigation burden"" by ""mitigation potential"" as mitigation burden underlies some policy prescriptive model of allocation of costs whereas mitigation potential is a neutral technical assessment."	Wording is correct

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Brian Gray (Environment Canada)	9	11	1	11	5	-	-	-	"Please clarify statement suggesting that REs can be regarded as ""a solution strategy for climate change if (and only if) fossil fuel consumption is simultaneously reduced."" Does this mean a solution strategy for current climate change or future climate change? Would the use of REs to offset what would have otherwise been an increase (or greater increase) in GHGs from non-REs qualify as a solution strategy in this context? "	Clarified
Brian Gray (Environment Canada)	9	11	23	11	24	-	-	-	"Please clarify the term ""transition to a non-carbon economy."" Perhaps what is meant is ""non-fossil-fuel-carbon economy"" since biomass and biofuels are also carbon-based. "	This paragraph has been removed.
Trigg Talley (U.S. Department of State)	9	11	26	-	-	-	-	-	"Please clarify what ""both"" sustainability paradigms refers to."	This paragraph has been removed.
Petteri Taalas (Finnish Meteorological Institute)	9	11	17	11	18	-	-	-	"Replace ""some aspects"" by ""environmental aspects"""	This paragraph has been removed.
Brian Gray (Environment Canada)	9	11	29	11	29	-	-	-	"Suggest changing the three pillars of SD to Economy, Society and Environment (from ""Ecology""), to be consistent with Figure 9.2.1."	Done
Trigg Talley (U.S. Department of State)	TS	11	1	-	-	-	-	-	"The subtitle in the TS substitutes the word ""growth"" for the word ""development"" on p. 66 of the main document. While ""development"" is often used as a synonym for ""growth"" they are NOT the same. There is no such thing as ""Sustainable Social and Economic Growth"" on a finite planet -- while sustainable human and social development may be possible."	has been corrected
Petteri Taalas (Finnish Meteorological Institute)	9	11	1	11	5	-	-	-	"This paragraph points out a significant issue (""if and only if fossil fuel consumption is simultaneously reduced"") which is worth mentioning in the Exectivev summary"	Agreed.
Trigg Talley (U.S. Department of State)	9	11	14	11	15	-	-	-	"This should be stated earlier (i.e., ""This chapter will focus on non-climate indicators and criteria¿"")"	This paragraph has been removed.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	11	43	11	43	-	-	-	"Where is the text discussion that supports the introduction here of a ""set of cross-cutting goals for sustainable renewable energy"", other than in a passing reference in the summary of Section 9.2 on p. 8? Since these 4 ""goals"" or ""criteria"" form the basis for the Chapter's organization, should there not be some basis? Perhaps, this organizing concept arises from reference [WDR 2010], but this reference does not appear in the reference listings for Section 9.2. "	The paragraph and the corresponding figure has been removed.
David Warrilow (Department of Energy and Climate Change)	9	11	1	11	5	-	-	-	Does this bullet recognise that the context we are talking about ranges from providing initial access to modern energy to a community for the first time through to supporting infrastructure development in informal settlements being integrated into mega cities?	This bullet points have been removed. The comment is acknowledged. It is not enough to make a GHG emissions analysis here, when there are other, maybe more important issues, at stake.
Klaus Radunsky (Umweltbundesamt)	TS	11	11	11	13	-	-	-	In the last sentence of this clause biomass is not seen as a RET what seems to be strange.	Noted
David Warrilow (Department of Energy and Climate Change)	9	11	29	11	30	-	-	-	Slight difference in wording on the three pillars here from that used elsewhere	Harmonized
Klaus Radunsky (Umweltbundesamt)	TS	11	6	11	13	-	-	-	The following addition is needed: ¿, based on assumptions about the availability and costs of those technologies, and not including the damages from climate change in the analysis. Correspondingly, as options available for constraining GHGs are limited, GDP losses are also increased under the above assumptions.	The TS has been revised.
Klaus Radunsky (Umweltbundesamt)	TS	11	14	11	18	-	-	-	This clause ignores the fact that RE are already cost-competitive if the external costs related to damage induced by climate change are internalized.	Implicit
IPCC WGI TSU (University of Bern)	9	11	3	-	-	9.2.1	-	-	Please reword. Perhaps a formulation along the lines, '...be regarded as part of a portfolio of options to prevent dangerous climate change' would work?	However, these bullet points are removed for space constrains and to avoid wrong emphasis.
Petteri Taalas (Finnish Meteorological Institute)	TS	12	11	-	-	-	-	-	"Add: "" ¿system in case feedstock production is in balance with re-growth of new biomass.""""	Editorial

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	TS	12	2	12	5	-	-	-	Be a bit more specific. RE affects energy security positively through increased diversity and negatively through reduced reliability. Biomass is also less reliable than fossil. You can still extract oil during a drought or period of increased prevalence of insects and disease. Not so for biomass. Biomass is also seasonal (as is hydro). Nuclear and fossil are not. RE is a very important technology to develop, but it is also important to be very clear on its benefits and challenges.	Noted
Marianne Lilliesköld (Swedish Environmental Protection Agency)	TS	12	-	-	13	-	-	-	Food security is a barrier which is important but this area is complicated. From a SD perspective, inefficient food production is a barrier which also influences the potential of biomass for energy use. This could be mentioned.	Noted
Trigg Talley (U.S. Department of State)	9	12	44	19	-	-	-	-	This section contains too much information on vehicles. Much of this information could be cut out.	This comment probably refers to another section (?)
Klaus Radunsky (Umweltbundesamt)	TS	12	2	12	21	-	-	-	With regard to transport sector it is very important to inform the reader that the studies investigated did not consider the potential of the use of higher share of electricity in the transportation sector. If possible the results of those studies should be reflected also in chapter 9 and in the TS.	References not provided to support the comment
Brian Gray (Environment Canada)	9	12	13	12	17	-	9.2.1	-	"Figure is difficult to understand and figure caption is not sufficiently descriptive. The terminology used in the figure and caption is also inconsistent with the associated text creating confusion while reading (e.g., criterion in diagram is ""economic development"" whereas criterion listed in text is ""social and economic development"". Suggest that new model to represent this information be considered. "	Figure eliminated
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	12	-	-	-	-	9.2.1	-	It is difficult to understand what actually the linkages that the arrows in figure 9.2.1 describe are.	Figure eliminated
Roxana Bojariu (Meteo Romania)	9	12	-	9	-	-	9.2.1	-	This figure may be removed to save space, since it is not very informative.	Figure eliminated

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	13	-	13	-	-	-	-	"Adapt the current text to be aligned with the underlying literature source. Specifically, change the current text ""As one example, to avoid with a probability of 50% breaking through a 2¿C temperature guardrail, a total of approximately 1000 Gt CO2 can be emitted from 2010 to 2050."" into ""As one example, to avoid with a probability of 25% breaking through a 2¿C temperature guardrail, a total of approximately 1000 Gt CO2 can be emitted from 2000 to 2050."" Note that both the probability as well as the starting year has changed in order to reflect the underlying literature (Meinshausen, 2009). "	Box removed
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	13	26	13	28	-	-	-	"Delete, as it is imprecise. GHG concentrations have not been mentioned before, thus ""higher GHG concentrations"" does not make sense. Further, also temperature rises below 2¿ will be accompanied by rising sea levels."	Box removed
Trigg Talley (U.S. Department of State)	9	13	1	13	44	-	-	-	"Given the page limits consider deleting this contextual information - the linkage to climate as a motivating factor is fairly obvious and this point is made elsewhere in the chapter - the box could be deleted at minimal cost. That said, there is one point in the box does NOT appear elsewhere. The reference to the effects of climate change, such as sea level rise raise important questions about siting of RE and the impact of development patterns on efficiency of electrical distribution. While this is a mitigation report, a short reference to the capacity to respond to climate change is worth mentioning here or elsewhere. For example, if one is building a micro grid or an array of green buildings in a flood plain, the mitigation will not be effective if the infrastructure is not properly hardened to allow for ""adaptation."" "	Box removed
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	13	3	13	3	-	-	-	"replace ""greenhouse gases"" by ""greenhouse gas concentrations in the atmosphere"""	Box removed

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	13	9	13	12	-	-	-	"replace ""over 50%"" by ""almost 50%"". For 2007 fossil CO2 emissions, the CAIT of WRI database gives a share of 49.38% for Annex-I countries, which is less than 50%, and not more (http://cait.wri.org/) "	Box removed
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	13	19	13	19	-	-	-	"replace ""represents"" by ""implies"""	Box removed
Roxana Bojariu (Meteo Romania)	9	13	-	-	-	-	-	-	"The Box ""Sustainable Development, Renewable Energy and Climate Change" should be significantly reduced in size. Renewable Energy appears in its heading but in fact just three lines in the Box refer to renewable energy."	Box removed
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	13	-	13	-	-	-	-	Box needs to be revised- e.g. the examples chosen for climate change impacts seem to be erratic. Also, renewables are not the only possibility to reduce emissions from the energy sector- this should be mentioned	Box removed
Taro Kawasato (Ministry of the Environment, Japan)	TS	13	11	16	-	-	-	-	It is highly appreciated that a subsection has been dedicated to cost-oriented barriers in the new version of Chapter 9 because there is no comprehensive discussion on such costs in any other part of the Special Report. This part of the TS could, however, include more explicit reference to the high upfront costs, instead of just noting the costs required over the projected life of a facility, as these are among the crucial barriers to harnessing available renewable energy sources in developing countries.	Noted
Taro Kawasato (Ministry of the Environment, Japan)	TS	13	44	14	50	-	-	-	The aim of including a Synthesis before Knowledge Gaps and Future Research Needs is quite unclear, especially because much of what is written in the Synthesis overlaps with the Executive Summary and could perhaps be omitted. If this section is meant to focus on the policy perspectives of SD potential of RE in conclusion, that point should be made more explicit by adding a subtitle and being as unrepetitious as possible.	Rejected.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
David Warrilow (Department of Energy and Climate Change)	9	13	-	-	-	-	-	-	The box on this page seems to be part of the wider rationale for action - why has it been placed here? Could it be removed and does it repeat text in other chapters?	Box removed
David Warrilow (Department of Energy and Climate Change)	9	13	1	-	-	Box 9.2.1	-	-	Do the contents of this box add anything to the section and associated themes? Could be removed?	Removed
Klaus Radunsky (Umweltbundesamt)	9	13	-	-	-	Box 9.2.1	-	-	It is suggsted to delet this box. Impacts of climate change, concepts addressing climate change are clearly beyond the scope of chapter 9.	Box removed
IPCC WGI TSU (University of Bern)	9	13	30	-	31	Box 9.2.1	-	-	"""..some general conclusions are clear"" -- it seems that in the following sentences no such ""clear conclusions"" are presented. Please clarify what you think are the ""clear general conclusions"" and what those conclusions are based on."	Box removed
IPCC WGI TSU (University of Bern)	9	13	26	-	26	Box 9.2.1	-	-	"""On the other side of the geographical distribution"" -- which other side of what distribution? - this statement is very unclear, in particular as the sentence then ends with ""on a global scale""¿.??? Is this sentence correctly placed?"	Box removed
IPCC WGI TSU (University of Bern)	9	13	28	-	30	Box 9.2.1	-	-	"""still significant uncertainty as to the exact magnitude of negative climate"" -- Rewording needed. Are not rising sea levels and ocean acidification also climate change impacts? I think what you mean to say is ""projections for extreme climate and weather impacts"". In any case you imply that there is only uncertainty regarding the exact magnitude of the NEGATIVE impact, but in fact, there is even uncertainty as to the sign of the impact in many regions and for many extremes, eg, floods. Please adapt. Possible better wording might be: ""there is still significant uncertainty regarding the regional projection of impacts from some extreme climate and weather events.....""""	Box removed
IPCC WGI TSU (University of Bern)	9	13	22	-	23	Box 9.2.1	-	-	"""widely recognized guardrail in the strong sustainability sense"" -- what does this mean ""in the strong sustainability sense""? It's not clear to me at all and seems rather subjective, too. In addition, also on the expression ""widely recognized guardrail"" -- widely recognized by whom? Provide evidence, preferably in the form of peer-reviewed publications."	Box removed

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
IPCC WGI TSU (University of Bern)	9	13	13	-	13	Box 9.2.1	-	-	"(i) increasing realization -- by whom? Provide evidence of ""there has been"", preferably in the form of peer-reviewed publications. (ii) ""that it may be necessary to use temperature guardrails"" -- this is close to being policy prescriptive. Provide evidence, preferably in the form of peer-reviewed publications."	Box removed
IPCC WGI TSU (University of Bern)	9	13	18	-	19	Box 9.2.1	-	-	"...a total of of approximately 1000 Gt CO2 can be emitted...' - add ""according to Meinshausen et al. 2009"""	Box removed
IPCC WGI TSU (University of Bern)	9	13	24	-	25	Box 9.2.1	-	-	"Another comment on the use of the term ""budget"" and varieties of it, here ""carbon emission budget""? Is this budget the same budget discussed above, but then doesn't the budget involve all fluxes and storage terms, not just emissions? Please clarify and change wording accordingly."	Box removed
IPCC WGI TSU (University of Bern)	9	13	14	-	14	Box 9.2.1	-	-	"BTW, what is meant by ""guardrails as goals for climate policy""?"	Box removed
IPCC WGI TSU (University of Bern)	9	13	1	-	1	Box 9.2.1	-	-	"Delete 'clear negative' -- ""negative"" involves your personal judgement and is not neutral. Some people argue that for their region, increased GHG concentrations, warming etc. would be economically beneficial."	Box removed
IPCC WGI TSU (University of Bern)	9	13	33	-	33	Box 9.2.1	-	-	"I am not sure how useful this statistic is and the source is not clear - a population could be happily living on high elevation hilly land within 100km of the coast so I think this 40% is misleading!. I would favour using the statistic from Chapter 6, WGII AR4, ie, ""23% of the worlds population lives both within 100 km distance of the coast AND <100 m above sea level""."	Box removed
IPCC WGI TSU (University of Bern)	9	13	14	-	15	Box 9.2.1	-	-	"I don't understand the sentence ""One proposal for quantifying ¿allowable¿ future emissions is that of a carbon budget"" -- it doesn't make any sense to me. How else than through a ""carbon budget"" would one possibly arrive at allowable emissions? This needs further explanation."	Box removed
IPCC WGI TSU (University of Bern)	9	13	41	-	43	Box 9.2.1	-	-	"The concluding sentence currently appears completely unrelated to the rest of the box. Perhaps the last part deals to some extent with ""large variability in the capacity for societies to respond to a changing climate"" but most of the box does not. -- Please consider a more appropriate and useful concluding sentence."	Box removed

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
IPCC WGI TSU (University of Bern)	9	13	19	-	19	Box 9.2.1	-	-	"Two comments on the sentence ""This carbon budget represents a significant reduction in yearly emissions..."": (1) The total cumulated emission number given just before don't constitute a ""carbon budget"" themselves, just on part of it; (2) I am having problems with the formulation ""this carbon budget represents reduction in emissions"" -- can a carbon budget ""represent"" reductions in emissions?"	Box removed
IPCC WGI TSU (University of Bern)	9	13	20	-	20	Box 9.2.1	-	-	"unclear sentence - ""....and should developing countries be privileged in the distributions of shares""?"	Box removed
IPCC WGI TSU (University of Bern)	9	13	34	-	34	Box 9.2.1	-	-	"What is ""coastal pressure"" - please redefine here or at least briefly summarize the Millennium Assessment's definition."	Box removed
IPCC WGI TSU (University of Bern)	9	13	16	-	17	Box 9.2.1	-	-	"What is the timescale for this statement about the ""final temperatures of the global system"". This statement in such generality is simply wrong."	Box removed
IPCC WGI TSU (University of Bern)	9	13	9	-	9	Box 9.2.1	-	-	"why ""geographically""? the ""industrialized world"" is a socioeconomic classification."	Box removed
IPCC WGI TSU (University of Bern)	9	13	13	-	13	Box 9.2.1	-	-	delete 'report' -- AR4 stands for Fourth Assessment Report	Box removed
IPCC WGI TSU (University of Bern)	9	13	38	-	39	Box 9.2.1	-	-	Given this is a controversial subject, you would be better to stick closer to the wording used by Knutson et al. 2010 - ie, 'an increase in the globally averaged intensity of tropical storms'. This is important because increases will not be seen in all ocean basins, so you should avoid generalising (note, I presume you mean to reference Knutson ET AL., not just Knutson, 2010).	Box removed
IPCC WGI TSU (University of Bern)	9	13	4	-	5	Box 9.2.1	-	-	Need to be specific about the scenario referred to here -- see WGI AR4, Chapter 10, Meehl et al.. But actually why are you choosing and highlighting one scenario when IPCC AR4 does not give a likelihood to any if the scenario assessed?	Box removed
IPCC WGI TSU (University of Bern)	9	13	27	-	28	Box 9.2.1	-	-	Perhaps more important.....' - This is a value judgement. And what is this judgement based on? Provide evidence, preferably in the form of peer-reviewed publications.	Box removed
IPCC WGI TSU (University of Bern)	9	13	6	-	6	Box 9.2.1	-	-	Rather than 'increasing net carbon flux....', it might be better to stay simple, i.e., write- 'increasing the atmospheric CO2 concentration'.	Box removed
IPCC WGI TSU (University of Bern)	9	13	17	-	17	Box 9.2.1	-	-	Suggest to delete 'As one example'	Box removed

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
IPCC WGI TSU (University of Bern)	9	13	9	-	9	Box 9.2.1	-	-	The papers cited here are not int the reference list, it's thus unclear how 'current' these references are - but consider citing a very recent paper by Le Quere et al. which supports your statement here (2009, nature geoscience DOI: 10.1038/NGEO689) or even refer to the Global Carbon Project (http://www.globalcarbonproject.org/) directly.	Box removed
IPCC WGI TSU (University of Bern)	9	13	32	-	33	Box 9.2.1	-	-	Using another measure...' - Not clear. A measure for what? Please be specific here.	Box removed
IPCC WGI TSU (University of Bern)	9	13	5	-	5	Box 9.2.1	-	-	WGI AR4 must be cited, not WGIII AR4 (Metz et al.). Need to elude to the IPCC AR4 assessed range of projected temperature increase by 2100. It is questionable to just mention here the high end case, top of the SRES range increase of 6 degrees only.	Box removed
Petteri Taalas (Finnish Meteorological Institute)	9	14	6	14	11	-	-	-	It is mentioned that a set of thirty indicators are used in this chapter. It is unclear what are the indicators (not given) and how they are used. I never found an explanation. This section (9.2.2.) need to be clarified.	Section shortened and clarified
Brian Gray (Environment Canada)	9	14	14	14	19	-	-	-	It may be helpful if these indicators were quantified in the following sections and presented in forms of figures or tables. Many indicators are cited in this Chapter (e.g. section 9.2.2 page 14 and 17), but their applications to renewable energies is not shown.	This section is meant to be a conceptual overview, whereas data will be presented in 9.3.
Roxana Bojariu (Meteo Romania)	9	14	6	14	6	-	-	-	There is an unnecessary repetition of Vera and Langlois	Repetition eliminated
Trigg Talley (U.S. Department of State)	9	14	34	15	25	-	-	-	This bolded section is not clear and is conceptually turgid.	Rewritten and shortened
David Warrilow (Department of Energy and Climate Change)	9	14	35	15	25	-	-	-	This section is academically rigorous, but in the context of the SRREN document (and target readership) is it too long?	Shortened
Brian Gray (Environment Canada)	TS	14	43	14	47	-	-	-	This sentence exactly repeats lines 17-20 on page 4. It could be removed here.	Editorial
Brian Gray (Environment Canada)	TS	14	29	14	33	-	-	-	This sentence is not central to the purpose of this paragraph and could be removed.	Right in context
Roxana Bojariu (Meteo Romania)	9	14	-	-	-	9.2.2	-	-	It's hard to predict when the economic crisis is over, so one has to take into consideration the crisis related issues, too.	This seems to go beyond what we can consider in this report

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	TS	15	0	-	-	-	-	-	"This is the same comment as for Chapter 9 p. 96-97: Section 9.7: Knowledge gap: An urgent knowledge gap: The evaluation of maintenance of even existing levels of economic activity (much less development) in view of pending oil depletion and the resulting large increases in the cost and decreased availability of transportation fuels, and food. Renewable fuels (with the possible exception of algae) will compete with food supplies. Islands and remote, often indigenous communities heavily dependent on diesel fuel for their electricity supplies are particularly vulnerable and are already seeing complete economic collapse and dispersal of populations to more urban centers. The dynamics of the coming energy transformation must be better understood. The economic impacts of not managing this transformation are potentially a human and social disaster of the first order; including the collapse of Nations and the global population.. This is no longer an academic question as oil depletion may completely transform global and local social structures. The ""climate"" however, will improve for those that are left, as our global energy intensity is dramatically reduced."	Unclear
David Warrilow (Department of Energy and Climate Change)	9	15	27	15	40	-	-	-	Do not forget the urban and peri-urban energy poor - provision of modern energy to these groups can be huge drivers of local economic growth and broader wealth creation	Discussion of access here and in Sec. 9.3
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	15	36	15	36	-	-	-	More important than the gathering in an unsustainable manner might be the fact, that the use of traditional biomass is accompanied by serious negative health effects.	Health effects are discussed in 9.3
Brian Gray (Environment Canada)	9	15	29	15	30	-	-	-	The eight Millennium Development Goals are referred to several times throughout the document (including in the SPM and TS), but they are not listed anywhere in the document. Suggest that they could be included as a footnote or table in Chapter 9 to increase usability of the document.	Reference is made to UN documents; space constraints do not allow inserting more detailed information here

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	16	25	16	26	-	-	-	"Delete sentence starting with, ""By definition, "". It is misleading to label fossil fuels as a ""temporary"" solution, if clean uses can extend for hundreds of years into the future. It is also incorrect to label all fossil fuel solutions as ""not sustainable"". This branding of FE is normative and applied pejoratively. All such references throughout the IPCC's work on RE need to be expunged. The Brundtland definition of SD (p. 9) suggests that if fossil fuels can ""meet the needs of the present without compromising the ability of future generations to meet their own needs"", then fossil fuels cannot be excluded from the portfolio of clean energy solutions. They may, in fact, provide a vital and affordable pathway to a long-term sustainable future. "	deleted
Trigg Talley (U.S. Department of State)	9	16	38	17	2	-	-	-	"Regarding energy security, a distinction must be made between diversity of ""energy supply"" and diversity of ""sources of energy supply"". The former, as used in the context of the existing text, means ""types"" of energy supply. RE can enhance energy security, if there are reasonable long-run opportunities for substitution in an country's economy, but enhanced energy security mostly arises from diversification of ""sources"" of the same type of energy supply. Witness strategies in Western Europe regarding Russian supplies of natural gas; or world strategies to diversify sources of oil outside sensitive regions in the Middle East. "	Changed to clarify

