



# INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



## Special Report on Renewable Energy Sources and Climate Change Mitigation

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Government and Expert Review of the Second Order Draft  
Jun 21, 2010 – Aug 16, 2010

### Chapter 8

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<sup>1</sup> 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](http://www.ipcc.ch/meetings/session33/ipcc_p33_decisions_taken_procedures.pdf)>>

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## Special Report on Renewable Energy Sources and Climate Change Mitigation, Second Order Draft

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by the writing team
Christoph von Stechow (IPCC WGIII TSU)	8	0	-	-	-	-	-	-	According to agreements reached during LA3 in Oxford, chapter 8 is recommended to discuss the barriers 'technological lock-in' and 'grid access'. Although the text touches on these issues, the terms themselves are not mentioned ('lock-in') or only mentioned once for a case study ('grid access'). Please consider providing a more in-depth analysis of these barriers.	relevant, considered in rewrite process of 8.2.1
Australia (0)	8	0	-	-	-	-	-	-	Additional context to this chapter would be provided by stating that integration issues are different for each technology: for example, geothermal and hydropower are fundamentally able to be scheduled whereas wind and solar are not, therefore the chapter needs to deal with the two integration issues in a different way. Much of the analysis is based on the super-grids of Europe and the USA, and whilst this is a challenge for those countries it makes it difficult to apply the chapter across other countries. The chapter also needs to note that more infrastructures, including IT related, are required to manage the electricity system and it should note that the cost of integration and storage are 'externalities' of implementing renewable energy. There is a lack of discussion and 'rethinking' of the relationship between integration and control for maximum RE use; as the existing supply network is built around 'many to many' and able to be forecast and scheduled, RE does not have this, so we need to consider how best to make use of resource capability. In considering RE integration into the electricity supply system, the following questions need answers on a country-specific basis: -what are the natural resources available? -what technologies/expertise does nation possess? -are there adequate governance /institutional arrangements to implement? -is there a potential energy security problem? -what human health/environmental/social issues are created/avoided?; and -what human perceptions/preferences and political preferences will influence decisions? Chapter 8 would benefit from some analysis of where including 'smart grids' are appropriate and also where different supply-demand relationships (building integrated solar) and cross sector substitutions (transport/electricity) would offer holistic solutions. Finally, this chapter confuses 'energy efficiency' with 'demand management' which are quite different things.	relevant, considered in rewrite process of 8.2.1

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Kristin Seyboth (IPCC WG III TSU)	8	0	-	-	-	-	-	-	Ch. 11 claims (ch. 11 p. 37 line 39/40) that Ch. 8 shows 'the cost of moving to a sustainable energy system has been quantified in the hundreds of billion of dollars'. Please liaise with Ch. 11 authors on this point.	Lars liaising with Chapter 11
Kristin Seyboth (IPCC WG III TSU)	8	0	-	-	-	-	-	-	Ch. 11 claims (ch. 11 p. 37 line 39/40) that Ch. 8 shows 'the cost of moving to a sustainable energy system has been quantified in the hundreds of billion of dollars'. Please liaise with Ch. 11 authors on this point.	relevant, considered in rewrite process of 8.2.1
United States (U.S. Department of State)	8	0	-	-	-	-	-	-	Chapter 7 contains some discussions of integration issues which should be moved into Chapter 8.	it is not possible to change that anymore. References to ch7 will be given in order to minimize overlappings
United States (U.S. Department of State)	8	0	-	-	-	-	-	-	Forecasting should not be overemphasized as a solution to manage variability that is better than a number of other operational and planning solutions that are relevant and useful.	relevant, considered in rewrite process of 8.2.1

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United States (U.S. Department of State)	8	0	-	-	-	-	-	-	<p>General comment on Ch. 8: In its opening pages, this chapter should state forcefully and succinctly that integration of large fractions of RE will require the affected governments to assume responsibility for managing a set of critically important transitional problems. Some suggested language: Integration of relatively large percentages of RE into electricity systems (i.e., more than 20% of end-use consumption in the affected area) would occur gradually and require the management of major ongoing transitional problems. Management of this transition would require strong leadership and direction from appropriate governmental institutions. Some likely challenges include: 1. Some affected constituencies could resist adapting to changing conditions, and seek to shift costs or other burdens associated with needed adjustments to other groups. 2. Integration of high percentages of RE, while maintaining system reliability, would not be feasible in many geographic areas without: 2a. The provision of additional transmission capacity (or storage if feasible). In many industrialized countries, development of major new transmission projects is controversial and requires the resolution of major institutional and societal issues. 2b. The provision of sufficient system frequency responsiveness. Severe but infrequent system imbalances could propagate into system-wide blackouts if the system is not designed to take corrective action to such conditions within seconds. 3. Cost allocation for transmission and other grid-related investments is likely to be a major obstacle. This is because of the magnitude of the aggregate investment likely to be required, and the likelihood that the expected benefits would be widely but not uniformly distributed. 4. Development of the markets, operational rules, tools, practices, and training regimes required to ensure reliable electric service at reasonable cost would require broad cooperation from the owners and operators of grid-related facilities.</p>	relevant, considered in rewrite process of 8.2.1
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	0	-	-	-	-	-	-	<p>Heat pumps, including geothermal hot water heat pumps, room air conditioners, hot water heat pumps of Japan know as 'Ecocutes", are renewable energy. Review the the current status, technology development and policies. Literature include, to name a few, SRREN_Draft2_Review_Sugiyama_Taishi_Material_1, SRREN_Draft2_Review_Sugiyama_Taishi_Material_2,SRREN_Draft2_Review_Sugiyama_Taishi_Material_3,SRREN_Draft2_Review_Sugiyama_Taishi_Material_4,SRREN_Draft2_Review_Sugiyama_Taishi_Material_5.</p>	Importance of heat pumps is recognised in 8.2.2 and 8.3.2 but more detail on this specific technology is beyond scope of chapter

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Lennart Söder (KTH, Royal Institute of Technology)	8	0	-	-	-	-	-	-	-	I am a bit surprised when I read this chapter. What is the role of this chapter, especially in relation to chapter 7. Chapter 7 has a clear focus, but the meaning of chapter 8 is unclear. Sometimes it sounds like Renewable Energy, RE is all type of renewable energy and sometimes only the variable ones. Norway and Iceland have, e.g., today already 100 % RE, but that is not mentioned. And then a lot of the detailed integration issues treated in chapter 7 are considered also here, but in an unclear way. In general I think the chapter needs a total rewrite. Below I will comment on some issues, but that does not mean that I think the chapter is OK if they are considered in the next edition. I am just a reviewer and I have not time to come up with a suggestion of a better structure. Ome general issues are also when percentage are used. Ther must be a clear defition wether one mean percent of capacity, percent of total electric energy, percent of toal energy supply etc. In some parts RE also means all types of renewable energy, not only electricity	resolved by rewrite
United States (U.S. Department of State)	8	0	-	-	-	-	-	-	-	In general, the material in Sections 8.1 and 8.2 looks good. One general comment is that the references and examples/case studies are somewhat dominated by Europe and the US. Given the global scope, it would be desirable to include some more material from other parts of the world, provided it has undergone peer review.	Agree -balance aimed for
United States (U.S. Department of State)	8	0	-	-	-	-	-	-	-	In order to achieve fundamental carbon objectives cost effectively, attention to water consumption will be required. RE integration will impact water demand, in some cases positively and in others negatively.	Chap 9
United States (U.S. Department of State)	8	0	-	-	-	-	-	-	-	In order to achieve fundamental carbon objectives cost effectively, attention to water consumption will be required. RE integration will impact water demand, in some cases positively and in others negatively.	dealing with water requirements of renewable integration is too detailed compared to other more important issues of integration
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	0	-	-	-	-	-	-	-	Integration of PV with power grid should be addressed more - there is hot debate in Japan. I find many literature with regard to wind power in wind chapter and the intergration chapter, but almost none in solar and integration chapter with regards to solar.	Since amnded