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	16	6	17	15	-	-	-	"The discussion of energy security lacks sophistication and is too oriented toward physical arguments. It needs an integrating framework, grounded in resource economics. ""Imports"", for example, are not by themselves vulnerabilities. Witness England during the oil disruptions of the 1970s, whose oil-exporting economy at the time suffered more than most in the run up of world oil prices. Japan's 100%-oil-importing economy, by contrast, was at that time among the least affected economies. All four ""broad themes"" and their metrics (or proxies) have problems. ""Availability of resources"", for example, suggests the need for indigenous supplies, where most countries would be better served by ""access to energy markets"". ""Risk of disruption"" addresses a real concern, but would be better understood as ""reliability"" (electricity, gas) or ""reduced vulnerability to energy price shocks"" (world oil markets). ""Diversification"" is commented on elsewhere (p. 16, lines 38-43). ""Temporarily fluctuating sources"" seems to be RE-specific and would seem to overlap with the other three. "	Some of these issues are now included more explicitly
Trigg Talley (U.S. Department of State)	9	16	34	-	-	-	-	-	"The following is noted: ""reference to be supplied later"". Please add this. In general, this underscores that this manuscript is not complete."	Completed
Trigg Talley (U.S. Department of State)	9	16	26	-	-	-	-	-	"The statement that ""if fossil fuels are a temporary solution, then that solution is not sustainable"" is simplistic, please delete. With over 100 years of coal reserves and potential technologies to reduce harmful emissions like CCS, it seems short-sighted to declare that coal-CCS (or any other fossil technology) has no potential to contribute to SD objectives. "	deleted
Trigg Talley (U.S. Department of State)	9	16	22	16	26	-	-	-	"This is a very important paragraph, but the parenthetical ""(even if for many decades)"" provides a completely false sense of security. There is ample evidence in the literature including, finally, admissions in the latest IEA Energy Outlook that ""conventional oil"" has peaked on planet Earth. This raises the near-term prospect of much higher oil prices and coming shortages that will have a major impact on prospects for economic development throughout the planet, bringing into question the prospects for completing an energy transformation that maintains current standards of living, much less improving on them in a global context."	Pessimist and optimist views are quoted briefly

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	16	22	16	26	-	-	-	"This paragraph is problematic, as it fails to acknowledge a vast body of economic literature on energy and scarcity (e.g., M. Adelman, MIT), where supply, demand, prices, and innovation all work against simplistic arguments of physical limits or ""finite"" supply of energy. "	Pessimist and optimist views are quoted briefly
Trigg Talley (U.S. Department of State)	9	16	41	-	-	-	-	-	Authors should add hydropower as it is subject to weather variability in terms of rain, river flow, etc.	Example included
David Warrilow (Department of Energy and Climate Change)	9	16	5	17	15	-	-	-	Enhanced energy security: the authors could reduce the first half of this section.	Shortened
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	16	-	17	-	-	-	-	In the definition of the concept of energy security little attention is given to the fact that the interpretation of energy security is highly context dependent.	We believe the section makes clear the context dependence of "energy security" through the examples provided
David Warrilow (Department of Energy and Climate Change)	9	16	6	16	21	-	-	-	Need to be careful in talking of high penetration systems as it can be seen as implying a substitution of renewable for fossil rather than renewable led energisation	Not discussed
David Warrilow (Department of Energy and Climate Change)	9	16	27	16	37	-	-	-	Need to explore the macro economic Impact of being tied in to long term often dollar denominated contracts?	Potentially important, but would take us too far from the main focus
Trigg Talley (U.S. Department of State)	9	16	39	16	40	-	-	-	Reliability depends not only on diversification of energy sources, but also the probability of disruption of each individual energy source in the system. It is entirely possible that a system with more energy sources could be less reliable if each source is highly prone to disruption.	Addressed
Brian Gray (Environment Canada)	9	16	27	16	37	-	-	-	Suggest making paragraph more focused. It is not clear what point the example about the IEA is trying to make.	This issue is covered in CH8; several links to the discussion are included in the section.
Trigg Talley (U.S. Department of State)	9	16	25	16	26	-	-	-	The timeline can be argued here. Centuries of supply of fossil fuels exist in many countries. If they are used cleanly they represent significant opportunities.	deleted
Trigg Talley (U.S. Department of State)	9	16	22	16	26	-	-	-	This paragraph, due to bifurcation of weak and strong sustainability, detracts from overall message.	eliminated

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	16	22	16	26	-	-	-	This short paragraph touches on a crucial issue: specifically, the relationship over the long term between RE and the exploitation of exhaustible resources. In the long run, if the incremental effect of RE development and use does not reduce the aggregate quantity of exhaustible resource extraction/exploitation/use (i.e., reduce the amount of the resource that is economical to extract in comparison to the counterfactual scenario), then the impact of RE on many important SD indicators is ambiguous.	definition of RE has been given that emphasises this point in Section 9.1.1. However, other critical impacts with respect to raw materials (Box 9.3) and water use and consumption (Section 9.3.4.4) have also been highlighted.
Brian Gray (Environment Canada)	9	16	1	16	4	-	-	-	This text could be taken to assume that a goal is to make rural areas equal to urban areas with respect to energy forms and quantities used. Please clarify message here.	Discussion is not normative, but rather about need for data about these differences
David Warrilow (Department of Energy and Climate Change)	9	17	16	-	-	-	-	-	"the title ""reduced environmental impacts"" could be seen as contentious - renewables are varied and give rise to some impacts - especially air pollution (biomass), land use and water use.. Take out ""reduced""?"	Title changed
David Warrilow (Department of Energy and Climate Change)	9	17	3	17	10	-	-	-	Geographic diversity (i.e. diverse locations) can also help	Added short statement
David Warrilow (Department of Energy and Climate Change)	9	17	40	18	8	-	-	-	How is it envisaged that differing requirements for grid and similar infrastructure will be fed into the conceptual framework? Whilst posed in the text on LCA it has much wider ramifications.	We tried to clarify why we use LCA here, and explicitly acknowledge that his only part of the relevant studies.
David Warrilow (Department of Energy and Climate Change)	9	17	11	17	15	-	-	-	Re energy security: why no direct indicators of renewable energy supply? The fossil energy indicators can¿t substitute for these. This needs an explanation.	The share of RE in total energy consumption is no valid measure of energy security. For instance, a country that is abundantly endowed with fossil fuels can enjoy a high level of energy security with a low share of RE. On the other hand, RE is not heavily traded and imports of fossil fuels (as a share of total energy consumption) constitute a feasible indicator of energy security.
Petteri Taalas (Finnish Meteorological Institute)	9	17	40	17	41	-	-	-	Reference for the statement in first sentence. Cherubini, F., Str¿mman, A.H. Life cycle assessment of bioenergy systems: State of the art and future challenges. Bioresour. Technol. (2010), doi:10.1016/j.biortech.2010.08.010	Unclear to which sentence it refers to. Cherubini is also mostly a LCA review on biofuel methodologies; other reviews also address other sustainability concerns.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Christian Bauer (Paul Scherrer Institut)	9	17	11	-	15	-	-	-	These selected indicators do not reflect the intermittency of stochastic renewables like solar PV and wind power	This is now discussed more explicitly here and in 9.3
David Warrilow (Department of Energy and Climate Change)	9	18	34	19	6	-	-	-	Need to be careful about making such sweeping statements at a country level - for example India has enclaves of great wealth (and high energy consumption) in close proximity to areas with very low development levels.	That's exactly the point being made in this paragraph: structural change and industrialization lead to changes in energy consumption patterns, as can well be observed in India. High-income households exhibit very different patterns of energy consumption compared to poor ones.
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	18	5	18	8	-	-	-	The indicators selected here (GHG emissions and land-use changes), although justified by data availability, are very limited and might give a misleading representation of the environmental impacts of RETs. Water use and biodiversity impacts should be somehow included.	A clearer description of which indicators are used has been provided
Yun Gao (China Meteorological Administration)	9	18	1	18	8	-	-	-	The introduction of indicators is conceptual and the discussion is too general. There is no need to spend so many pages on this. Can be shortened to half page.	Chapter has been thoroughly edited to address this issue.
David Warrilow (Department of Energy and Climate Change)	9	18	30	18	31	-	-	-	Whilst there is an observed association between GDP and energy use, it is perhaps overstating the case to talk of a causal link. For example if there is a causal link how does it explain the growth in the UK economy over the past 20 years and associated reduction in emissions?	The paragraph does not claim that there is a causal link between energy consumption and output. To the contrary, it highlights the fact that such causal links are hard to establish
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	18	-	-	-	9.3.3.1	-	-	It should be clarified if the GDP is measured as MER or PPP. The conclusions drawn on for example convergence of intensity is dependent on MER or PPP is used.	Some studies use MER, others PPP. The choice of GDP measure usually does not matter; the broader overall pattern that similar per-capita incomes. The Markandya et al. Study employs PPP. We now mention this (in brackets)
David Warrilow (Department of Energy and Climate Change)	9	19	2	19	6	-	-	-	There is a potentially interesting side discussion here about the need for demand side growth in order to support investment in (largely centralised) modern energy systems	Due to severe space limitations, we were unfortunately not able to pursue this strand of the discussion
Roxana Bojariu (Meteo Romania)	9	19	-	-	-	-	9.3.1	-	This figure is not related to renewable energy. It may be removed, to save space.	Figure 9.3.1. gives an overview of the relationship between economic development and energy use patterns, upon which much of the following content is based. Hence, it is rather essential for the Chapter

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Roxana Bojariu (Meteo Romania)	9	20	18	-	-	-	-	-	"It is not clear what ""providing access to modern energy"" means."	An explanation '(such as electricity or natural gas)' has been added
Roxana Bojariu (Meteo Romania)	9	20	-	-	-	-	9.3.2	-	This figure is not related to renewable energy. It may be removed, to save space.	Figure has been removed
Trigg Talley (U.S. Department of State)	9	21	26	-	-	-	-	-	"Do the authors mean 236.000 and 161.000 people; or 236,000 and 161,000 people?"	Has been changed to '236,000' and '161,000'
Klaus Radunsky (Umweltbundesamt)	9	21	16	21	16	-	-	-	"The term ""formal economy"" is used only once, without further explanation. As it is not a common term some explanation would be required."	An explanation '(i.e. legally regulated and taxable)' has been added
Trigg Talley (U.S. Department of State)	9	21	29	21	30	-	-	-	Brazil sugar cane employment example is not necessarily representative, and therefore not relevant as RET and labor will be technology-specific and to a certain extent scale-specific	The example has been merged with the sentence before it, such that now it reads: 'Examples of the use of RE in India, Nepal, and parts of Africa (Cherian, 2009) as well as Brazil (Goldemberg et al., 2008; Walter et al., in press) indicate that in many parts of the developing world RE can stimulate local economic and social development. '
David Warrilow (Department of Energy and Climate Change)	9	21	23	21	27	-	-	-	Need to check these numbers - they seem to imply that Germany has 10% of the global RE jobs.	Will be verified and corrected if necessary
David Warrilow (Department of Energy and Climate Change)	9	21	14	23	18	-	-	-	This is a hugley important section, but currently comes across as lengthy and repetitious	We have endeavoured to shorten it at make it more concise
David Warrilow (Department of Energy and Climate Change)	9	21	23	-	-	9.3.1.3	-	-	Can add that RE, especially in decentralised forms, can obviate the need to make enormous investments in infrastructure with uncertain payback - there are lots of examples where grid electrification has worsened the economic performance of the utilities	Grid extension vs. off-grid is discussed in Section 9.3.2. on energy access

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Brian Gray (Environment Canada)	9	21	-	-	-	-	9.3.3	-	"Figure 9.3.3 seems to contradict the text in lines 2-4: many points on the graph show a weak primary energy demand with a medium HDI (between 0.5 and 0.8 as defined on pg 21, line 3). Defining ""significant access to non-traditional energy supplies"" might help with interpretation."	Wording has been changed to: 'The graph reveals a positive correlation between energy use and the human development index. In particular, countries with the highest levels of human development are also among the largest energy consumers. For countries with a relatively low energy demand (<2 toe/cap), the picture is more diverse: while some are constrained to low HDI levels (<0.5), others display medium ones (between 0.5 and 0.8) at comparable energy consumption.'
Christian Bauer (Paul Scherrer Institut)	9	21	10	-	-	-	9.3.3	-	a) are there more recent data available than from 2004? b) would be interesting to single out selected countries explicitely, e.g. China, India, USA, avg. EU	Figure has been updated with most recent data
Roxana Bojariu (Meteo Romania)	9	21	-	-	-	-	9.3.3	-	This figure is not related to renewable energy. It may be removed to save space.	Figure has been removed
Yun Gao (China Meteorological Administration)	9	21	11	21	11	-	figure 9.3.3	-	Data from 2004 in this figure is outdated and needs to be updated.	Figure has been updated with most recent data
Roxana Bojariu (Meteo Romania)	9	22	25	-	-	-	-	-	"Please replace ""Moldowa"" by ""Moldova""."	Has been changed
Taro Kawasato (Ministry of the Environment, Japan)	9	22	13	-	23	-	-	-	"Reference to a ""Global Green New Deal,"" or increased employment opportunities through the promotion of RE - not explicitly mentioned in the previous version - is very welcome."	No need to change anything
David Warrilow (Department of Energy and Climate Change)	9	22	13	22	23	-	-	-	"The previous paragraph quotes Fankhauser on why the evaluation of labour market impacts is complex - we're interested in ""net"" effects of renewable investment. This paragraph then uncritically cites a number of studies that appear to ignore the complexities."	The studies cited are among the few estimates of labor market effects of RE. In any case, such an analysis would be burdened by a number of complications, and we believe that the introductory qualification makes it clear that the number given in these studies should be taken with a grain of salt.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
David Warrilow (Department of Energy and Climate Change)	9	22	13	22	23	-	-	-	Are the figures factored for converting investment into jobs for a US or developing economy? - more of the investment tends to convert to human capital in emerging (low wage) economies. Keynesian multipliers also tend to be higher for secondary employment impact.	The two studies estimating the impact of stimulus spending are for the US
Trigg Talley (U.S. Department of State)	9	22	13	22	23	-	-	-	The paragraph on the number of jobs estimated created or saved as a result of stimulus funding excludes the official U.S. estimate produced by the Council of Economic Advisors of approximately 720,000 job-years through 2012 as a result of $90 billion in clean energy spending. See: http://www.whitehouse.gov/sites/default/files/image/arra_%20and_clean_energy_transformation_3Q_supplement.pdf	Reference has been added: 'The Council of Economic Advisors to the US administration projects the US $ 90 billion spending on clean energy included in the American Recovery and Reinvestment Act (ARRA) to create or safeguard, respectively, 720,000 job-years through 2012'
David Warrilow (Department of Energy and Climate Change)	9	23	29	24	4	-	-	-	Take care with this wording - development stimulates a demand for energy, but increased energy provision does not always stimulate economic development	agree and will emphasize in text
Christian Bauer (Paul Scherrer Institut)	9	23	19	-	-	9.3.2	-	-	section should be streamlined, seems to me slightly repetitive in stressing the importance of access to energy for the poor	Section has been thoroughly edited to address this issue.
David Warrilow (Department of Energy and Climate Change)	9	24	4	-	-	-	-	-	Bazilian not Brazilian	changed
Trigg Talley (U.S. Department of State)	9	24	13	-	-	-	-	-	By citing AGECC (and this happens in other cases as well) the tenor of the citation suggests that this is an authoritative source, rather than one illustrative example amongst many or at least several sources.	wording changed to reflect this
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	26	2	-	-	-	-	-	It should read '3 billion' instead 2.5	with agreement on using WEO 2010 figures on access the precise number will be used
Trigg Talley (U.S. Department of State)	9	27	10	29	11	-	-	-	This is a good section which could perhaps be placed further up in this Section 9.3.2.	point well taken but not possible to change structure without affecting overall flow
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	27	10	27	14	-	-	-	This is the main point of the relation between RE and energy access. It could be better highlighted within the section.	wording to be moderated to explain links
Klaus Radunsky (Umweltbundesamt)	9	28	-	-	-	-	-	9.3.4	It is suggested to explain in a footnote the range of pico-scale, micro-scale and small-scale hydropower plants.	footnote to make reference to hydro chapter for definition discussion

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Klaus Radunsky (Umweltbundesamt)	9	28	-	-	-	-	-	9.3.4	It is suggested to include in a box or as a separate column regions with real world examples and some references (e.g. links to a webpage).	examples were included earlier but was taken out due to space restrictions and sections still too long. Including weblinks with no details does not make much sense
Yun Gao (China Meteorological Administration)	9	28	-	28	-	-	-	table 9.3.4	REN21 reference should be assessed here in a more balanced manner: transition to renewable energy in rural area in most cases is of low quality supply of energy. Once higher income is achieved, people in rural areas may change to conventional energy forms. Therefore, this does not mean a transition, but only a temporary choice for the poor and those living in the remote area.	agree that the small scale RE may be part of a transitional process but not necessary one leading to fossil and can be planned in this way to lead to better RE
Trigg Talley (U.S. Department of State)	9	29	31	29	36	-	-	-	"Expand the discussion of EROEI. Add more quantitative detail. Clarify what is meant by ""strong decline over time"" and ""even lower""? A table with more details may be helpful. "	Discussion has been expanded and cross-reference to 9.3.4. has been added. No Table, because of space constraints
Brian Gray (Environment Canada)	9	29	1	29	1	-	-	-	"It would be useful to have here or elsewhere in the report a definition of ""off-grid"" as it is uncertain whether countries define this term in the same manner. "	included brief note and check to see if it can go in list of terms
Christian Bauer (Paul Scherrer Institut)	9	29	34	-	-	-	-	-	"The reference ""(Seljom et al., 2010)"" is not referring to a specific source"	Seljon et al. Review technical literature from a variety of sources to demonstrate that energy payback of unconventional sources is significantly lower than for conventional ones
David Warrilow (Department of Energy and Climate Change)	9	29	1	29	7	-	-	-	Does this section overlook some of the social and cultural barriers to moving to modern energy systems, such as social hierarchies, attitudes to cash and credit etc.?	a note on constraints will be inserted but not explained as it would lead to significant expansion and literature is sparse
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	29	9	26	11	-	-	-	Not sure what the paragraph refers to. Not Table 9.3.3. Also not sure what the point is here.	comment not clear, will look at text
Taro Kawasato (Ministry of the Environment, Japan)	9	29	23	-	-	-	-	-	Other statistics show that proven reserves will last for another 53 years (Petroleum Association of Japan) while there are smaller estimates (40) as well. Therefore, a range should be presented instead of a single figure.	R/P ratios from the World Energy Council have been added. The phrase noe reads: 'recent estimates suggest that at the current rate of production global proven conventional reserves of oil and natural gas would be exhausted in about 41 to 45 and 54 to 62 years, respectively (WEC, 2010; BP, 2010)'

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Hein Haak (KNMI (Royal Dutch Meteorological Institute))	9	29	23	-	-	-	-	-	The word exhausted is not in line with the content of footnote 4 on this page. Oil and natural gas will become more diffucult to exploit and this could cause higher prices if the technological progress in this field is slow.	Has been rephrased
Trigg Talley (U.S. Department of State)	9	29	13	-	-	-	-	-	Section 2.2 should be 9.2.	Has been changed
David Warrilow (Department of Energy and Climate Change)	9	29	19	30	2	-	-	-	The 2010 report by UKERC on peak oil gives a more up to date review of the relevant literature	Reference has been added: 'a recent report (UKERC, 2010) concludes that “a peak of conventional oil before 2030 appears likely and there is a significant risk of a peak before 2020” (p. 171).'
Trigg Talley (U.S. Department of State)	9	29	18	29	36	-	-	-	The description about increasing scarcity of fossil fuel resources has some flaws. There is no mention of the role that price will play both in rationing existing resources and incentivizing investment in new ones - as oil becomes more scarce, its price will go up, this will result in less oil use and more use of the cheapest alternative. The role of price should be integrated into the discussion. Right now it appears the authors are making a limits to growth argument based on current projections of existing reserves, but this reasoning has been wrong before (namely, in the 1970s). Please reconsider inferring this sort of argument again.	We believe that footnote 4 includes the points raised by the reviewer, stating that 'Ultimately recoverable reserves (which include reserves that are yet to be discovered) are considerably larger than proven reserves; their actual size crucially depends on future oil prices and development costs'. Furthermore, some material relating to 'peak oil' and the interpretation of R/P ratios has been included
Trigg Talley (U.S. Department of State)	9	29	19	30	18	-	-	-	These passages are not particularly useful to discussion of energy security and could be deleted or at least pared down.	Section 9.3.3. discusses a broad concept of energy security including availability of resources, risk of energy supply disruptions, diversity of energy supply and temporal fluctuations of energy supply. Hence, we believe that these Sections are highly relevant in the scope of a broadened conception of energy security
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	29	8	29	11	-	-	-	This is a central point that deserves more attention. What are the implications of such reasoning? Maybe in relation to energy access the difference is not between Res and non-Res but between distributed and centralized supply systems.	point is being made earlier but can be emphasized further

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
David Warrilow (Department of Energy and Climate Change)	9	29	12	33	35	9.3.3	-	-	"The term ""enhanced"" energy security again may be seen as contentious. Energy security is not necessarily the same as ""security of supply"". Oil and gas prodcuers are concerned with ""security of demand"" and could see large scale investment in renewables as a threat. There is a simple reliability dimension to security of supply arising from the variable/unpredictable output of some renewables. A minimal amount of new text which cross-refers to chapter 8 would be sufficient. For these reasons chaneg the title to ""energy security"""	Title has been changed
Brian Gray (Environment Canada)	9	29	12	-	-	9.3.3.	-	-	Section 9.3.3. could also cite that conservation and energy efficiency are important elements of energy security as well.	p.32 l.14 now reads: 'Besides reduced energy consumption and more efficient energy use, RE constitutes a further option that can improve energy security in all the three of the dimensions discussed above.'
David Warrilow (Department of Energy and Climate Change)	9	30	11	30	14	-	-	-	"Some countries are bound to see this statement as contentious. Can it be ""put another way""?"	Rephrased to: 'regions in which political events can have an adverse impact on the extraction or export of fossil fuel resources'
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	30	14	30	18	-	-	-	The paragraph does not seem so relevant. It could be removed.	Paragraph has been removed
Brian Gray (Environment Canada)	9	30	-	-	-	-	9.3.7	-	Reserve-to-production ratios require careful interpretation when comparing different regions or countries that may have different methodologies for counting reserves (e.g., Feygin, M. and Satkin, R. (2005) The oil reserves-to-production ratio and its proper interpretation. Natural Resources Research, 13, 57-60). Suggest that further discussion on this could be included here to support this figure.	A footnote has been added to clarify the interpretation of the R/P ration and the suggested reference cited.
Brian Gray (Environment Canada)	9	31	11	31	16	9.3.3	-	-	There could be more elaboration in text or in a footnote to clarify that there are some sub-regional differences. For example, North America is net importer of energy, but Canada is net exporter.	A footnote has been added: 'It should be noted that there is considerable heterogeneity within single regions (e.g. while the US is a net oil importer, Canada is a net exporter). '
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	31	-	-	-	-	9.3.8	-	I do not really understand this Figure apart from what is claimed that is shows in the text on page 30. What is on the axis?	Figure has been removed

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	32	-	-	-	-	-	-	"Reduced environmental impact ""As no large-scale technology deployment will come without environmental tradeoffs, environmental interventions and impacts of RE technologies should be evaluated and compared to conventional alternatives prior to their concerted deployment"". This is very important and it should be highlighted. Conventional alternatives could be clarified. As an example, increased unconventional oil production can be an alternative to RE. It is unclear if this comparison is included."	Comparison will be framed more clearly. Data are included e.g. in EPNT discussion and subsection 9.3.4.1 and 2. Full comparison to unconventional oil production is beyond the scope of this chapter, however limited data available suggest that unconventional oil has very high environmental impacts in many categories. see response to 519/130 and 522/56
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	32	12	-	12	-	-	-	In cold climate like the Nordic countries district heating is an important part of the energy system as alternative to electricity, natural gas or oil for heating. Modern district heating plants have generally low emissions and health impact. There exist several studies on this topic in the literature.	The focus of the report is on the contribution of renewable energies and the respective section discusses in how far RE can contribute to energy security. Emissions and health issues are not covered in Section 9.3.3.
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	32	17	32	20	-	-	-	Intermittency (variability on short time scales) is should be mentioned here as well, as it requires fast reacting backup or storage solutions.	The paragraph mentions 'variable availability due to e.g. seasonal variability or changing weather conditions'. The latter is commonly understood as intermittency. We decided to use the term 'variable availability' in order to be consistent with the other Chapters. The discussion has been expanded and a cross-reference to Ch8 has been added
Trigg Talley (U.S. Department of State)	9	32	4	32	29	-	-	-	This section would be more readable if the three key points were presented as bullet points.	Section has been restructured and bullet-points have been introduced
Brian Gray (Environment Canada)	9	32	10	32	12	-	-	-	Wind power has been traded amongst European countries - suggest verifying and revising here as appropriate.	Rephrased to: 'RE are in general less traded on the world market compared to fossil fuels'

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Christian Bauer (Paul Scherrer Institut)	9	34	17	-	23	-	-	-	"There is something wrong in this paragraph; seems that copy/paste did not work. I'd suggest to write in this way: ""The employment of renewable energy technologies in the passenger transport sector includes liquid or gaseous fuels produced from biomass feedstock in conventional internal combustion engine vehicles, use of renewable electricity generation for charging of electric battery vehicles or hydrogen production with subsequent use of this hydrogen in combustion engine or fuel cell vehicles. However, the use of renewable electricity in conjunction with battery and fuel cell vehicles is not further discussed in this chapter, as currently only utilization of biofuels can be considered as a mature technology available for large-scale application.""""	Accepted
Paulina Jaramillo (Carnegie Mellon University)	9	34	20	34	21	-	-	-	Hydrogen is generally produced using natural gas. For hydorgen to be a truly renewable resource it should be produced via electrolysis using renewable power.	Accepted
Paulina Jaramillo (Carnegie Mellon University)	9	34	21	34	23	-	-	-	Incomplete sentence	Accepted
Klaus Radunsky (Umweltbundesamt)	9	34	12	34	24	-	-	-	It seems that this section ignores transport by railways as well as mass transport in cities which also may use electricity as energy source (e.g. subways, trams, trolley buses).	As stated in introduction, it is not possible to cover all means of transport, and discussion solely focuses on Biofuels vs conventional fuels. Renewable electricity generation is covered regardless of the sector, and reference to chapter 8 is provided. While this is indeed a limitation, what this section does address is made clear.
Yun Gao (China Meteorological Administration)	9	34	1	65	-	9.3.4	-	-	This section uses life cycle analysis for looking at net environmental impacts from renewables. Such information is highly convincing and valuable. However, there is one issue that we need to look at as well, ie. the additional fossil fuel capacities to back up renewables because of their intermittent nature. Also, this may be examined in a more historical and long term manner. The positive environmental impacts will be increasing along with technology improvement.	This is incorporated in the discussion about consequential LCA. Unfortunately such studies are rare. back up capacities and storage are not well covered by the literature, intermittency and resulting system changes are discussed in the introduction, both caveats will be outlined even more clearly in relevant parts of 9.3.4 and will be taken up in 9.5,

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
David Warrilow (Department of Energy and Climate Change)	9	35	18	35	39	-	-	-	"This discussion contains terms of art such as ""attributional LCA"" that are not explained. For the non-expert, this text is therefore not very transparent."	now explained, attributional LCA is defined later on same page and references are provided for further edification
Trigg Talley (U.S. Department of State)	9	35	32	35	38	-	-	-	Please include uncertainties regarding determining the effects of developing biomass-based energy or biofuels on land use as a key challenge.	We agree that increased emphasis needs to be placed on uncertainties with bioenergy. A new section of introduction to 9.3.4.1 has been added for this purpose.
Trigg Talley (U.S. Department of State)	9	35	39	36	25	-	-	-	This discussion illustrates the importance of considering the policy context of RE. Specifically, a small scale RE project (e.g., solar panels distributed to remote areas of a developing country), an attributional LCA may be perfectly adequate for assessing the policy's environmental impacts. However, to defensibly assess the environmental impacts of a large scale transformation of an industrialized economy's electric power sector, true economic analysis is required.	noted - 9.3.4 is "bottom up"/micro level-transformation issues are rather covered in 9.4 - 9.7. LCA limitations are explicitly stated, Indeed, there are questions where Consequential LCA is needed to adequately asses impacts from large scale changes. We discuss these two approaches and their benefits in this section. Unfortunately, the base of previous research for consequential LCA is small, so can not today inform the assessment provided in this report. Also, the context-specific nature of CLCA results hamper their use in broad assessments such as these.
Trigg Talley (U.S. Department of State)	9	35	39	36	25	-	-	-	This discussion is a useful addition to the chapter, and should be retained and enhanced.	Discussion will be stressed in introduction and interpretation, however, there is to the date limited data available, so no comprehensive assessment based on this literature can be provided
Christian Bauer (Paul Scherrer Institut)	9	36	26	37	21	-	-	-	"concerning ""energy payback"":the definition of the different terms as applied in this chapter need to be provided, otherwise just using the terms does not help the reader in understanding the results."	Definition is provided in Annex, reference will be inserted, terms are explained in accompanying box
David Warrilow (Department of Energy and Climate Change)	9	36	31	36	31	-	-	-	Embedded' is another term that is also widely used in this context	True, but not that often

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	36	-	-	-	-	-	-	The whole energy payback might well go into a relatively small box. Important but not to motivate a subchapter here. Also difficult to understand why biofuels is omitted in table 9.3.6 as there exist several studies looking at energy payback for biofuels (check other chapters in SREEN)	This will go into a small box. Energy Payback reported POWER/Electricity generation only. Biofuels is a different story, will be clarified.
Brian Gray (Environment Canada)	9	37	11	37	21	-	-	-	"The justification for excluding biomass from Table 9.3.6. because of controversy relating to ""...its ability to supply a developed economy with sufficient energy..."" should be cross checked with Chp. 2 of the SRREN. Brazil is moving ahead with sugar cane ethanol, and fenno-scandinavian countries are using forest biomass in industrial facilities for power generation. "	text will be revised
Paulina Jaramillo (Carnegie Mellon University)	9	37	16	37	21	-	-	-	Do the papers referenced provide estimated for the net energy metrics. I think it would still be useful to include a range of values found in the literature so the reader at least has an ide of the magnitudes of these numbers.	Ranges included in table
David Warrilow (Department of Energy and Climate Change)	9	37	19	37	21	-	-	-	If there are uncertainties justifying the omission of bio-power, there should be a clear statement as to what these uncertainties are.	text will be revised
Yun Gao (China Meteorological Administration)	9	37	16	37	21	-	-	-	More explanation for payback and energy ratio is required. The range for low and high value differs a lot. Some information on such wide gap might be useful. Discussion on financial issues, too. Does it constitute an element for such difference in payback time? Add the terms to the glossary.	We've already resisted calls to exclude or shorten this Section, so we can't really add to it. Financial issues are not the subject of this section. Terms will be included in Glossary. More information is included in Annex
David Warrilow (Department of Energy and Climate Change)	9	37	16	37	21	-	-	-	Other factors such as land use etc. can also make biomass based systems very difficult to model	Sentence has been removed and argument made clearer.
David Warrilow (Department of Energy and Climate Change)	9	37	16	58	30	-	-	-	This is fascinating and detailed stuff - but should it be in the development chapter? This section could be dramatically shortened to focus on the chapter topic and replaced with a reference to the section of the report that has the full, general, discussion of impacts, LCA etc. If such a section does not exist in the wider document much of this text could be annexed to the end of this chapter.	Environmental impacts are an important part of SUSTAINABLE development. This is the section of the report that provides full general discussion/comparison of impacts on a life cycle basis, and therefore discusses LCA. Chapters do not have Appendices by convention. Will shorten but not cut all.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Christian Bauer (Paul Scherrer Institut)	9	37	11	-	15	-	-	9.3.6	"It's not easyto understand the results in this table without the definition of the two terms ""energy payback time"" and ""energy ratio"". I guess both do not include the energy in the fuel in case of non-renewable systems, which does not make sense, because the important difference between renewable and non-renewable energy systems is by definition not reflected."	Definition is provided in Annex, reference will be inserted. Regarding the important difference mentioned, it is not reflected in definition, but included in the text, terms are explained in the accompanying box.
David Warrilow (Department of Energy and Climate Change)	9	37	16	37	21	-	-	9.3.6	The exclusion of bio-power from Table 9.3.6: this is understandable but surely contentious.	Explanatory sentence has been included in caption of Table 9.8
Paulina Jaramillo (Carnegie Mellon University)	9	37	14	-	-	-	-	9.3.6	What is the definition of the Energy Ratio? This term is mentioned in the text, but it is only defined in the appendix. Looking at the units, I would have thought that this was a meassure of energy efficiency. But I don't think the KWhprimary is actually the energy content of the fuel. Instead it reprsents the energy embodied in the life cycle of the generation technology. I would suggest making this clearer in the main paper.	terms are explained in text and in the Annex
Paulina Jaramillo (Carnegie Mellon University)	9	37	14	-	-	-	-	9.3.6	Where do the lifetime assumptions come from? Has there been any experience that wind turbines have a life of 25 years? Is there a replacement of any component that would affect the energy payback period?	Lifetimes were taken from the original literature, I have changed the column header
Brian Gray (Environment Canada)	9	38	11	38	12	-	-	-	"Recommend better characterizing the term ""important"" in this sentence. "	important here means that LUC could contribute a signficant portion of total LC GHG emissions for these technologies. However, owing to space constraints, we can't afford to more completely define this term and assume readers will understand.
Brian Gray (Environment Canada)	9	38	10	38	25	-	-	-	Suggest that this information may be better communicated as a table that lists the technology and then describes its LUC impact on GHGs. This section is difficult to read in its present form.	space constraints prevent this approach though the suggestion is good.
David Warrilow (Department of Energy and Climate Change)	9	38	38	-	-	-	-	-	The reference to Gross (2007) is not about life cycle GHG emissions - it's not clear why it's cited here.	this reference reviews evidence for efficiency penalty and additional reserves for up to 20% wind power and thus provides evidence to support this statement, which confirms the results of an LCA study.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Brian Gray (Environment Canada)	9	38	33	38	38	-	-	-	The studies referred to here by Pehnt et al. (2008) and Gross et al. (2007) were based on specific settings of balancing reserves and it is not possible to generalize these results. For example, the balancing reserves for wind power integration may be minimized if hydro-power is used as a backup system due to hydro-power's short response time (about 15 to 30 min.) combined with relatively good accuracy in very-short term (30 min.) wind forecast.	Gross reviewed over 200 studies, and though the included studies only evaluated wind up to 20% of generation, we feel the results are as useful as we can find. That their review results were confirmed independently using a totally different approach in Pehnt is important corroboration. Furthermore, the sentences suggest further research is needed to assess applicability to other technologies, which would seem to be in line with the reviewer's concerns.
Paulina Jaramillo (Carnegie Mellon University)	9	38	12	38	14	-	-	-	You should clarify that land use impacts of lignocellulosics are generally dominated by direct land use impacts, while the indirect land use impacts dominate the land use impacts of agricultural crops.	excellent point, we will try to work that in.
Klaus Radunsky (Umweltbundesamt)	9	38	-	-	-	9.3.4.1	-	-	As comparisons of different LCA studies are usually not straightforward due to methodological reasons it would have been helpful to focus on comparative LCA studies that have been designed for making comparisons across RET.	very few such studies are available and do not evaluate all technologies considered in the SRREN so would not support this report as well as what is done. Limitations to this approach are discussed.
Petteri Taalas (Finnish Meteorological Institute)	9	39	23	39	23	-	-	-	"Suggest to add to the sentence: ""Biopower with CCS displays significantly negative GHG emissions in case biomass utilisation is in temporal balance with regrowth and there are no high terrestrial C losses due to LUC""."	see response to 519/110
Trigg Talley (U.S. Department of State)	9	39	23	-	-	-	-	-	"This line should be changed to read, ""Biopower with CCS can display significantly negative GHG emissions."" There is no guarantee of negative emissions for biopower-CCS because some forms of biopower emit large amounts of net GHGs when land use change is considered."	caveat of not including LUC will be strengthened throughout this section
Christian Bauer (Paul Scherrer Institut)	9	39	20	-	-	-	-	-	Are there only results for post conbustion CO2 capture considered? None for pre combustion or oxyfuel combustion?	We performed an exhaustive review of available LCA literature, including those evaluating technologies employing any form of CO2 emission reduction strategies. The literature base for CO2 reduction strategies evaluted by LCA is thin, and we report all that pass our quality and relevance screens.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Paulina Jaramillo (Carnegie Mellon University)	9	39	9	39	19	-	-	-	Hydropower reservoirs may be a source of methane. Maybe there should be a discussion about this source. Here is a brief article in Nature about this issue: Nature 444, 524-525 (30 November 2006)	hydropower's methane emissions result from LUC and so are discussed in the previous page where readers are pointed to Ch 5 for more detailed discussion.
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	39	9	19	-	-	-	-	Suggest reduce this section - the statistical detail do not add relevant knowledge	this section's length will be reduced upon revision
Klaus Radunsky (Umweltbundesamt)	9	39	20	39	25	-	-	-	There have been examples of deployment of CCS on a commercial scale (e.g. Sleipner Fjord, Norway).	Thank you for pointing this out to us. We will adjust our statement upon confirming the scale of this example mentioned.
Hein Haak (KNMI (Royal Dutch Meteorological Institute))	9	39	25	39	27	-	-	-	I suggest to skip this sectence. The content is highly speculative. Leaking from CCS-projects is not very likely and if there is leakage it seems to be very small compared to the normal emission rates.	as we do not have considerable experience with storage, leakage rates have to be assumed, and the likelihood of leakage is a matter of professional judgment rather than an objectively measured phenomena currently. This sentence points out that the assumed leakage rate strongly influences the results and GHG reduction benefits of CCS. We are not speculating that CCS will leak or leak at any given rate, just that the benefits are sensitive to this parameter.
Petteri Taalas (Finnish Meteorological Institute)	9	39	41	39	43	-	-	-	This a questionable BAU with respect to European practices. One could also consider as baseline the situation where e.g. harvest residues would be left on site and come into a totally opposite conclusion on climate impacts.	We will improve the clarity of this sentence. The residues being referred to are all destined for the landfill (i.e., not crop or forest residues but rather wood in urban waste, etc.)

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
David Warrilow (Department of Energy and Climate Change)	9	41	12	44	19	-	-	-	Could add that can get significant variation between WTT an WTW according to assumptions on vehicle type, drive cycle etc.	All the GHG results are now reported on the basis of 1 MJ of fuel produced and used in a passenger car. The LC GHG emission comparison is based on the function/service1 MJ of fuel provides in a comparable passenger car. Different vehicle types and drive cycles have different fuel consumptions (to run one unit of distance) regardless of the type of fuels used (i.e., whether it is particular petroleum fuel or biofuel). The focus of this section is on fuels not on different vehicle types, and drive cycles. Therefore, we assume the use of biofuels and their respective petroleum fuels will be in the same vehicle.
Paulina Jaramillo (Carnegie Mellon University)	9	41	1	41	11	-	-	-	How do the boundaries in the studies differ? It seems clear that the renewables numbers include manufacture/construction. Is this also included in the studies about fossil fuels? Maybe a figure comparing the boundaries would be useful.	There is indeed differences in system boundary of the studies included in this plot. But there is not effective way of reporting this information, besides for in a multi-page table with a row for each estimate from each study, because every study differs slightly. In general, we applied quality screens to the values presented here to ensure they were true LCAs, i.e., investigating GHG emissions from more than one life cycle stage (but not necessarily all). See Methods Annex for more informaton on the screening criteria.
Paulina Jaramillo (Carnegie Mellon University)	9	41	12	44	19	-	-	-	I think this section should include the WTT emissions from transportation fuels, even if the TTW emissions are included in another chapter.	We have included WTT emissions and now present life cycle GHG emissions (on a WTW basis).

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	41	12	44	19	-	-	-	This section illustrates the importance of policy context in evaluating claims about biofuels GHG emissions. By far the most common approach in the biofuel LCA literature is to assume that biofuel production displaces an energy equivalent amount of fossil fuels. However, many biofuel policies are subsidies for production or consumption mandates. In the context of economic analysis, there can be no a priori conclusion about the policies' impacts on fossil fuel production or consumption. To the extent the policies result in biofuels adding to the quantities of fossil fuels that would have been consumed in the absence of the policy, the policies' overall impact on GHG emissions will be attenuated.	The reviewer raised a valid point that the adoption of biofuels could affect the total production and consumption of fossil fuels, and therefore the biofuel production will not necessarily displace the energy-equivalent amount of fossil fuels due to change in demand/supply of all fuels. As a result, the overall GHG impact of displacing fossil fuels with biofuels due to introduction of biofuel (or renewable fuels in general) might be attenuated. To address this issue, we have noted this as an additional area of uncertainty in the introduction to Chapter 9 (see Section 9.3.4.1.)
Trigg Talley (U.S. Department of State)	9	41	12	44	19	-	-	-	This section would benefit from liberal editing. It could get to the point much more quickly and reduce pages.	We have consolidated the first two paragraphs and reduced page length significantly.
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	41	-	-	-	-	-	-	What is the difference of seed-based biodiesel and renewable diesel? Renewable diesel=FTD from biomass?	A footnote has been added to the figure to explain what renewable diesel refers to and the difference between biodiesel and renewable diesel from oil seeds. Renewable biodiesel is not esters (chemically) and thus is distinct from biodiesel. However, both renewable diesel and biodiesel are renewable fuels derived from biomass feedstocks.
Trigg Talley (U.S. Department of State)	9	41	12	44	19	-	-	-	Why does LCA of transportation fuels spans well-to-tank rather the more complete well-to-wheels? The argument offered is that there is no difference between conventional and renewable liquids from tank to wheels. But if energy-efficiency losses in that final stage of the cycle swamp the aggregate LCA, it makes concern at prior stages relatively less urgent in the overall scheme of things.	We agree that a well-to-wheels comparison can provide a more complete picture about the GHG intensity of different fuels, and avoid confusion about difference in efficiency of vehicle drivetrains associated with various fuels. We have made changes accordingly, and all the GHG emissions are reported on a life cycle (i.e.,well-to-wheels) basis.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
David Warrilow (Department of Energy and Climate Change)	9	41	1	-	-	-	-	9.3.11	A table summarising this data would be really useful	Unfortunately, there is not space available for such a table. However, results of the underlying review of the LCA literature will be published for most technologies reviewed here in a special issue of the journal of industrial ecology in late 2011 or early 2012.
Paulina Jaramillo (Carnegie Mellon University)	9	42	21	42	24	-	-	-	"I understand the desire to separate the land use and non-land use impacts. However since it has been found that land use change can ""make or break"" biofules, I question wether this statement is appropriate. Withou land use, you really can't make a informed decision about biofuels."	LUC is being intensively examined for first-generation biofuels. However, there is no estimate on indirect LUC for petroleum fuels and very limited studies for second-generation biofuels, which can be derived from a wide variety of feedstocks. Due to lack of evidence, we are unable to provide a scientifically justifiable comparison of life cycle GHG emissions including LUC across the range of fuels we evaluate. Nevertheless, we added a paragraph to this section to emphasize the importance of LUC on total GHG emissions of transportation fuels and have reported available LUC estimates in units of per MJ fuel to facilitate the reader combining the two.
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	42	21	42	24	-	-	-	"insert ""if emissions form land use change are ignored""."	We have inserted " without considering potential LUC-related GHG emissions" accordingly.
Petteri Taalas (Finnish Meteorological Institute)	9	42	21	-	24	-	-	-	"It should be emphasized that dLUC and iLUC emissions are not included, for example: ""Results from the meta-analyses and studies reviewed here suggest that both existing and next-generation biofuels have lower WTT GHG emissions compared to petroleum-derived gasoline and diesel fuels from a variety of sources, when emissions from direct and indirect land use change are excluded."""	See explanation above.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	42	6	42	9	-	-	-	"The assertion that the CO2 released from biofuels is ""different from the fossil carbon in petroleum fuels"" is not accurate."	We have deleted this statement because our GHG emissions are now presented on a life cycle basis (i.e., well-to-wheels results). All CO2 emissions as well as adsorptions from the air during biomass growth have been taken into consideration.
Paulina Jaramillo (Carnegie Mellon University)	9	42	4	42	6	-	-	-	"This statement assumes that the efficiency of consumption of all the fuels is the same so that a MJ of each fuel provides the same km of driving. This may not be true and it is not clear that the vehicle efficiency is included. Here are some back of the envelope calculations I did on vehicle efficiencies.The fuel efficiency data comes from EPA's vehicle information (http://www.fueleconomy.gov/) and I am using the highway efficiencies they provide. VW Golf Diesel (42 mpg; 138,700 BTU/ga) = 3,300 BTU/mile. VW Golf Gasoline (30 mpg; 125,000 BTU/gal) = 4,165 BTU/mile. Chevrolet Malibu Gasoline (33 mpg, 125,000 BTU/gal)=3,790 BTU/mile. Chevrolet Malibu E85 (23 mpg; weighted average energy content of E85 90,660 BTU/gal) = 3,940 BTU/mile. These differences will affect the life cycle comparison of these fuels and should be included."	We did not assume that the efficiency of consumption of all the fuels is the same across all vehicles (as listed by the reviewer). As stated in the text, vehicle fuel efficiency remains virtually unchanged when biofuels considered in this chapter displace their counterpart petroleum fuels. In addition, our LC GHG emissions comparison is based on 1 MJ of fuel produced and used in a passenger car. The lower the vehicle fuel efficient, the less mileage a particular vehicle can travel on 1 MJ of fuel regardless of the type of fuel used. However, when we displace gasoline with ethanol, and diesel with biodiesel, renewable diesel and FTD, the function or service 1 MJ of biofuel provides will remain virtually unchanged as that provided by 1 MJ of their respective petroleum fuels displaced. For more information, the reviewer may refer to CARB (2009, ES-18 to ES-19).