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Greece (National Observatory of Athens)	8	0	-	-	-	-	-	-	Since at footnote #2 in page 11 there is a definition of penetration (i.e. "RE share of the total gross annual electricity consumption"), any reference to penetration as a percentage should not be more specific than this definition (unless it refers to a different issue) because it is confusing. For example, in page 16 lines 6-7 there is a reference to a percentage of total annual electricity demand, in page 17 line 3 a reference to penetration levels higher than 20-30% of the demand, wind penetration up to 20% of gross energy demand etc.	the comment is specifically directed to e.g. a specific phrasing of the (old) section. Hence it is not relevant anymore due to the rewrite of the section.
United States (U.S. Department of State)	8	0	-	-	-	-	-	-	The authors should show great caution in dealing with specific countries, unless there is a major benefit to dealing with a specific country context, for example, page 27 lines 1-11. In many cases, the central point could be made abstractly without reference to specific countries. The review team for Chapter 8 feels it would be more appropriate to present the case studies in appendices.	resolved by rewrite
United States (U.S. Department of State)	8	0	-	-	-	-	-	-	The chapter could be better organized particularly to highlight key messages and make them more visible to the reader. Also, the editors should settle on either Smart Grid or Intelligent Grid or another comparable term, define it, and use it consistently.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	0	-	-	-	-	-	-	The chapter currently contains a LOT of information, and is for the most part clearly structured to allow a reader to navigate well through it. Sections 8.2.1, 8.2.2, 8.2.5 and 8.3.2 currently need the most attention, to assure that the content relates to the headings above it, to reduce overlap, to assure consistency with the content and structure of the other sub-sections, and to assure a clear story-line, in some cases needing a thorough rewrite. The reader still misses some clear link among the subsections of 8.2, and a link with the sector subsections that follow in 8.3. It seems that this would be a useful conclusion of the entire chapter if it's possible.	resolved by rewrite
Greece (National Observatory of Athens)	8	0	-	-	-	-	-	-	The chapter has too much details at some points (e.g. page 12 box 8.1 is too detailed, page 12 lines 2-5 present how the steam turbine operates), as well as repetitions (e.g. the reference to the advantage of decentralized production is mentioned much more times than it is needed).	resolved by rewrite
Greece (National Observatory of Athens)	8	0	-	-	-	-	-	-	The chapter puts too much emphasis on wind, as almost all the references regarding the integration of variable RE refer to wind energy. There must be also published work in the literature on PVs and solar-thermal plants and thus the text should be enriched with these.	Since amended
United States (U.S. Department of State)	8	0	-	-	-	-	-	-	The concept of RE penetration level should be defined in the beginning of the chapter. The definition should also distinguish between energy and capacity, and the difference between load served and RE rating.	Defined where first mentioned