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	42	21	42	23	-	-	-	Actually, Corn-ethanol processed at coal-fired biorefineries have been reported to have higher LCA's than gasoline.	This is correct that direct coal-fired corn mills have been reported to have higher GHG emissions than gasoline. To address this comment, we have clarified that the ranges of LC GHG emissions for existing biofuels represent state-of-the-art technologies and projections of near-term technological improvements. Recently-built and projected future corn dry mills are virtually all natural gas fired, or use natural gas, biomass, and coal CHP (combined heat and power) systems.
Paulina Jaramillo (Carnegie Mellon University)	9	42	13	42	16	-	-	-	As mentioned in my previouse comment, the efficiency of the vehicles can vary.	This has been clearly stated in the text that vehicle fuel efficiency remains virtually unchanged when displacing gasoline with ethanol and displacing diesel with biodiesel, renewable diesel and FTD. See explanation to Comment 523/9.
Trigg Talley (U.S. Department of State)	9	42	6	42	9	-	-	-	Current LCA approaches typically assume that all tailpipe CO2 emissions are reabsorbed the following growing season, but this need not be true. Outside of iLUC, biofuel LCA also tends to neglect biofuel feedstock production's impact on sequestered carbon, in particular in soils.	Soil carbon change resulting from direct land use change due to expanded biofuel production is covered in detail in the BOX on Direct and Indirect Land Use Change and Bioenergy and in ch 2.
Christian Bauer (Paul Scherrer Institut)	9	42	24	-	27	-	-	-	One reason for different GHG emissions of crude oil from differnt regions is production technology and treatment of gas as by-product.	Due to page constraint, we are unable to discuss variations and uncertainties related to GHG estimates for petroleum fuels.
Trigg Talley (U.S. Department of State)	9	42	16	42	16	-	-	-	Please make clear in the text why excluding land use change emissions is an important limitation of the analysis.	A new paragraph has been added to this section to remind readers of the limitation of the direct LC GHG emission comparison between petroleum fuels and biofuels.
Petteri Taalas (Finnish Meteorological Institute)	9	42	20	-	20	-	-	-	Should it be LUC GHG emissions instead of LC GHG emissions?	This is indeed LC GHG emissions rather than LUC GHG emissions

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	42	13	42	14	-	-	-	The text states that the vehicle fuel efficiency remains virtually unchanged when using biofuels compared to fossil fuels. This is not correct. There is a distinct energy penalty from using biofuels. Biofuels have about 33% less energy per unit of volume than gasoline, for instance.	It is true that ethanol has about 33% less energy per unit of volume (e.g., liter, gallon, etc.,) than gasoline. However, our GHG emissions for all fuels are reported on a per MJ of fuel basis, which is a unit of energy content, not a unit of volume.
Petteri Taalas (Finnish Meteorological Institute)	9	43	5	43	5	-	-	-	"Add: ""...of selected literature, when the LUC impacts and the temporal imbalance between feedstock production and regrowth of new biomass are not considered"""	It is clearly stated that LUC impacts are not included, though it has been re-emphasized upon revision. The time value of CO2 emissions and absorption has not been considered in our LC GHG emission estimates. It will be added to a new introduction to 9.3.4.1 discussing uncertainty. The temporal profile of LUC is discussed in the LUC box.
Paulina Jaramillo (Carnegie Mellon University)	9	43	-	-	-	-	9.3.12	-	I can't read the text in this figure. Even if I did it, seems very busy and hard to read.	The figure has been significantly improved. The WTT bars have been removed from the figure.
David Warrilow (Department of Energy and Climate Change)	9	43	1	43	2	-	9.3.12	-	This Figure is difficult to read.	The figure has been significantly improved.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Petteri Taalas (Finnish Meteorological Institute)	9	43	-	-	-	-	9.3.12.	-	This figure is important but quite unclear. There is a lot of information included in the same figure, which might confuse the readers. It can be rather difficult to understand why there are two different emission values given for each biofuel and what are the negative emissions. Is it necessary to show the bars with WTT emissions minus biogenic CO2 emissions? Often the WTT emissions are expressed only as the yellow bars in this figure. At least the bars for fossil fuels should be yellow as there are no biogenic emissions reduced from those bars. The WTT emission estimates for fossil fuels are quite high. According to the CONCAWE study, e.g. the emissions of crude oil refining vary from 10 to 14 gCO2e/MJ (depending of the final product, see: http://ies.jrc.ec.europa.eu/uploads/media/WTT%20App%202%20v30%20181108.pdf). Also the capture of this Figure is quite unclear, containing many brackets and parentheses. This Figure and the capture would be clarified if the results of Hsu et al. (2010) would be left out from the figure and transferred to the main text.	We have removed the bars, which represented the WTT emissions from the figure. In the revised figure, the bars represent life cycle (i.e., WTW) GHG emissions for both biofuels and petroleum fuels. We have also removed the results from Hsu et al. (2010) from the figure. However, the petroleum fuels still have wider ranges than those reported in CONCAWE based on several recent studies, which examine the GHG emissions for petroleum fuels from a large number of crude oil sources at a global scale.
Petteri Taalas (Finnish Meteorological Institute)	9	44	33	44	33	-	-	-	"Add 2 sentences: ""In addition, even without change of land use type, e.g. in long-rotation forestry the above and below-ground carbon stocks vary. The growth and use of biomass are not in temporal balance with each other having climate impacts"""	We believe that this criticism is addressed in the last sentances of paragraph two of the LUC box, albeit without the same phrasing.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Petteri Taalas (Finnish Meteorological Institute)	9	44	6	-	-	-	-	-	"Reijnders & Huijbregts 2008 as a source for fossil fuel input in palm oil processing. The result in Reijnders & Huijbregts is based on lightly justified assumption (75% fossil input) which is not in line with other literature on fossil fuel inputs. See e.g. Schmidt 2007, Subramaniam et al. 2008, JRC 2007, Helin et al. 2009. Refs: Schmidt J., Life cycle assessment of rapeseed oil and palm oil. Ph.D. thesis, Part 3. Aalborg University, (2007). Subramaniam V., Ngan M., May C., Sulaiman N., Environmental performance of the milling process of Malaysian palm oil using the life cycle assessment approach, American Journal of Environmental Sciences 4(4), (2008), ISSN 1553-345X, pag. 310-315. European Commission Joint Research Centre, Background material for RES-directive development, Notification in written form: ¿Updated figures communicated - Update on Data on pathways for RES Directive.xls¿, (2008). Helin T., Soukka R., Panapanaan V., Heinim¿ J., Linnanen L., Greenhouse gas balance in palm oil milling and assessment of EU RES-Directive emission savings values. Proceedings of 17th European Biomass Conference and Exhibition, 29.6.-3.7.2009, Hamburg, pp. 1746-1754. "	Rejected. See above.
Paulina Jaramillo (Carnegie Mellon University)	9	44	3	44	6	-	-	-	Again, I am not sure making this statement is really of any use, since land use change is so important in the life cycle of biofuels. I think any discussion of the comparison should be made after the land use change impacts are described and should include at least the magnitude of the land use impacts and how they affect each biofuel's life cycle.	See explanation to Comment 523/13
Klaus Radunsky (Umweltbundesamt)	9	44	21	45	38	-	-	-	box: The information in the box is very much appreciated.	thank you

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	44	1	44	11	-	-	-	Provide a more explicit discussion of negative land use changes associated with deforestation to make biofuels crops outside of box. Tropical deforestation to build biofuels plantations increases GHG's, destroys ecosystems, reduces water quality, and has deleterious long-term sustainability impacts.	We have provided additional paragraph to emphasize the importance of LUC on total LC GHG emissions of transportation fuels. However, due to page limit, we are unable to discuss detailed driving forces of LUC, type of land converted, adverse consequences of deforestation, etc., in this section.
Petteri Taalas (Finnish Meteorological Institute)	9	44	6	44	9	-	-	-	Reijnders & Huijbregts 2008 as a source for fossil fuel input in palm oil processing. The result in Reijnders & Huijbregts is based on lightly justified assumption (75% fossil input) which is not in line with other literature on fossil fuel inputs. See e.g. Schmidt 2007, Subramaniam et al. 2008, JRC 2007, Helin et al. 2009.	The reviewer brought up a valid point. We have reviewed the papers/reports the reviewer provided, and agree that palm oil processing continues to evolve, and more palm oil plants have switched to residual biomass as primary energy sources. Unfortunately, due to space limite, we are unable to include these details in this section.
David Warrilow (Department of Energy and Climate Change)	9	44	5	-	-	-	-	-	The reference to Whitaker and Heath appears to be missing in the reference list.	This has been added to the reference list.
Trigg Talley (U.S. Department of State)	9	44	21	46	15	-	-	-	The text box concerning indirect land use change is a worthwhile addition to the chapter and should be retained.	thank you
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	44	21	45	38	-	-	-	There is an entire chapter dedicated to bioenergy. Is this box really needed here? Also considering space constrains.	See comment 529/60
David Warrilow (Department of Energy and Climate Change)	9	44	21	45	38	Box	-	-	Box is again far too long	LUC is an important and complex topic. We strive to only use the minimum space required to present the reader with a review of the evidence on LUC as it relates to estimates of life cycle GHG emissions from bioenergy that are reported in this Chapter. Other reviewer comments directed us to expend the box, which requires us to balance the differing opinions.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	44	-	-	-	-	Box	-	The risk of ghg emissions when energy crops replace forest is mentioned. However, it could also be mentioned that replantation of forest on the same land after the energy crops can have the opposite effect. It would also be interesting to have the time horizon of 100 years in the text since this is common in GWP.	The general point of the 2nd sentence is already addressed in the text of the box even if this specific example is not mentioned. As to the time horizon, 20-30 years is the common time horizon in the literature. 30 years was selected as most prevelent in the LUC (dLUC and iLUC) studies collected, but the intrinsic value and scientific justification of these time horizons is fairly weak. The effect the selected time horizon has on results is noted, but not discussed as such methodological discussions are more appropriate for chapter 2.
Petteri Taalas (Finnish Meteorological Institute)	9	45	18	-	18	-	-	-	"Should it be ""iLUC impact""?"	It is LUC. Will clarify in text by stating that iLUC is generally not reported as a separate estimates.
Trigg Talley (U.S. Department of State)	9	45	29	45	38	-	-	-	"Some of the variability across iLUC estimates reflects differing estimates of the food vs. fuel tradeoff. For instance, the relatively small iLUC impacts found in some GTAP-based estimates was the flip side of the finding that feedstock demand simply outcompeted demand for food--in plain language, people ate less. Since this was a ""market mediated"" effect, its reasonable to assume that it was the lowest income households that were priced out of the market for food. Given that the relationship between RE and SD is the impetus for this report, this issue should be included in this discussion."	The impacts of bioenergy production on food security is discussed more extensively in Chapter 2.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	45	9	-	-	-	-	-	"While it is true that iLUC is ""..complex to model.."" this hardly makes it unique or even unusual. This complexity might be valid argument for not including iLUC if it didn't have the potential to materially change the fundamental conclusions of the analysis. Since iLUC is among the largest single contributors to many biofuels' LCA GHG emissions, it cannot be ignored."	LUC is discussed, and quantitative estimates, converted to per MJ fuel energy content to facilitate comparison or combination with the attributoinal LC GHG emisison results reported in the section on transportation fuels, are presented in the LUC text box. We are not able to combine results from LUC studies and attributoinal LCA studies into one figure for the following reasons. The first reason is the lack of similar data on LUC for fossil fuels to compare apples to apples, a very few estimates for some biofuels. The second reason is that highlighting LUC values in a directly comparable manner similar to the "direct" emissions would be misleading to readers as LUC ranges are highly determined by the study scope, also not allowing apples to apples comparisons and leading to misleading ranges.
Trigg Talley (U.S. Department of State)	9	45	36	45	38	-	-	-	The chapter recommends a very specific approach to sustainable development of bioenergy in the textbox with little discussion of when it may or may not make sense when the rest of the chapter clearly stays away from these types of specific recommendations. Please delete or appropriately caveat.	The policy was cited as an example using the words "for instance". In any case, another example was added due to other comments and additional language was added that should leave no doubt about the purpose of this paragraph
Klaus Radunsky (Umweltbundesamt)	9	46	22	-	-	-	-	-	"What are ""first principles""? It is suggested to keep the language clear and simple, e.g.: While some broad conclusions can be made based on the current, limted literature, additional research ¿."	Text will be clarified, similar to reviewer's suggestions.
David Warrilow (Department of Energy and Climate Change)	9	46	17	49	21	-	-	-	Need explicit reference to fact that discharge limits on once-through cycles can impact on operational availability etc?	An explicit reference to the fact that once-through systems are especially vulnerable is necessary. Text will be modified to explicitly state once-through systems are affected primarily.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Roxana Bojariu (Meteo Romania)	9	46	-	-	-	9.3.4.2	-	-	Nothing is said about the tendency to replace freshwater by seawater. A possible good reference might be CN Hodges, L Thomson, JJ Riley, EP Glenn, Reversing the flow: water and nutrients from the sea to the land, Ambio, 22(7) 1993 p. 483. More recent references by EP Glenn and coworkers and by Tim Flowers and coworkers are also useful.	While this research may be promising for developing high salt tolerant crops, the effects on long-term soil quality (as seen in Iran, among other places) has been negative and thus this may not represent a viable sustainable growth option for energy crops
Klaus Radunsky (Umweltbundesamt)	9	46	-	-	-	-	9.3.13	-	The ordinate lacks description - is probably the same as in figure 9.3.11?	will be addressed by graphic designer
Petteri Taalas (Finnish Meteorological Institute)	9	46	-	-	-	-	9.3.13 .	-	The emissions due to LUC shouldn't be separated from the emissions of production of biofuels as LUC might be the most important emissions factor related to biofuel production. This figure should be reported more closely with the figure 9.3.12. This information should be included in TS.	See response to comment 519/126. We plan to include results from this section in the TS.
Petteri Taalas (Finnish Meteorological Institute)	9	46	-	-	-	-	9.3.13 .	-	There is a problem with units in the legend of this figure (gCO2e/ha should be tCO2e/ha). For example the emissions per hectare of palm oil plantation on peat land, natural rainforest are 1600 gCO2e/ha even though according to Fargione et al. (2008) they are 1294-3452 MgCO2e/ha. It might help the reader to better understand the magnitude of the figures if the WTW emissions of fossil fuel comparator were shown in the figure or in the caption. It should be more clearly stated that this figure presents the direct LUC emissions. At least in the caption the dLUC should be written as direct LUC.	The first issue is indead a mistake and is now fixed. For the comment about adding WTW emissions into this figure, see explanation to comment 519/126. Fixed the last issue related to dLUC
Christian Bauer (Paul Scherrer Institut)	9	46	2	-	-	-	-	9.3.13	"concerning ""Maize (US)"": isn't it possible to provide the results in terms of CO2/MJ (fuel); yields and energy content should be known."	Yes. Fixed using proxy US conversion data.
Paulina Jaramillo (Carnegie Mellon University)	9	47	32	48	11	-	-	-	Gleick (1994) estimates evaporative losses from hydroelectric dams to range betwee 5.4 and 26 m3/MWh (lower than what you are reporting). He mentions that this may be an overestimate since some reservoirs have multiple uses besides power generation. This is true, however, I think it is innapropriate to not included hydropower in Figure 9.3.14. Quite frankly, not including the power generation technology that may have the largest water consumption shows an innapropriate bias towards renewables (hydro being a renewable resource).	The values the reviewer is referring to are originally from a Gleick (1992) publication. This value can be added and the figure can be modified. Careful text will also have to be added to ensure the figure is not misleading and showing an inappropriate bias against hydropower, given that power production is just one of many uses for many reservoirs.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Tormod Schei (SRREN ch 5)	9	47	32	-	39	-	-	-	in a kind of side remark it is mentioned that hydropower reservoirs can serve other purposes than electricity production. The context is allocation of impacts. The panel have pointed out that hydropower mitigate in two directions, ghg and freshwater scarcity. This is also the reason ch 5 was given an additional subchapter looking at water management. In a cross cut chapter where sustainability is discussed on a more general level I suggest that multipurpose hydropower should be given a bit more prominent place. In many parts of the world the electricity production by storage hydro is ranked behind water supply, irrigation and for inst flood control. However, the electricity plant will in these cases often function as a financial mechanism enabling the construction of reservoirs and thus holding back surface run-off for human consuption or use. In a world where freshwater increasingly may be a limited resource the ability of a RE to alleviate this is interesting. ch 9 could mention/discuss this under the headline of Water and refs could be made to 5.10	References will be made to Ch. 5 treatment of hydropower's multiple uses, and the sentences will be reworded to be more explicit about how power production is just one of many uses for a reservoir.
Trigg Talley (U.S. Department of State)	9	47	16	-	-	-	-	-	Under the section called Water Use, there are references to the U.S. system ¿ Line 16 ¿ which does not seem particularly useful in the development context.	It is clearly stated in the text: "Data are from studies of U.S. systems only, but represent a wide range of technology vintages and climatic conditions, both of which can affect water use rates (Miller et al. 1992), and thus their results should apply to other contexts. " A further clarifying sentence and a source from outside the U.S. will be added to convey the fact that the technologies to be used in developing areas will have water use factors that are within the range of the U.S. values reported.
Klaus Radunsky (Umweltbundesamt)	9	47	15	47	18	-	-	-	With respect to water footprint it is in general not justified to apply results from one specific region to another region. Usually only site/region specific studies can provide relevant insights. Far more results would be needed to e.g. identify generic results that are characteristic of a region specified e.g. by a certain climate/precipitation pattern. Unless such parameters can be provided to categorize regions the lnaguage should be more cautious. The language on page 48, lines 12 to 14 is much more appropriate.	The language will be modified to provide more caveats and to explain the highly site-specific characteristics of the water footprint metric.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Tormod Schei (SRREN ch 5)	9	48	22	-	-	-	-	-	comment as for pg 47 line 32	Reservoirs' multiple uses will be more clearly addressed.
Paulina Jaramillo (Carnegie Mellon University)	9	48	14	48	17	-	-	-	Sentence structure is confusing.	Sentence will be restructured.
Brian Gray (Environment Canada)	9	48	0	48	1	-	9.3.14	-	Recommend explanation of why Hydro with Reservoir is not included in this figure, as it was discussed in the previous section.	Hydropower with reservoir will be added, along with appropriate caveats and explanations to avoid misrepresentation of the water use impacts associated with power production.
Tormod Schei (SRREN ch 5)	9	49	9	-	11	-	-	-	"Impacts on hydropower from climate change is mentioned and there is a ref to Harrison and Whittington 2002 - this ref is not mentioned in ch 5 - and there is no refs or mentioning of assesments done by ch 5 which is to be regarded as the authority on this topic - the para creates an impression of two independant assessments (ch 9 and ch 5 - both discussing the impact of CC) not necessarily in line with each other - ch 9 should ref er to ch 5 - in re to fig 9.1.1 it is not allways clear when ch 9 deviate from the tech chapters making its own judgements/assessments - when reading ch 9 I felt it to be a ""stand alone"" chapter not a synthesis building a.o. on the tech chapters - so maybe there should be stronger refferences to other chapters?"	References will be made to Ch. 5 treatment of hydropower.
Trigg Talley (U.S. Department of State)	9	49	0	-	-	-	-	-	It seems much text is spent on biofuels for this section ¿ not that it is not critical to mention, but overall an excess of space is used for this discussion.	Text will be reduced in this section to provide a more concise assessment of these issues.
Klaus Radunsky (Umweltbundesamt)	9	49	42	50	7	-	-	-	This paragraph lacks the necessary clarity and is confusing.	The paragraph will be reworked and reworded to provide greater clarity
Trigg Talley (U.S. Department of State)	9	49	15	-	-	-	-	-	Tradeoffs and constraints are mentioned here but the chapter notably does not dive into the tradeoffs and constraints.	Tradeoffs and constraints are highly site-, climate-, and technology-specific. Diving into specific tradeoffs and constraints would be outside the scope and length restrictions of this section. However, a further sentence can be added to provide some context to what these tradeoffs and constraints are.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Paulina Jaramillo (Carnegie Mellon University)	9	49	42	49	45	-	-	-	Water consumption for fossil fuel production will become increasingly important, as unconventional resouces are further developed. Oil sands, oil shale, and gas shale will have significant water consuption. This may be of particular concern in areas that at already water constrained, where some of these resources are located.	The overall body of literature is sparse on these topics, and many water quality and water quantity impacts are site-specific, making generalizations difficult. However, we will include water related impacts of these alternative methods of extracting fossil fuels
Paulina Jaramillo (Carnegie Mellon University)	9	49	35	49	37	-	-	-	Why is the water footsprint of bidiesel so much higher than for ethanol? I think a description of what causes this difference would be useful. In addition, you should point out that there are some feedstocks for biodiesel (like palm oil) that are not included and may be better.	A short description why the water footprint associated with biodiesel is higher than that of ethanol will be provided, along with discussion of other potential feedstocks.
Paulina Jaramillo (Carnegie Mellon University)	9	50	19	50	21	-	-	-	Are there any efforts on developing methods to capture these regional differences so there can be a direct comparison among energy sources? These is also relevant for water quality and air quality impacts	This is a good question and a good point. There have been some efforts in the past to provide generic regional water consumption for power production in the U.S., and some ongoing efforts to determine the water footprint of energy crops in the U.S. based on detailed climatic information, but these studies would not provide insight into this chapter at this time. Additionally, within any particular country there are likely to be wide variations depending on the local climatic conditions.
Trigg Talley (U.S. Department of State)	9	50	23	50	29	-	-	-	Balance the thermal impacts discussion with a brief presentation of the positive benefits that can come from warmer waters. One of the best sports fisheries in the Chesapeake Bay (U.S.) is right outside a once-through cooling system at a nuclear plant. The warmer water stimulates primary productivity and attracts fish. Similarly, large cooling ponds at nuclear plants and coal plants in the U.S. often provide excellent warm-water fisheries. Just ask any local fisherman. The biggest problem here is in rivers. Be more balanced.	A short description of potential benefits of thermal pollution (e.g. increased fishing yields) will be addressed.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Klaus Radunsky (Umweltbundesamt)	9	50	22	51	40	-	-	-	This chapter is lacking the necessary comprehensive. It does not address the significant water pollution by transport of oil and oil production off shore. Furthermore the literature cited is quite outdated and relates to a period of much less production and economic activity (1970!!!). It also does not address the long-term nature of water pollution (eg. of ground water reservoirs, e.g. by waste related to mining and/or the fuel cycle. The chapter also ignores the impact of hydrodams on water quality, in particular in countries with poor (waste) water management systems.	This chapter does address water pollution by transport of oil and oil production. It is correct that some of the literature cited is out of date; efforts will be made to include more recent published data. Long-term effects of water pollution have not been explicitly addressed; a sentence can be added in relation to this. Hydropower impacts on water quality will also be addressed.
Trigg Talley (U.S. Department of State)	9	50	23	-	-	-	-	-	This is an example of acronym use (EGU) where the reader would benefit from full words.	Full words will be used.
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	50	-	-	-	-	9.3.15	-	It is unclear whether the natural precipitation which is included in the crops water need is there actual need or if all the precipitation is needed for the crops. It could be cases when the crops need of water is less than the precipitation.	Natural precipitation is included in the water footprint. This section will be reworded to provide greater clarity to avoid such confusion.
Paulina Jaramillo (Carnegie Mellon University)	9	51	4	51	7	-	-	-	Not true for corn. In fact, nitrogen runoff from corn cultivation is a significant contributor to hypoxia zones in the Gulf of Mexico	We will provide a caveat explaining that corn cultivation (as it is predominantly a food row crop and not an energy row crop) is an exception and that significant pollution may occur from corn cultivation
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	51	5	51	6	-	-	-	the experiences in Germany show that the production of bioenergy crops requires the same amount of chemicals - particularly fertilizer - like cash crops, because also with the energy plants high yields should be achieved, moreover, land use changes must be considered, e.g., if meadowland (UNFCCC-nomenclature: grasland) converted into arable land (UNFCCC-nomenclature: crop land) and these aeras then more fertilised, increase the impacts for the water quality. Please use UNFCCC-nomenclature throughout the report.	Further research will address the German situation or other similar situations where energy crops may require more inputs. A more caveat-filled section will explain the differences. UNFCCC nomenclature will be used.
Trigg Talley (U.S. Department of State)	9	51	18	51	38	-	-	-	These two paragraphs are unnecessary and add little to the chapter.	Paragraphs will be consolidated and reworked throughout the section.
Paulina Jaramillo (Carnegie Mellon University)	9	51	34	51	38	-	-	-	This paragraph seems to fit better with the description about coal mines.	Restructuring the section will improve the flow and order of topics.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	52	19	53	15	-	-	-	Black Carbon Box ¿ The text here seems to delve to far into the weeds - consider condensing.	text will be revised and shortened
Paulina Jaramillo (Carnegie Mellon University)	9	52	7	52	9	-	-	-	Impacts of air pollution also depend on exposure.	will add this aspect to the text
Paulina Jaramillo (Carnegie Mellon University)	9	52	27	52	27	-	-	-	Maybe you should refer to Climate Change instead of Global Warming. This is true througout the entire document.	not a convention for SRREN; both terms are used. In particular, this Box refers to warming and cooling properties of aerosols
Roxana Bojariu (Meteo Romania)	9	52	-	53	-	-	-	-	The Box on Black Carbon could be significantly shorted. It is based mainly on regional data and I think the details provided are making too much of a particular case.	Box willl be shortened, however the regional focus will remain as a) it is important to have examples from DCs, b) Asia is the global black carbon hotspot
IPCC WGI TSU (University of Bern)	9	52	28	-	30	9.3.4.3	-	-	Please consider replacing the 2004 reference with a more recent one.	Will try to find comprehensive and more recent data, however Bond gives a good description of location and sources, and there are more recent citations in the text.
Trigg Talley (U.S. Department of State)	9	53	36	-	-	-	-	-	Acronym LCI is used for the first time - it should be spelled out	Accepted
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	53	9	53	11	-	-	-	It should be made clear that aerosols are very short lived and therefor normally not calculated into CO2 equivalents. In most of the literature, CO2 equivalents are only used for long lived and well mixed GHG - this should be made clear to avoid confusion.	will modify text accordingly
Trigg Talley (U.S. Department of State)	9	53	18	54	22	-	-	-	Section should be shortened. The first paragraph in this section is not particularly helpful.	the section is already as short as possible from my perspective. I find the 1st paragraph strictly necessary, since LCA results very much depend on assumption, boundary conditions, etc. and therefore it's necessary to provide this information to a minimal extent

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	53	17	54	22	-	-	-	There are too many references to Europe and U.S. Data, where possible, should reference developing countries. This is a reoccurring problem throughout this chapter.	As an integrative chapter, our approach has been to try to compare comprehensive assessments as available, and not focus on case studies or single values. Database is very weak for most technologies and many developing countries. In particular, more comprehensive assessments are lacking. This is unfortunate, and efforts have been made to include references from DCs, and include the perspectives/differences/specific conditions into comparisons.
Klaus Radunsky (Umweltbundesamt)	9	54	15	-	-	-	-	-	Please add: minor emissions of air pollutants, only ...	will do
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	55	-	-	-	-	9.3.16	-	Since the coal and gas technologies are not existing technologies the cases is not comparable. This must be highlighted.	coal and gas technologies WITH CCS are not operational yet; figure caption will be modified accordingly
Paulina Jaramillo (Carnegie Mellon University)	9	55	-	-	-	-	9.3.16 a	-	"Somewhere in the text it should be noted that the emission saving from renewables is not necessarily a 1 to 1 ratio. Solar and Wind are intermittent and variable resources. This variability has to be balanced with traditional power resources. Recent research shows that operating natural gas power plants to balance wind can cause an increase of NOx emissions (compared to operating the natural gas plant at optimal conditions). This ""emission penalty"" may also be true in regards to CO2. Here is a reference: W Katzenstein, J Apt ""Air emissions due to wind and solar power."" Environmental Science and Technology. 2009, 43, 253¿258"	will add this information and the provided source
Trigg Talley (U.S. Department of State)	9	57	38	-	-	-	-	-	"Not all the literature finds that Brazil's ethanol use has benign AQ impacts, see, for instance Anderson, L. ""Ethanol fuel use in Brazil: air quality impacts,"" Energy Environ. Sci., 2009, 2, 1015-1037. "	will add this information and the provided source

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
David Warrilow (Department of Energy and Climate Change)	9	57	11	57	12	-	-	-	"p.57 lines 11-12 ¿cultivation of energy crops in the US and Europe shows much less environmental benefits¿: this is an understandable but overly general assertion, firstly because there is a spread of GHG reduction values across temperate world crops used for biofuel, both actual and prospective, with EU sugarbeet performing relatively well in GHG terms; and second because the life cycle environmental impact profile of Br sugarcane is different to that of EC/US crops (see Zah et al) ¿ i.e. performance is better in terms of some environmental impacts than others (particularly smoke/particulate matter from sugarcane field burning). Also there will be stock carbon losses from the soil if Brazilian ethanol is cultivated on converted grassland, whereas this is unlikely in Europe. Moreover, by using the phrase ¿energy crops¿ rather than ¿first generation feedstocks for liquid biofuel¿, the sentence unwittingly includes miscanthus and other woody crops that can be used for power, heat and transport fuel, and which overall have a better environmental (particularly biodiversity) performance than arable crops. Conservative default values for the GHG % reductions are available here: http://www.renewablefuelsagency.gov.uk/page/guidance-v3 "	I agree to the comment's content; however, without extending the text significantly, it is hardly possible to deal with it in a satisfying way. I will modify the text as far as possible without getting much longer. However, the general assessment of "environmental benefits" other than air pollution is not the focus of this section.
Trigg Talley (U.S. Department of State)	9	57	12	-	-	-	-	-	"Wording is incorrect, ""less"" should actually read ""fewer"". Editing should be more careful."	Accepted
Klaus Radunsky (Umweltbundesamt)	9	57	2	-	-	-	-	-	Please clarify by using language such as: The environmental performance of biofuel based transport services with respect to air pollution depends ¿.	will do
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	57	10	57	12	-	-	-	Please explain why (if at all) it its the location and not the type of crop making the difference in environmental performance.	will modify the text: actually both aspects mentioned in the comment contribute to differences in the environmental performances
Trigg Talley (U.S. Department of State)	9	57	33	-	-	-	-	-	This discussion of biofuels is too extensive. Here there is a discussion on future vehicle design which may be inappropriate or out of scope for this chapter.	since other reviewers (e.g. 529/12) require more information and claim that the discussion is too general, I will not shorten it significantly. Since electric vehicles are in fact a way of using renewables in the transport sector, they must be mentioned.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	58	18	58	40	-	-	-	"This is good technically; weak stylistically."	Accepted
Paulina Jaramillo (Carnegie Mellon University)	9	58	58	-	34	-	-	-	There is a model in the U.S to estimate the externality costs of emissions of criterai air pollutants (APEEP model). These costs include mortality and morbidity costs, so it most include a model of the health effects of ambient air pollution. Here is a reference: Muller, N.Z. and R.O. Mendelsohn, Measuring The Damages from Air Pollution in the U.S. Journal of Environmental Economics and Management, 2007. 54(1): p. 1-14.	Section 9.3.4 does not include cost estimate, as explained in Introduction (9.2.2). Those can be found in other parts of the report, most prominently in 10.6, Will insert reference
Trigg Talley (U.S. Department of State)	9	59	24	-	-	-	-	-	"Consider changing the word ""high"" to ""intensive""-- since high could also refer to elevation."	Accepted
Christian Bauer (Paul Scherrer Institut)	9	59	4	-	6	-	-	-	"the context for this statement is missing: ""High concentration of populations and working migrants during construction phases have also raised concerns about for large infrastructure projects (ref WCD ch 5)"""	Accepted
Trigg Talley (U.S. Department of State)	9	59	16	59	17	-	-	-	"This statement is not completely accurate. Increased cancer risks to local residents from nuclear power plants is not an ""open question"". It is a question that has been answered. No statistically significant increased risk has been found. It would be more accurate to say that studies have not shown an increased risk of cancer to residents living near a nuclear power plant."	The reader is kindly refered to the cited study that discussed the contrasting findings of studies in the UK, Germany and Italy. Sentence will rephrased to better reflect this.
Taro Kawasato (Ministry of the Environment, Japan)	9	59	11	-	15	-	-	-	Radioactive pollution is a very important point, indeed, but its relevance in the context of health impacts of RE is ambiguous. If there is no significance in including discussion on nuclear energy - if the authors intend to make a comparison that perspective must be made clear - perhaps these lines could be omitted.	Rationale for comparison will be explained more clearly in introduction. In general, the subsection informs about LC effects of all ET, so line won't be omitted.
Trigg Talley (U.S. Department of State)	9	59	1	59	22	-	-	-	These two paragraphs make little sense. Suggest deletion or dramatic redraft.	Comment is too general to allow incorporation
Roxana Bojariu (Meteo Romania)	9	59	-	-	-	9.3.4.4	-	-	I think Sub-section Other health impact could be better written/organized. There is a mixture of health impact aspects due to RE and non-RE that should be presented into a more systematic way. I would prefer putting the RE impact aspects at the end of the sub-section.	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Brian Gray (Environment Canada)	9	59	23	-	-	9.3.4.5	-	-	Land intensity of bioenergy is dependant on the origin of the feedstock. The section correctly points out that dedicated biomass production for bioenergy requires a large landbase for simple biophysical reasons. However, it could also mention that a substantial portion of the current biomass supply comes from forestry and agricultural residues as well as organic wastes. The production of such feedstock does not require any additional land compared to the fossil fuel scenario. (Refer to Chp. 2 of SRREN SOD)	Accepted
Brian Gray (Environment Canada)	9	59	34	61	17	-	9.3.17	-	There are energy technologies discussed in this section that are not included in the Figure 9.3.17 (e.g., geothermal, nuclear, tidal, etc.). Suggest noting more explicitly that Figure 9.3.17 includes only some technologies and that descriptions of land use for other technologies are found in text.	figure will be cut
Tormod Schei (SRREN ch 5)	9	60	26	-	-	-	-	-	"insert ""and 5.10"" after 5.6 in paranthesis"	Accepted
Trigg Talley (U.S. Department of State)	9	60	27	60	29	-	-	-	It is unclear why there is a discussion of fossil fuels here and elsewhere.	it is clearly stated that the aim of this subsection is to compare RE and other ET life cycle impacts - but text will be revised to emphasize
Trigg Talley (U.S. Department of State)	9	60	23	60	24	-	-	-	The issue of involuntary displacement from hydropower or other RE projects deserves greater prominence in a chapter about SD. Please provide references summarizing the extent of the problem (e.g., estimates of how many people have been affected).	has been included in Section 9.5.1.
Brian Gray (Environment Canada)	9	60	-	-	-	-	9.3.17	-	Suggest considering the integration of biomass from agricultural and forestry residues into this figure. As this feedstock does not involve land use change (Repo et al. 2010: GCB-Bioenergy: doi: 10.1111/j.1757-1707.2010.01065.x), the additional area required to grow them is close to nil. Amounts of biomass from these sources are not trivial. If they were included, the life-cycle land use would range from near zero value to the maximum value noted in the graph. This situation is analogous to the comparison of Solar PV with Solar PV roofmounted which is shown in the graph. Suggest also that hydro could also be integrated into this graph as it also impacts land use.	graph will be omitted, but reviewers suggestion will be considered in main text.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Brian Gray (Environment Canada)	9	60	-	-	-	-	9.3.17	-	To provide the necessary context for interpreting the graph, suggest that a column could be added on the right describing how the land is used or the level to which it is used completely for energy extraction. For example, the wind total area includes all area between turbines in a 3.5 rotor diameter spacing, notwithstanding that housing, farmland, etc. is located between turbines. This contrasts with the open-pit coal where much of the land area used is unsuitable for other things. Information on this is included in the text in the following section, but could also be integrated into the graph.	graph will be omitted, but reviewers suggestion will be considered in main text.
Paulina Jaramillo (Carnegie Mellon University)	9	61	10	61	11	-	-	-	"I don't think this sentence appropriately covers this issue. Wind resources are generally distant to population centers so it is expected that significant investments will need to be made to build transmission lines. You should at least mention this issue. Here is an article slightly related to this issue: DAVID C HOPPOCK, Dalia Pati¿cheverri ""Cost of Wind Energy: Comparing Distant Wind Resources to Local Resources in the Midwestern United States"" Environmental Science and Technology, 2010 vol. 44 (22) pp. 8758-8765. "	RE are diverse and not generally more remote from centers of demand; cited lit does not cover subject; however, we will integrate information on increased network requirements for remote renewable developments if this can be located
Trigg Talley (U.S. Department of State)	9	61	0	-	-	-	-	-	"The section on biofuels (roughly p. 61 on) does not address the emerging issue of the carbon neutrality of biomass first address in Searchinger et al 2009 and now being further developed in the gray literature (See Manomet 2010). This is likely to become very important. References: Farigione, J. et al. 2008 Land Clearing and Biofuel Carbon Debt,: Science 319:1235-1238. Lippke, B. et al. 2010. Letter to the Congress. May 12, 2010 Manomet, 2010. ""Biomass Sustainability and Carbon Policy Study, ""Manomet Center for Conservation Science, Manomet Ma. 02345 http://www.manomet.org/sites/manomet.org/files/Manomet_Biomass_Report_Full_LoRez.pdf Schlesinger, W. et al. 2009. Letter to the Congress July 20, 2010. Searchinger et al. 2009. ""Fixing a Critical Climate Accounting Error,"" Science 326:527-528. "	LUC discussions have been strengthened.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	61	-	-	-	-	-	-	¿Bioenergy is also driving introduction and spreading of genetically modified species¿. This seems impossible. General modified species is driven by the more important sectors of foresting and agriculture and not the bio energy. Of cause, the energy sector can use these species but the sector does not drive the development.	There is a lot of research on genetically modified cultures for energy production, as optimal performance is different for energy purposes than for food crops or hardwood. However. text will be revised omitting the word "driver".
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	61	-	-	-	-	-	-	¿Bioenergy is also driving introduction and spreading of genetically modified species¿. This seems impossible. General modified species is driven by the more important sectors of forestry and agriculture and not the bio energy. Of course the energy sector can use these species but the sector does not drive the development.	There is a lot of research on genetically modified cultures for energy production, as optimal performance is different for energy purposes. However. text will be revised omitting the word "driver".
Paulina Jaramillo (Carnegie Mellon University)	9	61	7	61	9	-	-	-	As I understand it there is no central nuclear waste repository yet (in the U.S.). Currently all nuclear waste is store in ponds on site, so this land use is covered when accounting for the land used by the power plants. If a central repository is in fact used in the future, then land used would increase, but you should point out that this is not the case yet.	It is common practice for LCA to include future impacts (from downstream stages, e.g. decommissioning), that is part of the rationale of reflecting the whole life cycle. will insert a reference on current lack of depositories, and resulting future land use
David Warrilow (Department of Energy and Climate Change)	9	61	19	61	22	-	-	-	The authors could state that it is too early to know the environmental effects of marine turbines or the variety of other marine and tidal devices (aside from barrages).	Accepted
Brian Gray (Environment Canada)	9	61	40	-	-	-	-	-	This paragraph could be more balanced with positive and negative referenced case studies. For example, using residues from sustainably-managed forestry operations as biomass feedstock has a had a low impact on biodiversity and ecosystem properties (Verschuyl, J., Riffell, S., Miller, D., Wigley, T.B. , Forest Ecology and Management, in press). Also, plantations for bioenergy have been shown, in some cases, to have positive impacts on biodiversity. For example by providing corridors for migration, the growth of perennial energy crops in agricultural landscape has been beneficial to biodiversity (Semere et al 2007 Biomass and Bioenergy 31:20-29). Other examples are found for riparian habitats.	Accepted
Trigg Talley (U.S. Department of State)	9	62	16	-	-	-	-	-	"Instead of "".. while and positive effects were found in some areas has increased due to .."" consider changing to "" .. while positive effects were found in some areas due to ..""""	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Brian Gray (Environment Canada)	9	62	12	62	13	-	-	-	Text could be more clear in identifying that wind turbines do cause bird mortalities. It could also better characterize these mortalities in the context of other more major sources of bird mortality (e.g., collision with buildings, cars and communication towers, and due to poisoning of pesticides and oil spills. See http://www.fws.gov/birds/mortality-fact-sheet.pdf).	due to limited scope of chapter, more detailed elaboration does not seem appropriate. Recommended source is not scientific. Ch 7 provides a very long and detailed discussion on this issues (reference will be inserted)
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	62	0	65	-	9.3.4.7	-	-	"The whole sections ""Hazards and risks"" could be substantially reduced or omitted. Interesting subchapter but focusses on risks associated with fossil and nuclear energy and not much information on renewables. The logic in the chapter seems to be that renewable energy systems should be more decentralized thus less risk prone and more robust compared to fossils. However, renewables do not need to be more decentralised compared to other energy supplies or less depednet on centralised functions. E.g. ""decentralised"" powerproduction is in very much need of a centralised distribution grid that could be quite vulnerable."	The "Hazards and Risks" sections aims to provide a balanced treatment of renewables. In the first part this is done by providing results of comparative risk assessment, which includes not only different renewable technologies, but also fossil chains, large hydropower and nuclear energy, otherwise renewables would be addressed in a very isolated perspective. While this first part focuses on quantitative consequence indicators, the remainder of the sections discusses a range of topics and issues that are less amenable to full quantification and/or less understood/investigated. The grid issue has not been addressed in this section, as it is much more suitable to be discussed in the section on energy security. Including it in this sub-section (similar to other topics requested by other reviewers) would require to allocate a substantial larger amount of space to this section.
Klaus Radunsky (Umweltbundesamt)	9	62	19	-	-	9.3.4.7	-	-	The long-term risks related to nuclear, e.g. resulting from long-term storage of nuclear waste, transport of nuclear material, is not well addressed in this chapter as well as risks related to proliferation. It is suggested to include some information and reference addressing those very relevant risks as well.	An additional references have been included to provide some more information on waste storage and proliferation issues. Similar to comment 522/40 a more extensive treatment would require more space allocated to this section.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Taro Kawasato (Ministry of the Environment, Japan)	9	63	32	-	33	-	-	-	"The phrase ""but at the same time the consequences of extreme accidents can be very large"" is irrelvant in this paragraph and should be discussed in P64-65. It could also be noted that nuclear consequences are also irreversible."	This sentence comments on the findings represented by the figure, and thus it would not make much sense to shift / separate the maximum consequence discussion for nuclear within the section. The issue of nuclear land contamination is mentioned on page 64, however irreversibility is not explicitly addressed because a much morecomprehensive treatment would be needed that is beyond the scope of this section as well as the space assigned to it.
Taro Kawasato (Ministry of the Environment, Japan)	9	63	33	-	44	-	-	-	"The reference to nuclear power - especially the argument that nuclear energy involves ""low fatalities"" - in this context seems very sudden and unnecessarily long. With governments divided on the priority (and safety) of nuclear power, its justification is not relevant in this context and could be omitted. "	This comment is partially in contradiction to several previous ones that were asking for more details concerning nuclear. With the aim of providing a comparative assessment we abstained from omitting the proposed content because it should not be the scientists role to judge which information is necessary for governments and other stakeholders to arrive at their decisions or to set priorities. The text on page 63 does not speak of "low fatalities", but rather "low fatality rates" vs. "maximum consequences" (in terms of fatalities), which are the two chosen indicators shown in the figure of this section.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	63	31	63	34	-	-	-	Be a bit more balanced in talking about large nuclear accidents. Yes, impacts from extreme accidents can be very large. But, they are extremely rare. Only Chernobyl had a large impact (the environmental and health impact of 3 mile island was very low). Yet, the total impact of this accident on ecosystems and people is arguably smaller than the total annual impact of coal, oil, and gas. Perhaps even smaller than the impacts of hydro (displaces native people, kills people in developing nations each year, kills fish each year, etc). Recommend a more balanced discussion of this where the risk of large nuclear accidents is put into a proper context w.r.t. other energy resources.	It is stated in the section that nuclear accidents are low proability events (Figure 9.3.18 and Appendix for Gen III), and it is contrasted with maximum consequences of a potential accident. The Appendix has been amended slightly to provide some more information, and a footnote has been added to the figure indicating that latent fatalites are included for nuclear. The other consequence and impact categories mentioned in the comment (e.g. for hydro) should be better addressed in sections on LCA, EIA, water, ecosystem and biodiversity impacts etc, otherwise the hazards and risks section "monopolizes" and/or repeats too many issues.
Trigg Talley (U.S. Department of State)	9	63	36	-	-	-	-	-	Please define latent nuclear fatality.	A footnote has been added to the figure including a remark that details are available in the Appendix.
Trigg Talley (U.S. Department of State)	9	64	0	-	-	-	-	-	The information on fatalities needs context and polishing. It is not clear why this section speaks to individual deals.	Unfortunately, it is not clear from the comment, what exactly the reviewer would like to have polished. If more information would be available the most adequate action could be taken.
Paulina Jaramillo (Carnegie Mellon University)	9	64	15	64	17	-	-	-	You should make it clear that when you talk about the risk of accidents like the Deepwater Horizon, you are talking about the deaths that result at the time of the accidents. As you have described in other sections, there are mortality risks that can be attributed to these type of accidents (resulting from air pollution, for example) that do not occur inmendiately. If I understand correctly, in this section you are only focusing about the former.	Yes, this section does not analyze and discuss impacts from normal operation (page 63, line 1 ff) because such effects are dealed with by LCA and EIA. Fatalities from accidental events are thus referring to so-called immediate fatalities, except in the case of nuclear where latent fatalities are considered due to their predominance. The difference between immediate and latent fatalities is explained in the Appendix.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Christian Bauer (Paul Scherrer Institut)	9	64	4	-	-	-	-	9.3.18	Is there a EU27 country which is not part of OECD? If all EU27 countries are part of OECD, how can the max. number of fatalities be higher for EU27 than for OECD?	Yes, there is no complete overlap between OECD and EU27; e.g. Romania is a member of EU but not OECD, and Switzerland is an OECD but not EU member. The number of accidents and associated fatalites for a specific energy chain can thus be larger for EU compared to OECD. This is actually the case for the fatalities in the hydro chain (see Appendix) with 1 accident in OECD resulting in 14 fatalities and 1 accident in EU with 114 fatalities in the period of observation. Also both indicators "fatality rates" and "maximum consequences" can be higher for EU because the former is normalized (e.g. coal) and the latter is referring to the most deadly event (e.g. hydro).
Paulina Jaramillo (Carnegie Mellon University)	9	65	12	65	12	-	-	-	In my opinion, this sentence does not fit in this section. You already talked about these issues in other sections.	It is true that this issue is also addressed in other sections, however I have been asked to include it here as well. A cross-reference to relevant sections (e.g. 9.3.4.1 and 9.4.3.1) could be added, but then such cross-referencing should probably be done consistently throughout the whole chapter.
Trigg Talley (U.S. Department of State)	9	65	4	-	-	-	-	-	Line 4 on p. 65 suddenly delves into geothermal without any previous context.	The paragraph below the table is intended to complement the table. To make this clearer we have added after the text reference to the table a statement that the table and the paragraph following it are linked.
Klaus Radunsky (Umweltbundesamt)	9	65	15	65	17	-	-	-	The last sentence is rather cryptic. Either those additional risks are identified, underpinned by literature, or this sentence is deleted.	This last sentence refers to those risks discussed in this section in a less quantiative manner than those for the selected consequence indicators based on fatalities. To make this clear the sentence has been slightly changed.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Brian Gray (Environment Canada)	9	65	2	65	3	-	-	9.3.7.	Suggest that this table may be better explained in paragraph format for greater clarity.	I fully agree that this table could be explained in one or several flow text paragraphs. However, this would require much more space because in contrast to the table some additional explanations would be needed, and unfortunately this space is not available for this section. In any case a full treatment is not possible within the limited space assigned, but we believe that the references given in the table allow a reader to get more details if he wants. Finally, few issues that could be summarized very brief are given in the paragraph below the table to somehow counter-balance the much more compressed information in the table.
Roxana Bojariu (Meteo Romania)	9	66	-	68	-	-	-	-	In the next chapter (i.e. ch10) references are made to these issues. The comments on these pages should be significantly shorted or even removed (or moved to ch. 10).	Overlaps with CH10 have been reduced and efforts have been made to improve the consitency between both chapters.
Trigg Talley (U.S. Department of State)	9	66	22	66	29	-	-	-	Move the first sentence regarding the 4 factors to paragraph 1 of 9.4 (lines 1-9),and delete the rest of this paragraph which is redundant.	The introduction has been revised
Klaus Radunsky (Umweltbundesamt)	9	66	1	-	-	9.4	-	-	This chapter should be shortened. Any repition, e.g. with chapter 9.2 should be avoided. The main message is that IAM models by now are poor in their ability to link RE with SD. The focus should therefore on needs for further research.	Redundancies have been reduced; wrt IAMs robust results have been highlighted. See also comment 520/26
Klaus Radunsky (Umweltbundesamt)	9	66	30	-	-	9.4.1	-	-	This chapter does not explain how models consider costs related to energy technologies - which internal costs are considered, which external costs are considered.Greater transparency would be very much appreciated.	Additional text has been included in the introduction to explain and categorize models in general. In addition to that, this important issue is also covered in CH 10; a link has been provided

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Klaus Radunsky (Umweltbundesamt)	9	67	5	67	6	-	-	-	"The sentence ""When a constraint is imposed on GHG emissions, welfare losses are incurred"" needs further qualification in order to avoid a midsleading message. The language might read as follows: When assessing the losses in GDP, however, it must be acknowledged that danages from climate change have usually not been included in the analyses that have been used for this report."	We agree that we are refering to cost-effectiveness studies and not to full cost-benefit studies. We added the statement, "This work is typically based on cost-effectiveness analysis and not cost-benefit analysis." at the beginning of the paragraph.
Trigg Talley (U.S. Department of State)	9	67	11	67	14	-	-	-	The assertion that IAMs have neglected RE is unfounded. Please provide references to back up this claim, or else delete.	The text does not say that RE was neglected, we said that "until recently insufficient" attention has been paid. And that statement is correct. Until recently renewable energy representations were relatively simple, particularly when compared to fossil fuel technologies. However, a sentence has been added to clarify that this is true for particular technologies in general.
Klaus Radunsky (Umweltbundesamt)	9	67	38	67	42	-	-	-	This paragraph is again misleading (and also redundant). If it is kept it needs further qualification: When assessing the losses in GDP, however, it must be acknowledged that danages from climate change have usually not been included in the analyses that have been used for this report.	We made the appropriate change in response to comment on line 531/30.
Klaus Radunsky (Umweltbundesamt)	9	68	13	68	14	-	-	-	"The sentence ""At the same time, higher mitigation costs result in decreasing overall energy consumption"" is difficult to understand because usually models show that increasing energy efficiency is among the low cost options to mitigate GHg emissions."	The statement in the chapter was not about whether or not there were inexpensive policy options available, but rather was purely descriptive of the way models behave.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	68	23	68	26	-	-	-	"Transportation electrification has been studied by U.S. EPA and U.S DOT. This discussion can be bolstered to address this gap as follows: See a quote from the report to Congress found at the following link: http://ntl.bts.gov/lib/32000/32700/32779/DOT_Climate_Change_Report_-_April_2010_-_Volume_1_and_2.pdf. ""If significant advances were to occur in battery technology and the use of low-carbon energy sources for electricity generation, electricity (through battery-electric vehicles) could also substantially reduce transportation GHG emissions by 80 percent or more per vehicle in the long term. Aggressive deployment could reduce total transportation emissions by 26-to-30 percent in 2050 if a 56 percent LDV market penetration could be achieved, which is the optimal end discussed in the literature."" (p. 20)"	We have cited this study and the general point that improved electric vehicle technology could dramatically change the transport sector's ability to mitigate emissions.
Klaus Radunsky (Umweltbundesamt)	9	68	34	68	37	-	-	-	Cost competitiveness of RE should also be discussed under the assumption of internalizing the externalk costs of climate change. Under such assumption many RE are already cost competitive with conventional energy technologies.	Technology choice under emissions mitigation does not change when the source of the carbon value is a cost-benefit calculation rather than a cost-effectiveness study. Models will produce the same emissions mitigation technology mix for a given carbon price regardless of whether the price was derived from a cost-benefit or cost-effectivness study.
Klaus Radunsky (Umweltbundesamt)	9	68	19	68	26	-	-	-	Given the trend in transport to use more hybrid cars and to move to more electric cars as well the limitation to studies that ignore the growing use of electric vehicles reduces the policy relevance of this report. It is strongly recommended to include assessment of studies that also allow for significant share of elctric cars by 2030/2050 and beyond.	Accepted. See above.
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	68	19	68	26	-	-	-	The logic behind the choice not to include electrification of transport and, at the same time, claim that there is a lack of cost-efficient alternatives to oil is unclear.	This paragraph is about an individual study, which did not include an electric vehicle option. However, we now note that other studies do explicitly consider a much wider range of vehicle types including electric and electric-hybrid vehicles.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Klaus Radunsky (Umweltbundesamt)	9	69	19	69	24	-	-	-	"This clause is difficult to comprehend, because it assumes use of a specific market instrument (emissions trading, including permits) or national emission caps. However, models do not need to take into account any such instruments but simply assume different options to meet the energy demand - the larger the demand therefore the larger the need to mitigate GHG emissions if the baseline is to use conventional energy sources. The SRREN should not move into a policy prescriptive direction (""who has to pay for what"") but limit itself to the technical facts - where are the mitigation potentials. Models as well as the SREEN should also deliver figures for cost but they should be quiet who should pay what as this would be policy prescritpoive and beyond the role of the IPCC. Therefore it is strongly suggested to delete that clause."	we have changed the paragraph to read more clearly.
Yun Gao (China Meteorological Administration)	9	69	11	69	18	-	-	-	The statement in this paragraph requires a factualistic thinking.In the future, the emissions from Non-Annex I countries will grow. However, no one expects that per capita emission in the Non-Annex I countries would be higher than that in Annex I countries. Moreover, Non-Annex countries have fewer resources than Annex I countries in terms of capital and technologies. Therefore, it should be careful in saying that Non-Annex I countries need to share a larger mitigation burdens than Annex I countries.	The literature does not support this assertion. Emissions mitigation patterns are in general independent of the burden-sharing regime when emissions trading is allowed.
Yun Gao (China Meteorological Administration)	9	69	1	69	2	-	figure 9.4.1	-	Figure 9.4.1 suggests that a majority of renewable energy technology deployment will be in the Non-Annex countries in the future . Such information is in conflict with the fact that renewables are more expensive, more capital and technology intensive, less reliable and intermittent. Given such features of renewables, deployment is expected to be more in the Annex I instead of Non-Annex. As this is an assessment report, the authors need to look at the information in a critical manner rather than simply copying it here,which might cause misleading.	This assertion that energy system growth will be limited in non-Annex I is inconsistent with energy growth pattern observed in the real world.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Yun Gao (China Meteorological Administration)	9	70	13	70	25	9.4.1	-	-	This section looks at social and economic implications of renewables from a mitigation point of view. It is very useful. On the other hand, there is a need to understand the issues from the views of (1) consumer behaviour, as the consumers would prefer low cost energy forms for larger purchasing power within their personal budget constraint, and (2) higher cost of renewable which might also have some negative impacts on the growth of the economy. Therefore, this section should look at both the social and economic impact of renewables in perspective rather than simply a GHG dimension.	the paragraph has been revised to make it clearer.The sentecne "There are also real concerns that forced shifts to renewables could affect household budgets and macroeconomic costs" has been added
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	72	13	72	13	-	-	-	"replace ""carbon"" by ""CO2"""	change made
Trigg Talley (U.S. Department of State)	9	73	19	73	21	-	-	-	"The statement ""But the real concern is not necessarily about oil .."" should be deleted. As noted on lines 38-39, same page (73), ""liquid fuels in the transport sector is highly inelastic and relatively little substitution¿ Oil depletion will cause major disruptions in the transportation and agricultural sectors causing enormous decreases in international product mobility, large increases in food prices, causing instability and social unrest throughout many parts of the world. The link between insecurity of liquid fuels to insecurity in food and the direct impacts on the reduction of energy and food security needs to be made."	We have changed the sentence to read: "However, despite its importance, the real concern is not necessarily about oil, but about the vulnerability and resilience to sudden disruption in energy supply and consequent price implications in general."
Klaus Radunsky (Umweltbundesamt)	9	73	38	73	38	-	-	-	"The term ""dun-use fossil fuel forms"" is not known."	changes made accordingly
David Warrilow (Department of Energy and Climate Change)	9	73	15	73	30	-	-	-	It would be worth referring to the concept of 'resilience' as part of the framing of this introduction on energy security. A general reference, not energy-specific, would be: http://www.nature.com/nature/journal/v461/n7263/full/461472a.html	change made

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	73	38	73	41	-	-	-	This statement is not exactly true. There are many options to electrify mass transit and service fleets in urban areas. These technologies are available and cost-effective today, and would enhance access to transportation services while also cleaning air, reducing GHG's, and improving health. Suggest the authors highlight this opportunity.	The statement does not say that no electrification occurs in response to a carbon value, but rather that failing technology breakthroughs penetration will be limited. We have edited the sentence to make our point clearer.
David Warrilow (Department of Energy and Climate Change)	9	73	38	73	38	-	-	-	what is ¿dun-use¿? end-use?	sentence changed to fix error
Klaus Radunsky (Umweltbundesamt)	9	73	31	-	-	9.4.3.1	-	-	It would be relevant to consider the role of improvement in energy efficiency in the context of scenarios. Unfortunately, the chapter 9 does not provide any such linkage although definitely very relevant.	This is a special report on RE, so EE comes up only as it interacts with RE.
Klaus Radunsky (Umweltbundesamt)	9	73	31	-	-	9.4.3.1	-	-	The scenarios also address unconventional oil supplies. It is suggested to address those also in other chapters such as 9.3.4.	Addressed in Box 9.3, Section 9.3.4.4,
David Warrilow (Department of Energy and Climate Change)	9	74	5	74	15	-	-	-	¿However the utilization of bioenergy depends strongly on whether or not CO2 capture and storage (CCS) technology is available¿. This is a dubious statement in a paragraph that needs qualification. As one reads on, the meaning of the sentence becomes clear, but initially it seems to refer to bio-ccs (BECCS). Even after reading on, the paragraph refers to bioenergy as treated in one model. Is this relationship to CCS a general pattern in other models? What about national variation? I seem to recall that modelling for the UK with Markal shows additional nuclear if CCS is withheld as an option. In any case, biomass could as well be sent to dedicated biomass combustion/gasification power plant or CHP etc, as processed for biofuel. Clearly the route that the biomass takes will depend on the assumptions and values in the model. We aren¿t told anything about Luckow et al¿s model here, which doesn¿t help. (The biomass-ccs linkage claim is made again on p.94, lines 9-10).	The section was unclear. It has been rewritten to make the point clearer. The paragraph discusses the question of the sector in which bioenergy is utilized rather than whether or not bioenergy will be used. The point is that without CCS, bioenergy is not used much in power generation and the majority of the fuel goes to the transport sector. With bio-CCS technology more bioenergy finds its way to power generation.
Trigg Talley (U.S. Department of State)	9	74	20	-	-	-	-	-	In a chapter on RE & SD, the interaction between bioenergy and food prices, which is only mentioned here in passing, merits its own paragraph or even section. Linking food prices to volatile oil markets has huge implications for SD. Expansion of bioenergy production could greatly benefit poor farmers, but it will harm the landless poor, who will face higher food prices.	we have modified the discussion to incorporate these thoughts.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	74	10	74	15	-	-	-	It should be discussed whether the models include emissions from biomass due to LUC, and whether this affects the results	this point is discussed in the following paragraph
David Warrilow (Department of Energy and Climate Change)	9	74	17	74	19	-	-	-	p.74 ¿As was previously discussed in earlier sections and chapters of this report, bioenergy is subject to indirect land-use emissions. There is a substantial literature on this point¿ ¿ Is this true? Some would say that the consensus is that the literature and science on iLUC is at an early stage. There is clearly going to be much geographical and other variation involved that models have only just begun to deal with. There are even contestations around whether models should be used at all for iLUC calculations ¿ the supplier Greenergy, for example, argue for a remote-sensing approach. Others have used iLUC factors as inputs to calculations (rather than as outputs of modelling) and there is a debate around the pros and cons of the two approaches. See for example: Croezen, H., Bergsma, G., Otten, M., van Valkengoed, M., 2010. Biofuels: indirect land use change and climate impact. CE Delft, Delft. Also see: IFEU, 2009. Synopsis Current Models and Methods Applicable to Indirect Land-Use Change (ILUC). Executive Summary. IFEU, Heidelberg, http://bdbe.de/downloads/PDF/fachinformationen/ifeu-Studie_ILUC/ifeu_Kurzfassung_englisch.pdf For modelling that shows the consequences of land use conversion for expansion of Brazilian ethanol (decadal payback times), see Lapola, D.M., Schaldach, R., Alcalmo, J., Bondeau, A., Koch, J., Koelking, C., Priess, J.A., 2010. Indirect land-use changes can overcome carbon savings from biofuels in Brazil. P. Natl. Acad. Sci. USA 107, 3388-3393.	have added the suggested references and indicated that the field is at an early stage
Klaus Radunsky (Umweltbundesamt)	9	74	16	74	27	-	-	-	Repetition of information already considered. Please delete, and provide just reference and context.	see preceeding comment
Trigg Talley (U.S. Department of State)	9	75	1	-	-	-	-	-	"Who does ""we"" refer to? Please clarify."	change made

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	76	42	76	42	-	-	-	Please mention also chemical storags as hydrogen or even methane	change made
David Warrilow (Department of Energy and Climate Change)	9	76	13	76	21	-	-	-	Suggest ¿notable¿ instead of ¿interesting¿, for this publication.	change made
Yun Gao (China Meteorological Administration)	9	77	17	77	27	-	-	-	Lack of reliability is a key constraint to widen the deployment of renewable technologies. There are two issues here. One is that more conventional capacity has to be added to back-up in the electricity sector. Another one relates with the cost in storing the renewable energy generated. The first issue is not touched and the second issue is insufficiently addressed. Both require a little bit more fact finding for policy and technology advancement.	we have added a paragraph to make this point
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	77	24	-	-	-	-	-	make reference to possible recycling options	change made
Klaus Radunsky (Umweltbundesamt)	9	77	4	77	4	-	-	-	Poor wording. The following language is suggested: Emission scenarios are generally ¿¿.	we have amended the text to include this point
Trigg Talley (U.S. Department of State)	9	77	0	-	-	-	-	-	RE have an increased risk of grid disruption. Larger grid (needed to reach disperse resources) increases the risk of grid failures due to bad weather. Also, the intermittent nature increases risk of grid failure due to electrical overload. This is a real sustainability problem in societies dependent on electricity (e.g. developed nations). It can be addressed, but does need to be discussed.	we have amended the text to include this point
Petteri Taalas (Finnish Meteorological Institute)	9	78	2	79	22	-	-	-	Check if Bollen et al. (2009) used PM emissions as air pollution indicator and not SO2	Thanks to the reviewer for catching it, it iwas PM, indeed. Changes made accordingly.
Trigg Talley (U.S. Department of State)	9	78	25	78	41	-	-	-	The land diversion issue to support biofuels is repetitive a brief reference or cross reference would be sufficient.	Condensed to "Wise et al (2009) and Melillo et al (2009) found deforestation, land diversion, and N2O emissions were driven by biofuels expansion without proper policies in place"

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	78	2	78	6	-	-	-	The text states that reductions in environmental impacts result from increased efficiency of providing services. It is not evident that this is true. Increased efficiency may result in a demand response of increased use, either because more people now have access to electricity or because they use more of it now that it is reliable.	Very likely the reviewer is thinking of “rebound effects” from efficiency improvements, which remain an area of fruitful inquiry. We have added a behavioral clause.
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	80	8	81	9	-	-	-	"The message here is limited and very confused. I read: ""Environmental concerns with respect to the deployment of RE have many different origins"" (what this mean exactly?). ""Perception and acceptance of (environmental) impacts vary considerably with source, type of stakeholders or policies in place"" (I assume this means that perception/acceptance is important, but also that it is dependent on certain factors). The rest of the sub-section is a list and description of issues somehow related to environmental concerns, but without a clear idea behind their inclusion. What is the point with environmental concerns, and how do they affect depolyment of RE? "	Noted
Petteri Taalas (Finnish Meteorological Institute)	9	80	21	80	29	-	-	-	Carbon Payback Time could be mentioned as an indicator of climate impacts of bionergy.	Energy payback time and carbon emissions already considered.
Trigg Talley (U.S. Department of State)	9	80	8	81	9	-	-	-	This section is redundant with earlier treatment of environmental concerns.	Noted
David Warrilow (Department of Energy and Climate Change)	9	80	8	81	9	-	-	-	why are ¿environmental concerns¿ classified as a socio-cultural barrier? Also isn't this section a duplication of some foregoing material on environmental impact?	Noted
Trigg Talley (U.S. Department of State)	9	81	10	81	44	-	-	-	"The entire ""social"" dimension of RE and SD is given short shrift (only 3 paragraphs) due to the analytical bias of authors who are too focused on the modeling box of what is there. This chapter particularly would greatly benefit from an expansion of our cognitive map."	References not provided to support the comment
David Warrilow (Department of Energy and Climate Change)	9	81	10	81	44	-	-	-	The only section dedicated to society relates to objections to infrastructure. Development is fundamentally about people and the chapter misses this because it is focussed on large scale models.	Such information is found in 9.5.1.2
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	81	10	81	44	-	-	-	The point of this text is not straight forward. Is it the fact the there are social concerns in connection with RE, or it is the public acceptance of these tradeoffs that affects the deployment of Res.?	Noted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	82	20	83	10	-	-	-	Box on capacity building: should add need to build understanding on the part of policy makers of the importance of non-energy policies and regulations to adoption of RE.	Unless referenced, it would be policy prescriptive
Trigg Talley (U.S. Department of State)	9	82	20	83	10	-	-	-	Box starting on p. 82: Capacity Building: As noted in the box, this is covered in Chapter 11 of SRREN. Delete and cross reference to Chapter 11. Suggest deleting the rest of the text as being duplicative.	Do not delete, but x-reference and emphasize that box refers to Capacity Building for SD
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	82	11	82	13	-	-	-	Explain why and give an example on what is possible, this might be interesing	Little space for this. Reference provided.
Trigg Talley (U.S. Department of State)	9	82	2	82	4	-	-	-	It is not clear that RE provides better opportunities for employment, skills development, etc. compared to conventional energy, as is suggested in the text. Please provide references to support this assertion.	Cross-reference with 9.3.1.3
Trigg Talley (U.S. Department of State)	9	82	11	-	-	-	-	-	SME should be spelled out	Editorial. Add after SME "(small and medium enterprises)"
Brian Gray (Environment Canada)	9	83	29	83	35	-	-	-	"This paragraph could be further clarified. A definition for ""project-based approach"", including what is the role of the private sector, should be provided. In addition, difficulties for developing countries in accessing funding for renewable energy projects could be addressed more specifically. "	Little space for this. Reference provided.
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	83	15	83	16	-	-	-	"Why does SD require ""cost-effective assessemnts"" and not just ""assessments""?"	Sentence reads correctly. Assessments are too broad
Trigg Talley (U.S. Department of State)	9	83	36	83	41	-	-	-	Very good example of the cultural dimension of RE and SD. The chapter would benefit from much more of this.	Little space for this. Reference provided.
Taro Kawasato (Ministry of the Environment, Japan)	9	83	11	-	-	9.5.1.3	-	-	It is highly appreciated that a subsection has been dedicated to cost-oriented barriers in the new version of Chapter 9 because there is no comprehensive disussion on such costs in any other part of the Special Report. This subsection could, however, include more explicit reference to the high upfront costs required to install necessary equipment and to secure the human resources required to operate and maintain the systems, which are among the crucial barriers to harnessing available renewable energy sources in developing countries.	Noted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	84	13	84	14	-	-	-	"This statement is not true (""only a level playing field of costs of energy carriers can support rational investment decisions¿"")."	References not provided to support the comment
Yun Gao (China Meteorological Administration)	9	84	11	84	28	9.5.1.3	-	-	This subsection looks at marker failure and economic barriers. This is an important issue that deserves an indepth examination. Current text only looks at the problems in the developing world. However, although the market in the developed world is more mature and their financial capabilities are much stronger, the deployment of renewables in Annex I countries is slow, even less than that in many Non-Annex I countries. We need to give a real picture of the barrier. Renewables are not only for the poor, but they are also for the rich. Why the rich are so reluctant to accept renewables? The barriers must provide an answer.	Unless referenced, it would be policy prescriptive
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	85	10	-	-	-	-	-	"Reference to ""Energy and Mining Board 2001"". Is this the best reference?"	References not provided to support the comment
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	85	32	85	36	-	-	-	Don¿t understand why this is the case and do not think that the references given actually reflects this opinion	As in references
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	86	11	86	11	-	-	-	"Explain what is meant by ""adaption of market mechanism"""	Editorial. "Adoption" instead
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	86	19	86	21	-	-	-	Do the author se sustainability criteria as a barrier to renewable energy ? Need to clarify this and to motivate and qualify this statement if that is the case.	Editorial. Add "too strict" before "sustainability criteria", page 86 line 20
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	86	23	87	13	-	-	-	The authors clearly support free trade for the promotion of RE and the fight against climate change. Although this might be true, it would be fair to point out that the positive link between international trade (free trade) and the environment is often contested.	Unless referenced, it would be policy prescriptive

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	86	12	86	12	-	-	-	To level the playing field is just a start for most RES technologies. They need temporary financial support as well for further development, see e.g. PVs, 2nd gen.biofuels, wind power a couple of years ago e.t.c.	Noted
Brian Gray (Environment Canada)	9	87	42	87	44	-	-	-	"There have been many criticisms of the sustainability dimension of Clean Development Mechanism. These criticisms are taken into account in the box on CDM (p. 88), but are not reflected in the main text where CDM are referred to as a ""good benchmark"" for sustainability screening."	Noted
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	87	21	86	21	-	-	-	It is very strong statement to claim that MDBs subsidize fossil energy. They function just like any other bank and gives loans to whatever technologies are availbe and competitive. Need to qulify if the author means that MDBs could do a better job in assessing renewable energy as an option	Statement is clear enough and referenced
Trigg Talley (U.S. Department of State)	9	87	31	87	32	-	-	-	R&D should not be listed as an activity without an associated externality that distorts the market. Typically, it is recognized that lack of government funding for R&D means too little is invested in basic R&D because the inventor cannot capture all the returns. As a result, there is typically a call for putting a price on carbon to correct for its negative externality but to also fund energy R&D to overcome this second market failure and spur more innovation.	Statement is clear enough and referenced
Trigg Talley (U.S. Department of State)	9	87	15	89	4	-	-	-	SRREN Chapter 11 has an extensive discussion of public funding and subsidies. Delete this section.	SD context
Trigg Talley (U.S. Department of State)	9	88	1	88	27	-	-	-	Box on p. 88: National SD Screening of KP-CDM projects: These issues are also discussed in Chapter 11 of SRREN. Be careful not to repeat. Authors need to figure out where best to place these sections. Might want to delete it here.	X-reference
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	88	12	88	14	-	-	-	Please mention also other voluntary standards, like e.g. the Gold Standard	References not provided to support the comment
Trigg Talley (U.S. Department of State)	9	89	5	90	8	-	-	-	Box starting on p. 89 is also discussed in Chapter 11 of SRREN. Delete it here.	X-reference

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	89	5	90	8	-	-	-	The box could be made much shorter	Noted
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	89	-	-	-	-	Box	-	Any real examples of leapfrogging would strengthen this box	Little space for this. Reference provided.
Trigg Talley (U.S. Department of State)	9	90	18	90	30	-	-	-	The principles laid out in this paragraph are not unique to RE and SD.	"Unique" not said
Christian Bauer (Paul Scherrer Institut)	9	91	23	-	25	-	-	-	""""Additional factors pointing toward the desirability of increasing reliance on renewable energy include concerns about uneven distribution and future supply scarcity of fossil-fuel resources"". Secondary benefits like reduction of air pollution and hence reduced impacts on human health should also be included among additional factors."	Noted
Trigg Talley (U.S. Department of State)	9	91	8	-	-	-	-	-	Box number (11.X) is not clear.	X-reference
Trigg Talley (U.S. Department of State)	9	91	3	91	8	-	-	-	Exemplary paragraph on psychological dimension that underscores the intellectual frailty of relying on the rational actor economic model - which is the main thread of chapter.	Noted
Yun Gao (China Meteorological Administration)	9	91	9	91	17	9.5.2	-	-	"This section looks like policy recommendations or synthesis. Therefore, it is suggested to shorten it substantially and move it to section ""9.6- Synthesis"". "	Sentence reads correctly.
Roxana Bojariu (Meteo Romania)	9	91	-	97	-	9.6	-	-	"The section is dealing with very complex issues; however, its approach could be improved. Technical progress in wind and solar energy is really fast and that has to be taken significantly into account. Also, it's hard to predict when the economic crisis is over, so one has to take it into account the crisis-related issues, too. There is excellent documentation in this section but perhaps more lines about new ideas and perspectives could be added. "	Section has been redrafted to provide a clear synthesis of the material covered in the chapter. The more knowledge gap related discussions have now been completely moved to section 9.7

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Taro Kawasato (Ministry of the Environment, Japan)	9	91	19	-	-	9.6	-	-	The aim of including a Synthesis before Knowledge Gaps and Future Research Needs is quite unclear, especially because much of what is written in the Synthesis overlaps with the Executive Summary and could perhaps be omitted. If this section is meant to focus on the policy perspectives of SD potential of RE in conclusion, that point should be made more explicit by adding a subtitle and being as unrepetitous as possible, thereby shortening the section as a whole.	Report structure
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	92	28	92	29	-	-	-	"Energy-economic models show in the short term and assumes in the long term that mitigation of GHG is linked to GDP. E.g some models actually show the potential for the opposite if we assumes a growing ""green sector"", see e.g. Sterner and Persson (2007) - An even Sterner Review Resources for the Future, RFF DP 07-37"	Accepted
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	93	20	93	20	-	-	-	"""Second..""". I¿m missing the first point somewhere?"	will require editing
Brian Gray (Environment Canada)	9	93	30	93	41	-	-	-	Suggest that the authors consider distinguishing between people with no access to electricity and people and economic sectors with access to electricity in the same countries in question. Meeting the needs in electricity of those still with no access to electricity is estimated to cause an increase in current GHG emissions of only about 2% (ref: page 235 and 236 of The Least Developed Countries Report 2010 ¿ UNCTAD, http://www.unctad.org/en/docs/ldc2010_en.pdf). Thus whereas the strategies in meeting the energy needs of developed and developing countries must play a crucial role in addressing climate change, providing access to the population currently without access will have only slight consequences for climate change for decades after access has been provided.	No apparent contradiction with the text. Different estimates of GHG impacts of energy access expansion has been provided and what is proposed here from UNCTAD does not contradict other findings. In addition No numbers have been indicated in the report (as far as I recall) as the underlying assumptions are quite tricky. IEA a few years ago made a LPG for all scenario with a 1% figures.
Yun Gao (China Meteorological Administration)	9	93	17	93	19	-	-	-	The statement that the renewables leap-frogging will happen more likely in developing countries than that in developed countries is questionable. Developed countries have a larger pressure for emission reductions, more financial and technological resources. Given such circumstances, one cannot imagine that such a leapfrogging would be in the poorer developing countries, where urbanisation and industrialization would require large amount, cheap and reliable conventional energy forms.	Sentence has been removed and argument made clearer.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	94	-	-	-	9.4.3.1	-	-	"There are other models which show different result. See e.g. Grahn M, Azar C, Lindgren K (2009). ""The role of biofuels for transportation in CO2 emission reduction scenarios with global versus regional carbon caps"", Biomass and Bioenergy, 33: 360¿371"	The issue of regional carbon markets and their implications for biofuel consumption that is discussed by Grahn et al. Is beyond the scope of the discussion in Chapter 9.4 However, the general results are not disjunct with other findings in the chapter, i.e. that the transportation sector is difficult to decarbonize.
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	94	-	-	-	-	9.4.2	-	"There are other models which show different result. See e.g. Grahn M, Azar C, Lindgren K (2009). ""The role of biofuels for transportation in CO2 emission reduction scenarios with global versus regional carbon caps"", Biomass and Bioenergy, 33: 360¿371"	The issue of regional carbon markets and their implications for biofuel consumption that is discussed by Grahn et al. Is not the focus of the discussion on p. 74, Fig. 9.4.2. Also, Grahn et al. remain silent about the implications of CCS.
Brian Gray (Environment Canada)	9	96	26	97	32	-	-	-	Suggest examining the use of a risk analysis approach (similar to what is used in the insurance sector) as a novel approach to assess and compare different energy pathways. This could be another way of integrating the social, natural and economic sciences in order to reflect the different dimensions of sustainability.	has been included in Section 9.8
Brian Gray (Environment Canada)	9	96	4	-	-	9.7	-	-	The electrification of the transport sector (e.g., electric cars and trains) and its implication in energy security, environmental impact, and GHG emissions could also be considered a future research topic.	has been included in Section 9.7
Trigg Talley (U.S. Department of State)	9	97	30	97	32	-	-	-	Rephrase the last sentence to be grammatically correct.	Sentence has been edited.
Trigg Talley (U.S. Department of State)	9	98	0	-	-	-	-	-	It is noted that the reference section is incomplete. Numerous cited references are not listed in the reference section. For example, the references cited in the first paragraph for section 9.2.2 (p. 14, lines 2-11) are missing from the reference list.	reference list has been updated
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.2	-	-	Food security should be incorporated into this section, in a holistic manner. Given the potential for RE to displace food production, food security would seem to be an essential element to any discussion of RE in the context of SD.	While clearly important, this section introduces the indicators actually used in this chapter. Issues of food security are addressed (although only briefly) later in the chapter.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Klaus Radunsky (Umweltbundesamt)	9	-	-	-	-	9.2	-	-	This chapter is very theoretical/academic and should be considerable shortened. It is suggested to explain which parameters have been used to describe sustainable development and why this choice has been made. This explanation should not be longer than one short paragraph or two to three sentences. The impacts of RE that have been considered in chapter 9 have already been introduced in chapter 9.1 (introduction).	Section has been reorganized and shortened; some of theoretical part has moved to 9.1. Overall introduction of indicators is now in 9.2, less in following sections.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.2	-	-	While a full assessment of climate change's anticipated impacts on agricultural productivity is beyond the scope of this report, it would be worth identifying the downside risks of adding RE's demands to an agricultural sector compromised by a changing climate.	anticipated impacts from climate change are addressed in each technology chapter of the SRREN
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	-	-	-	-	9.2.1	-	-	It is not made clear what role the distinction between weak and strong sustainability, as described in this sub-section, plays in the context of ch 9. Why it is relevant and how it is used in the remainder of the ch.	This discussion has been shortened, but also better integrated.
David Warrilow (Department of Energy and Climate Change)	9	-	-	-	-	9.2.1	-	-	This section could more clearly and concisely sum up the 4 goals of energy policy.	Section has been shortened to be more concise
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.2.2	-	-	"Stiglitz and Sen's recent work for France's ""Commission on the Measurement of Economic Performance and Social Progress"" is another key reference that should be cited in this section. "	Sentence has been added in Section 9.2.2 that uses this reference.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.2.2	-	-	This section needs to be easier to read and refer to. Consider, for each subheading, providing a bulleted list of SD measures for ease of reference.	Section has been shortened for better readability

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Petteri Taalas (Finnish Meteorological Institute)	9	-	-	-	-	9.3	-	-	"In Section 9.3 its is presented life cycle assessment (LCA) as a tool for assessing environmental impacts of renewable energy systems. However, in the section there is no decriptions about the methodology of life cycle sustainable assessment. Kloepffer (2008) defines a life cycle sustainable assessment (LCSA) to be composed of three components - an (environmental) LCA, a life cycle costing (LCC) and a social life cycle assessment (SLCA). [Kloepffer, W. (2008). ""Life cycle sustainability assessment of products."" The International Journal of Life Cycle Assessment 13(2): 89?95]. Cost benefit analysis (CBA) can be used for capturing the economic impacts of energy technologies. Furthermore, hybrid input-output models could be used for assessing employment and econmic impacts (Hertwich 2005) [Hertwich, E. G. (2005). ""Lifecycle Approaches to Sustainable Consumption: A Critical Review."" Environmental Science and Technology 39: 4673-4684.]"	there is not enough literature on LCSA to provide a solid foundation for review of all technologies within the scope of CH 9. Furthermore, the scope of 9.3.4 is environmental impacts, where LCA literature on energy technologies is extensive and adequate for the task.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3	-	-	Fifty (50) pages here offer many opportunities for deletion. Consider text boxes, bullets, and possibly listing issues rather than delving into them significantly. Also eliminate contents that have been discussed elsewhere in the Chapter.	some figures have been deleted and the text has been condensed in order to convey the main message in a more concise way
Roxana Bojariu (Meteo Romania)	9	-	-	-	-	9.3	-	-	I think that generally, this section relates poorly to RE. It mainly refers to general energy issues, with reference to RE as a particular case from time to time. In my opinion, this section should be significantly shorted.	Section 9.3. discusses sustainability aspects of energy along four dimensions: human development, energy access, energy security, and environmental issues. Necessarily, one has to discuss fossil energy in order to identify in which aspects RE can yield advantages in terms of sustainable development
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3	-	-	The main problem with Section 9.3 is that the information, while clear, is never particularly central to the discussion of energy in the development context. There is a chance that all information before Section 9.4 could be cut.	Given the dimensions of sustainable development discussed in 9.1. and 9.2., one needs to discuss energy in general in order to assess in which aspects RE differ from other forms of energy in terms of sustainabilty. Section 9.3. has been restructured and partially rewritten in order to clairify this point.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.1.1	-	-	This a good section.	No need to change anything

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.1.2	-	-	It is never very clear how aggregate measures such as the Human Development Index relate to either sustainability or renewable energy. Since they are never used to explicitly tie the two topics together, consider deleting this section from the text.	Human Development is one of the indicators of sustainable development that are discussed. As the HDI is probably most comprehensively used measure of broader human development (including health and development), discussing its relation to energy use appears to be self-evident.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.1.3	-	-	Consider shortening section 9.3.1.3 (p. 21-23), as it has unnecessary detail.	Section 9.3.1.3. has been split up and shortened
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.3	-	-	Consider shortening section 9.3.3 (p. 29-33), as it has unnecessary detail.	2 figures have been deleted and the text has been shortened
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.3.2	-	-	"This is a poorly written section; very unclear as to the point being made."	Section has been restructured and shortened to straighten the key message
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.3.2	-	-	The section discusses energy security and sustainability in the context of lowering import bills. However, an important aspect of sustainability is what effect this has on household energy expenditures. It is not clear that a household's energy bill will not go up as a result of relying on domestic and renewable sources of energy, even leaving aside the question of access.	The issue of higher costs is addressed in Sections 9.5.1.3. and 9.3.1.4. However, it is also emphasised that in remote off-grid areas with large distances to the national grid, RE technologies offer competitive options.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.3.2	-	-	The section discusses energy security and sustainability in the context of lowering import bills. However, an important aspect of sustainability is what effect this has on household energy expenditures. It is not clear that a household's energy bill will not go up as a result of relying on domestic and renewable sources of energy, even leaving aside the question of access.	The definition of 'enery access' used in this report includes being 'affordable'. As stated in section 9.3.2., government policies will have to be designed in a way that takes into consideration the affordability of energy when providing (physical) access to energy

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.4	-	-	"Greatly shorten section 9.3.4 (p. 34-65) on ""Reduced environmental impacts."" Thirty (30) pages for this section is too long for a chapter that is intended to focus on SD. For example, too much detail is given on LCA (isn't LCA covered in other chapters?). In addition, Figures 9.3.11 (p. 41), 9.3.12 (p. 43), and 9.3.13 (p. 46) are interesting, but there is no need for figures with this amount of detail in a chapter on SD. Likewise, the ""Box"" on p. 44-45 would be better placed in a chapter focused on LCA rather than SD."	Section will be shortened considerably. However, as there is no chapter on LCA and the authors chose LCA as a basis for comparison of environmental impacts which are a crucial part of sustainability, discussion of LCA caveats will remain. Box is on LanduseChange Emissions, not LCA. Figures were added based on multiple requests for sample estimates. LUC box is critically important for the interpretation of results reported in this chapter and also requested numerous times.
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	-	-	-	-	9.3.4	-	-	¿As no large-scale technology deployment will come without environmental tradeoffs, environmental interventions and impacts of RE technologies should be evaluated and compared to conventional alternatives prior to their concerted deployment¿.	see comment 522/55
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.4	-	-	At the end of the introduction on p. 34 (lines 34 - 35), the chapter mentions the omission of consideration of constrained supply of some materials. The chapter could at least qualitatively discuss this issue, in particular the role of fixed land supply and constraints on where solar, wind, hydro, etc. can be placed. There may be additional inputs where constraints are a consideration. The authors should supply a general notion of what form this could take.	Box on resource constraints included in section 9.3
Roxana Bojariu (Meteo Romania)	9	-	-	-	-	9.3.4	-	-	I think biofuels have to be considered only as a partial/transitive solution - on long range we have to eradicate burning.	thankyou for the comment. This report focuses on current and near fiuture and as such will not address longer term issues. Many also disagree about the transition solution nature of biofuels, in particular for second generation biofuels, which is how they are discussed in the text.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Marianne Lilliesköld (Swedish Environmental Protection Agency)	-	-	-	-	-	9.3.4	-	-	This is very important and it should be highlighted. Conventional alternatives could be clarified. As an example, increased unconventional oil production can be an alternative to RE. It is unclear if this comparison is included.	need for comparison will be highlighted in introduction, unconventional oil is mentioned/included e.g. in water section, EPBT discussion, and parts of 9.3.4.1 - the transportation fuels section of 9.3.4.1 has now clarified that unconventional fuels are included in the comparison; 9.3.4.2 also discusses unconventional fuels. a full range dicussion and comparison is however beyond the scope of this chapter. However associated environmental impacts and GHG intensity do not seem to suggest unconventional oil production as a sustainable alternative to RE
Petteri Taalas (Finnish Meteorological Institute)	9	-	-	-	-	9.3.4.1	-	-	The concept Carbon Payback Time could be introduced. Some bioenergy options increase the emissions with respect to fossil fuel BAU in the short run due to LUC impacts and the dynamics of the biomass stocks (e.g. long rotation periods of forest stands which means that regrowth is not in temporal balance with harvest and use of feedstock).	Due to shortage of space, this is not really an option. it is used in Ch 2. For an integrative chapter covering so many aspects of environmental effects, introducing too many metrics is confusing to readers. we already reference Gibbs' work which uses CPBT.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.4.2	-	-	"This is one of the better sections; quite excellent really in terms of elucidation and presentation."	Accepted
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.4.2	-	-	"This sections fails to effectively consider the broader issue of water constraints and ignores water as a potential barrier to sustainable growth - particularly in the developing countries that already suffer from water shortages. No attempt is made to characterize the water footprint of a sustainable clean, reliable, and affordable energy system and the challenge posed. Instead the focus is on water consumption per MWh generation among different energy technologies. The need for climate resilient energy technologies (i.e., energy and water efficient) needs to be emphasized in this chapter including the section on knowledge gaps and future research needs. Bottom line, the chapter acknowledges water as an issue but needs to do a better job on the big picture ""take aways"". "	The reviewer correctly notes that water scarcity can be a barrier to sustainable growth, particularly in developing countries. The topic of water scarcity and its impacts on sustainable growth will be addressed to better convey big picture "take aways"

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.4.2	-	-	This section should provide more discussion linking the issue of water back to SD. Water scarcity is a key problem in many low-income countries, and water constraints could be an important determinant of choosing sustainable energy systems for these countries.	The reviewer correctly notes that water scarcity can be a barrier to sustainable growth, particularly in developing countries. The topic of water scarcity and its impacts on sustainable growth will be addressed to better convey big picture "take aways"
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.4.2	-	-	Unconventional gas (including shale gas, coal bed methane, etc.,) is ignored under both water quantity and quality, and should not be.	The overall body of literature is sparse on these topics, and many water quality and water quantity impacts are site-specific, making generalizations difficult. However, we will include water related impacts of these alternative methods of extracting fossil fuels, increased references to unconventional gas in 9.3.4.2
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.4.3	-	-	Add to this section discussion on the interactive effects of air pollution and climate change. For instance, as we clean up more SO2 we are removing the cooling properties of those particulates from the atmosphere, which will result in more net warming. Likewise, climate change can exacerbate ozone problems due to higher heat days.	adding a general statement on these issues as in the comment is possible; however, the topic is complex and broad. Within the given space, it is not possible to carry out an extensive literature research on the topic and include a lengthy discussion
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.4.4	-	-	Include text about the negative health impacts from wind noise pollution. There have been studies suggesting negative impacts if windmills are sited too close to residential areas.	Nuisance from noise by windmills is already included in text of 9.3.4.4
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.4.4	-	-	This health impacts section is very confusing. Should this section be speaking to all health impacts of renewables or just biofuels? This seems like an odd place to jump into a discussion of health impacts. Then the next section on other health impacts seems to fill space.	Health impacts are an important category for sustainability; air pollution is the most important energy related health impact for ET (both fossil and biofuels). Other important health impacts are also mentioned in the next section. Text will be revised
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.4.5	-	-	"Include text about ""smart growth"" See p. 61, lines 10-11. General development patterns will effect the energy needed to support those new industries, residences, etc."	comment is too general, context not clear, section deals with Land Use of different ET - not energy demand of development patterns

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Roxana Bojariu (Meteo Romania)	9	-	-	-	-	9.3.4.6	-	-	I think it might be useful to add some text about consequences of using large scale turbine farms for ocean currents energy collection in the sub-section on Impacts on Ecosystems and Biodiversity. The slow-spinning turbine blade velocities should allow water to flow freely and fish population to safetly evade/avoid the machine. Otherwise, easily sensed whirling rotor blade structures have to be considered. Protective fluid permeable barriers, operating in conjunction with sonar-activated propeller blade unit braking systems could forestall any major physical harm to large migratory or curious marine mammals (V Badescu, D Isvoranu, RB Cathcart, Water Resources Management, 2010, 24(8), 1645).	depending on overall length of section, content might be added, but it is quite detailed and should rather be placed in chapter 6
Roxana Bojariu (Meteo Romania)	9	-	-	-	-	9.3.4.7	-	-	I think it may be useful to add some text about risks associated with using large scale turbine farms for ocean currents energy collection. When locating the turbine units, taking into consideration site impacts on oceanic shipping routes, and present-day as well as anticipated uses (such as commercial and recreational fishing and sport free and SCUBA diving) would, of course, be mandatory for establishing macro-project construction contracts. Additional required concerns include the genuine need to introduce all possible damage mitigating factors, such as the establishment of international fishery Exclusion Zones. Also, concerns about risks from slowing the current flow through the operating propeller blade units because of energy extraction are important (V Badescu, D Isvoranu, RB Cathcart, Water Resources Management, 2010, 24(8), 1645).	As suggested, a short status overview of tidal and wave power technologies has been included, however since the proposed reference appeared quite speculative at the moment, several other references were cited.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.4.7	-	-	Include text on the mineral, steel, and concrete requirements for RE infrastructure on a per unit energy basis. Wind and solar use some rare materials in their alloys, and have a higher demand for steel and concrete than their fossil/nuke counterparts on a per unit energy basis. This should be mentioned in a balanced discussion of sustainability.	Issue is not to be covered in risk section. However, rare materials will be examined in a subsection of 9.5; concrete and steel requirements are diverse for RET and no comprehenisve data of life cycle use of steel or concrete are available. To limit the comparison to the generating facility, excluding infrastructure needs of e.g mining operations, does not appropriately account for resource intensity of ETs

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.3.4.7	-	-	This entire section is not really on point. First paragraph is far too obscure. Also, it states it uses fatality data in part because that is what we have, which is not necessarily proof that such data are relevant to the overall topic. This is another example of how the chapter is driven and defined by a limited conceptual frame and methodological construct.	It is not really clear what is meant by "obscure" and how this should be interpreted in a scientific manner. The intention of the first paragraph is to provide a concise overview of available concepts and approaches (without the possibility of being full exhaustive due to the page limit for this section). Starting the section with what is currently paragraph two would be possible, but the broader context to an average reader not that familiar with risk assessment would most likely not be so evident.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
David Warrilow (Department of Energy and Climate Change)	TS	-	-	-	-	9.4	-	-	"The economic assessment here does not clearly delineate the boundaries or economic assumptions of the assessment. Studies at 4CMR (Cambridge, UK) indicate that use of overall GDP impacts can be less informative if one fails to examine the distribution of welfare across sub-populations, and if one is assuming (as in General Equilibrium Models) that an economy is already at full employment in the baseline scenario. If, however, secondary health benefits are included; if one allows for increased employment as RE industries develop (rather than assuming they take away employment from elsewhere in the economy); and if one considers distributional equity in welfare; the impact on GDP need not be negative."	The reviewer mentions a very important point, i.e. the potential (co-) benefits of climate mitigation. Next to what was mentioned by the reviewer, as most analyses assessed here run in a cost effectiveness mode, results presented do also not include potential beneftis from avoided climate damages. Therefore we added "That is to say, mitigation in general decreases economic growth, at least in scenarios that do not consider the feedbacks from a changing climate, as is the case with the majority of the integrated scenarios that exist to date." We also selectively added text to make the boundaries and economic assumptions clearer. We carefully accessed the results from 4CMR and the model E3MG and decided not to highlight its results. The employment effects for instance that arise from climate policy and particularly renewable energy do not seem to be as explicit as argued by the reviewer. In general, a specific policy (e.g. climate policy) can hardly be attached to an effect (e.g employment) and it is thus not clear whether employment benefits arise from climate policy or any other policy. However, results from 4CMR and their model E3MG are included in the ADAM model comparison project (Edenhofer et al. 2010), which is cited in this section.
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	-	-	-	-	9.4	-	-	As stated before, interesting but could be shortened and focussed more on explaing why IAMs are currently insufficient for adressing SD and which gaps that potentially could be filled by more reseach and equally important which gaps that could not	The section has been revised accordingly and streamlined.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.4	-	-	Entire section demonstrates the limitations of a chapter driven and defined by a limited conceptual frame and methodological construct.	We do not agree with the reviewer that there the conceptual frame and methodological construct are limited. However, we made efforts to make the main messages and methdologies clearer.
David Warrilow (Department of Energy and Climate Change)	9	-	-	-	-	9.4	-	-	This comment applies throughout Section 9.4, and is repeated in the Technical Summary. The energy analysis performed for this section relies too heavily on total energy generation capacity, with no evident link to the temporal and seasonal profiles of energy supply and demand. This is precisely the area in which energy technology models tend to lead to over-statement of the rate and feasibility of uptake of RE technologies. The problem that arises in deployment is usually one of load matching, which means one must consider how to deal with periods in which RE supplies are unavailable (e.g. slow wind) but where demand doesn't drop accordingly. This in turn requires a more bottom-up approach to energy systems modelling, rather than the top-down approach used in the chapter. These two approaches usually give give very different pictures of the feasibility of RE, and of the crucial role of energy storage and of redundant systems if energy security is to be met.	This issue is covered in CH8; several links to the discussion are included in the seciton.
David Warrilow (Department of Energy and Climate Change)	9	-	-	-	-	9.4.2	-	-	"The section on energy access is fine. Propose that they review and potentially include the recently published report by Practical Action (sponsored by UNDP) called ""Poor peoples' energy outlook 2010"" - http://www.practicalaction.org/energy-advocacy/ppeo-report-poor-peoples-energy-outlook. This has a definition for what would constitute a basic level of energy service, directly answering one of the gaps identified in the IPCC report."	We have not included the particular report, but a sentence has been added to cover the main issue raised there (p. 73): In recent years the view of renewable energy as an expensive tool to reduce emissions is changing to a potentially important energy supplier in their future energy systems in developing countries. An alternative reference has been added: Goldemberg, J., Reddy, A.K.N., Smith, K.R. and Williams, R.H., 2000. Rural energy in developing countries. In: Goldemberg, J., Editor, 2000. World Energy Assessment: Energy and the Challenge of Sustainability, United Nations Development Program, New York.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.4.3	-	-	This section is redundant with earlier treatment of energy security (ES).	No it is not as it looks at the topic from a scenario perspective.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.4.3.1	-	-	Discuss synfuels. Exxon has a commercially available technology to make gasoline directly from CO2 and H2. The problem is getting H2, as it makes no sense to make gasoline from H2 derived from coal or natural gas. However, in developing nations with poor infrastructure, it might make sense to make synfuel from CO2 and H2 (via water electrolysis powered by RE). Suggest the authors mention this as one possible option for getting to fuel from non-biomass RE.	That is a level of detail that goes beyond the scenario literature that is covered by the section.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.4.3.1	-	-	In this section and elsewhere in the chapter, there needs to be greater acknowledgement of the tradeoff between using land for biomass production vs. forest carbon sequestration (e.g., Wise et al. 2009, Science). Clearing forest land to produce biomass has ambiguous impacts on net GHG emissions and certainly has large implications for SD in forest communities.	The issue is also treated in section 9.4.4 and chapter 2
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.4.3.1	-	-	This is not the chapter to be discussing synfuels.	We agree.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.4.4.1	-	-	Provide more discussion on incorporating local air pollution impacts on health and productivity into IAMs	An additional reference regarding regional air pollution has been added (van Vuuren et al 2007). Unfortunately a more detailed discussion about modeling details is not possible due to spacing constraints. In the text, we refer to the literature for further reading.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.4.4.2	-	-	Discuss efforts to downscale a variety of models (e.g., GCAM, EPPA) and how these activities affect the current assessment of research gaps and address if there is a need for models at smaller geographic scales.	We added the following sentences and references on downscaling: “Some IAMs have addressed issues of smaller scale through downscaling. However, these downscaling methods have been applied primarily to variables like emissions and demographics (Grubler et al 2007; van Vuuren et al 2007; Bengtsson et al 2006). Because the downscaling was focused on informing other questions, it does not meaningfully resolve questions about local sustainability.” Further: "There is currently extensive discussion about the feasibility and mechanisms for achieving finer resolution in space and time in future scenarios, not only for physical and ecosystem changes but also in social, demographic, and economic factors. (Moss et al. 2010).
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.5	-	-	"Recommend including a section on barriers imposed by R&D policy. Most energy R&D is focused narrowly on technology ""stovepipes"" (e.g., nuclear, RE, fossil, etc.), instead of on problem solving (e.g. sustainability, security, climate mitigation). Thus, R&D produces technologies rather than integrated solutions. Technology is not always the answer, and is often a problem."	Conceptual comment
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.5	-	-	Barriers to RE adoption ¿ pointedly discussed in section 9.5 ¿ seem formidable enough to warrant more emphasis in the executive/technical summaries.	To TS
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.5	-	-	For improved consistency across the report, this section should be dropped, as this material is addressed in Chapter 11.	SD context addressed in Ch9

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.5.1	-	-	Include a subsection 9.5.1.4 which addresses the existing technical barriers and integration challenges for higher penetration of RE into the power grid, especially from the aspects of variability and uncertainty of RE sources. This subsection should also mention possible ways for overcoming these barriers in the future through wider use of energy storage and smart grid technologies, as well as the technological improvements and breakthroughs that may be needed (e.g., in improving the cost and performance characteristics of batteries).	Chapter 8
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	-	-	-	-	9.5.1.1	-	-	the title is misleading. Why socio-cultural? The entire sub-section is not clear and confusing.	Noted
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.5.1.1	-	-	This section is redundant with the rest of the chapter and could probably be eliminated.	Disagree
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	-	-	-	-	9.5.1.2	-	-	This section overlaps and blends in with the previous, and the result is not good. The point here (information and awareness) appears to be directly related to public acceptance of RE projects. What is the difference compared to the previous section?	Noted
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	-	-	-	-	9.5.1.3	-	-	"A number of problems affect also this section. The topic ""market failures and economic barriers"" is relevant in the context of ch9. However, the sub-section could be more to the point describing the need for additional evaluations of the economic feasibility of RE projects within SD; the relevance of economic barriers to RE deployment in the context of market failures (e.g. integration of environmental and social externalities); and finally discussing the issue of justice and distributional consequences of the promotion of REs. "	Noted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
David Warrilow (Department of Energy and Climate Change)	9	-	-	-	-	9.5.2	-	-	The discussion of opportunities is necessarily qualitative rather than rooted in data on uptake of energy technologies as a base of economic activity in developing nations. However, there is a window here in this Section to explore an issue raised in earlier sections: that of the developing nations leap-frogging the developed nations via the emerging Green Funds. RE technologies are disruptive in established economies with very large investments in existing energy infrastructure, but much less so in developing nations. Hence, there is a potential here to have the RE technology base created first in the developing nations, essentially reversing the traditional pattern of technology diffusion. This is one of the key areas in which the links between RE and sustainable development are evident, and can be better explored in the report.	Noted
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	-	-	-	-	9.5.2	-	-	The section mainly focuses on the discussion of how to reap the opportunities of RE deployment. The approaches suggested relate to policy, trade, financing, market regulations and so on. One could expect some sort of overlap with ch 11. In ch 9 the focus could be more on ways to evaluate the opportunities of developing RE in connecton to DS.	Focus on effects, not causes
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.6	-	-	"Recommend that the Synthesis start off with a ""key message"", and then elaborate. Clearly and succinctly identity how RE integration promotes SD goals according to the measures laid out. Suggest including a table that maps the Sustainability measure to the change that will occur as a result of RE adoption."	But table was rejected in previous draft
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.6	-	-	This section is punctuated with repeated examples of the failings of current models. This is very useful, but the reader gets the impression that he/she has just waded through 90+ pages of an analysis premised on a series of methodological assumptions that are riddled with gaps, omissions, and failings.	Noted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	9.7	-	-	"An urgent knowledge gap: The evaluation of maintenance of even existing levels of economic activity (much less development) in view of pending oil depletion and the resulting large increases in the cost and decreased availability of transportation fuels, and food. Renewable fuels (with the possible exception of algae) will compete with food supplies. Islands and remote, often indigenous communities heavily dependent on diesel fuel for their electricity supplies are particularly vulnerable and are already seeing complete economic collapse and dispersal of populations to more urban centers. The dynamics of the coming energy transformation must be better understood. The economic impacts of not managing this transformation are potentially a human and social disaster of the first order; including the collapse of Nations and the global population.. This is no longer an academic question as oil depletion may completely transform global and local social structures. The ""climate"" however, will improve for those that are left, as our global energy intensity is dramatically reduced."	has been addressed in the concluding sentences of Section 9.7
Marianne Lilliesköld (Swedish Environmental Protection Agency)	TS	-	-	-	-	9.3.4.1	9.2	-	The Figure should include FTD from coal. This could be an alternative to biofuels. Several experts have difficulties to understand and interpret the Figure.	Figure will be improved and simplified. Including FTD from coal will be considered
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	-	-	-	-	-	9.2.1	-	"Figure is not helpful in the current form- e.g. why does the arrow representing ""Energy access"" reach into the Environment? A more detailed figure caption might help, otherwise figure should be deleted, "	eliminated

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.2.1	-	"This figure adds little to the discussion; the text above it (lines 42 on p. 11 to line 12 on p. 12) is very good. If it were to be a useful figure, it would need to be reworked. Agree that large themes shown are useful but the visual is not as helpful as it could be. It is unclear what the vertical straight double-headed arrow is intended to represent. It is unclear why the vertical hooking arrow runs from ""Renewable Energies"" back to ""Renewable Energies."" It is unclear why the box labeled ""Energy Security"" is placed in the ""Environment"" sector. In addition, perhaps a graphic artist could add some 3-D axes (and depth) and show more clearly the arrows that denote interactions. Authors need to be sure that each graphic improves the readers' understanding and educates."	eliminated
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	-	-	-	-	-	9.2.1	-	Even after reading the entire ch., this figure is still very difficult to read, especially the arrows.	eliminated
Nicole Wilke (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	9	-	-	-	-	-	9.3.1	-	"It should be mentioned in the figure as well as the caption that the data for biopower does not include emissions due to LUC, and that these can change the associated emissions considerably, Also, ""with avoided emissions"" should be replaced by ""with CCS"". For biopower with CCS it should be explained, which portion of the carbon contained in the biomass is expected to be captured and stored. "	Comment refers to Figure 9.3.10; however caption has been adapted but it should be noted that "avoided emissions" is not equivalen to "with CCS".
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.10	-	Figure 9.3.10 and the accompanying caption deserve more clarity.	Graphic designer has improved clarity of figure
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.11	-	The results on indirect land use change for biopower should be incorporated into this figure (9.3.11). While it is fine to also include figure 9.3.13 showing a more detailed breakdown of the range across feedstocks and technologies, it is important to at least include an average (or range) associated with biopower land use emissions in figures 9.3.11 and 9.3.12 to show how the net impact of biopower compares with other energy sources.	LUC is excluded from this figure because a consistent comparison across all technologies where LUC could be relevant is not yet available in the literature. It is discussed at length in the text which we feel is the best place to explore such unresolved and uncertainty issues. LUC is also discussed extensively, albeit with a fuels focus, in the LUC box within CH 9.3.4.1 and in Chs 2 (bioenergy) and 5 (hydropower).

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.12	-	Incorporate the results on indirect land use change for biopower into this figure (9.3.12) as well. While it is fine to also include figure 9.3.13 showing a more detailed breakdown of the range across feedstocks and technologies, it is important to at least include an average or range associated with biopower land use emissions in figures 9.3.11 and 9.3.12 to show how the net impact of biopower compares with other energy sources.	not possible with required scientific scrutiny - however, emphasis will be put in text and LUC box on this issue, See comment 519/122
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.12	-	This figure is not legible. Improve graphics quality, and potentially break into two figures.	Graphic designer has improved clarity of figure
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.12	-	This graph cannot easily be read, although this may be because this document is still in draft version.	Graphic designer has improved clarity of figure
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.13	-	"This figured does not include geothermal and should. Geothermal steam electric consumes large amounts of water but seems to get a pass because of its ""complexity"". One could make a similar claim about many of the other technologies for which are already included."	It is excluded primarily because the water that is consumed is often geothermal fluids, not freshwater, thus not having the same impacts as the other technologies. In addition, including geothermal would require including another 12 data points along the x-axis or developing an entirely new graph for geothermal, for which there is not sufficient space.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.14	-	This figure speaks to issue that the data reported is mainly for technologies deployed in U.S. ¿ perhaps not the best data to use unless nothing else is available.	Data are not available widely for water consumption associated with particular technology-cooling system combinations in other countries. However, the technologies deployed in the U.S. are often quite similar to those in other countries and the climatic conditions in parts of the U.S. can be similar to those of other countries, meaning water consumption factors should be comparable. This will be discussed more thoroughly in the text.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.15	-	Add gasoline and diesel to the figure to show how various biofuels compare to conventional fuels.	Figure will be removed and this will be discussed in the text.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.15	-	Change y-axis and figure caption to note that these estimates do not include water for fuel processing	Figure will be removed and this will be discussed in the text.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.16 a	-	Traditional wood burning for heat should be included in this figure (9.3.16a). The comparison between local health impacts of traditional wood stove, more advanced fossil stoves, conventional modern heat sources, and renewable heat sources is important information needed to assess the contribution of each to SD.	No LCA data available for traditional systems to include in figure. Health impacts of indoor air pollution are contained in sections on health, and Box on Black Carbon. Level of detail limited by space constraints.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.16 b	-	Traditional wood burning for heat should be included in this figure (9.3.16b) as well. The comparison between local health impacts of traditional wood stove, more advanced fossil stoves, conventional modern heat sources, and renewable heat sources is important information needed to assess the contribution of each to SD.	No LCA data available for traditional systems to include in figure. Health impacts of indoor air pollution are contained in sections on health, and Box on Black Carbon. Level of detail limited by space constraints.
Roxana Bojariu (Meteo Romania)	9	-	-	-	-	-	9.3.4	-	This figure is not related to renewable energy. It may be removed to save space.	deals with traditional biomass health effect
Roxana Bojariu (Meteo Romania)	9	-	-	-	-	-	9.3.5	-	This figure is not related to renewable energy. It may be removed to save space.	deals with traditional biomass health effect
Roxana Bojariu (Meteo Romania)	9	-	-	-	-	-	9.3.6	-	This figure is not related to renewable energy. It may be removed to save space.	deals with traditional biomass health effect
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.7	-	Description for chart is unclear	Figure has been removed
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.7	-	Please define the term EME's in the figure caption.	Figure has been removed
Marianne Lilliesköld (Swedish Environmental Protection Agency)	9	-	-	-	-	-	9.3.7	-	There is something strange with the scale of the figure. The 'world' colums are probably presented in another scale.	Scale is correct. Figure has been deleted anyway.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.3.8	-	Please label the table axis in the figure itself.	Figure has been removed
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.4.1	-	"Define what ""in the global deployment of different renewable sources"" means. As an alternative, show graphically the share of RE in non-Annex I countries under two alterative scenarios (e.g., business-as-usual vs. a stabilization target), and discuss estimated GDP growth in these countries under these two scenarios. "	The caption has been changed accordingly to: "Non-Annex I countries' share of different RE sources deployed globally in long-term scenarios by 2030 and 2050". The issue of welfare implications of RE is discussed in detail in Ch10. A link and a summary of results important for SD are provided in section 9.4.1.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	9.4.1	-	Insert a definition of non-Annex I countries. This report will reach an audience that does not know what this term means.	Annex I/Non Annex I countries are defined in the Glossary.
Petteri Taalas (Finnish Meteorological Institute)	TS	-	-	-	-	-	TS 9.1	-	"The grouping of all biomass feedstocks into one ""bioenergy"" column seems to be quite an ambiguous approach. The GHG balances of different biomass feedstocks (waste, residues, dedicated crops, woody biomass etc) vary significantly even without the LUC/iLUC impacts. The uncertainty bar represents this to some extent. However, it would be beneficial to explain this source (different feedstocks) for the wide uncertainty bar for biopower somewhere in the text referring to the Figure TS 9.1."	Not completely sure if this is an NREL figure. Actually, with the exception of avoided emissions the differences between feedstock types are fairly small relative to within group variability. I though the variability was explained, but maybe needs to be clearer
Petteri Taalas (Finnish Meteorological Institute)	TS	-	-	-	-	-	TS 9.1	-	"The presentation of results ""with avoided emissions"" for all biopower seems by no means justified. First, avoided emissions are intrepreted among LCA practitioners most often as energy and material substitution and would be connectid to all the low carbon technologies by intuition. Secondly, as the avoided emissions is later defined in this TS as emissions avoided by avoiding decomposition of biomass (in fields, forests or landfills), it is evident that it can be applied to only a limited share of feedstocks. The share of such feedstocks is even more limited if only fast decomposing waste and residues is considered (according to the true climatic impact). Hence, it is questionable to group this information with all biopower (if all biopower should be grouped in the first place, see comment above). Visual information given in summaries is most often absorbed by the readers and this way of presentation leads to a biased message regarding likely range of GHG emissions from all biomass energy use. It is unclear why the avoided emissions (of a very limited share of feedstocks) are coupled for all biopower and the land use derived GHG impacts (relevant to a large share of current feedstocks) are omitted from the Figure."	Accepted
Trigg Talley (U.S. Department of State)	TS	-	-	-	-	-	TS 9.2	-	Figure is not legible.	Accepted
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	-	9.3.2	Update table with WEO 2010.	Table has been updated

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	-	9.3.5	What are the commas? Should these be decimal points? Also, please better explain what is meant by the value of lost turnover. Also recommend providing a column on OECD nations for comparison purposes.	Commas have been converted to decimal points. Turnover is a common expression that simply means 'sales'. A column for OECD nation would not be of interest - access to electricity simply is not an issue in industrialized countries.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	-	9.3.6	30 years is a very short assumed lifetime. Most coal and nuclear plants are now operating for 60 years or more in the electricity sector. It is true that a plant may be upgraded during that time, but it is not retired after 30 years.	true, but still the table is derived from published literature, and those are the values found
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	-	9.3.6	Even if the payback time associated with bioenergy is more uncertain than the other energy sources, it should still be included in the table, perhaps with a range. At a minimum, the range should be reported in the text so it is possible to compare bioenergy with other sources.	no data available for biopower, changed caption to reflect this
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	-	9.3.6	This energy ratio may be incorrect - in fact it may be reversed. For example, if a coal plant has 50% thermal efficiency, then each 1.0 MW of coal (primary energy) produces 0.5 MW of electricity (secondary energy). This table makes it look like 1 MW of primary energy produces 2 to 20 MW of electricity. Physically, that is not possible.	ER is correct (see Annex II for methods); comment is not clear, still, the fact that the physical energy content of the fuel (e.g. coal) is not included in the fossil fuel metric will be stated even more clearly in the final draft to exclude this misinterpretation. it is clearly counterintuitive, but hopefully better explanation in the text will explain this.
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	-	9.3.7	"One big challenge with RE in developed nations is the risk of massive power disruption due to cyber attack. RE integration requires advanced (computer-controlled) power balancing due to intermittency. This makes it much easier for a terrorist or ""damage-minded-person"" to hack into the system to take down a transmission grid. Thus, RE systems are more susceptible to cyber-attack than traditional centralized energy systems."	Integration aspects (in particular in connection with intermittency) are discussed in Chapter 8 of the SRREN
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	-	9.4.1	Define how the technology column on the table relates to the three pillars of sustainability used in this report.	Table has been removed
Trigg Talley (U.S. Department of State)	9	-	-	-	-	-	-	9.4.1	This table is redundant with information offered earlier in the chapter and could be deleted.	The table has been deleted.