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United States (U.S. Department of State)	8	0	-	-	-	-	-	-	The concept of RE penetration level should be defined in the beginning of the chapter. The definition should also distinguish between energy and capacity, and the difference between load served and RE rating.	resolved by rewrite
United States (U.S. Department of State)	8	0	-	-	-	-	-	-	The country case studies were well chosen examples of RE integration with differing needs and successes (the report did need to address several US large scale case studies-see further comments). There was not enough discussion of the various regulatory structures and how important a role regulation plays in the final deployment of these technologies. For example, the regulatory policies in Indonesia have held it back from much needed infrastructure development because of price fixing and government subsidies, whereas, the policies in Chile have benefited that nation greatly. The EU is poised to take advantage of its union with its policy making and seems prepared to initiate the RE production control, prediction and coordination that is needed. Such coordination at the local level implies the need for global coordination. It is clear the regulatory model in the US is not conducive to this and the US case has not been addressed in this section of the document. For example, for the State of California to mandate 20% wind power by 2020 shifts the economic burden of developing this infrastructure to the people of a state that is on the verge of bankruptcy. The state cannot mandate that the wind will blow when the demand is greatest, or that the wind is favorable near where the electrical load exists. In a free market economy, it would be desirable for the long term economic success of such an undertaking to have regulatory policy makers provide incentives rather than mandates. Policies should help jump start needed developments and change, but it has to be economically feasible to survive in the long term. Thus, some comparison between various countries regulations is needed to determine which policies provide the most favorable environment for sustainable RE integration.	resolved by rewrite
United States (U.S. Department of State)	8	0	-	-	-	-	-	-	The individual country examples should be moved to an appendix and the key points included in the chapter body.	the comment is specifically directed to e.g. a specific phrasing of the (old) section. Hence it is not relevant anymore due to the rewrite of the section.
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	0	-	-	-	-	-	-	There is a lot of description with regards to energy efficiency and conservation - but they are should be deleted as they are beyond the scope of this report. Instead, discuss technologies which lies inbetween renewable and energy efficiency technology - e.g. passive solar, heatpumps.	Energy efficiency is recognised as important for facilitating RE integration. Passive solar is discussed in 8.3.2, as is HP:s

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United States (U.S. Department of State)	8	0	-	-	-	-	-	-	There was a categorization and analysis of dispatchable RE sources (such as reservoir-hydro, bioenergy and geothermal) and non-dispatchable RE sources (such as fluctuating wind, wave and solar PV). However there was little information given as to the cost, efficiency, return on investment, cost of operation and other important factors that would come into play in the selection of RE sources.	it is not the topic of this chapter to deal with the techno-economic parameter of renewable energy like costs (apart from integration). The technology chapters have to address these issues.
United States (U.S. Department of State)	8	0	-	-	-	-	-	-	This chapter represents a thorough and accurate assessment of renewable energy (RE) generation, transmission and distribution. It gives an excellent overview of the available technologies and the current state of development and plans for deployment through many areas of the world. The chapter also provides a through treatment of the hurdles that prevent further RE integration with the grid. The chapter seems to be full of $\zeta$ altruisms $\zeta$ and study report references regarding grid codes and unique RE characteristics. This was viewed by the reviewer as necessary to provide a complete picture of the barriers to RE integration.	Accept
Richard Mueller (Climate Monitoring Satellite Application Facility, DWD)	8	0	-	-	-	-	-	-	To address and clarify the problems concerning the integration or renewable energies into the existing grids is quite important. Well done.	OK
Ladislaus Rybach (Geowatt AG Zurich (company))	8	2	-	-	-	-	-	-	Table of Content: after Section 8.2.2 (Integration of renewable energies into heating and cooling networks $\zeta$ ) a section should be inserted about decentralized systems. Besides district heating or cooling systems there is now a real boom on the market for geothermal heat pumps (GHP). This technology enables space heating, cooling, and domestic warm water production with the same installation. The decentralized systems can be tailor-made, taking into account the local needs and conditions. More details in [4.3.8].	Included in other sections
Juan Llanes (Centre for Environmental Studies)	8	5	15	-	16	-	-	-	$\zeta$ Through measured system integration, there are few, if any, technical limits to the level of RE penetration in the many parts of the world where sufficient resources exist. $\zeta$ To optimistic?	Statement was correct for technical potential but reworded
United States (U.S. Department of State)	8	5	31	5	44	-	-	-	Add citations for the cost numbers referred to in this section.	Not in Exec summary.
Australia (0)	8	5	13	-	-	-	-	-	Add sentence: Cost-competitiveness, particularly in relation to network integration, will be a key driver in determining the extent to which technical potential is realised.	resolved by rewrite

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Australia (0)	8	5	13	-	-	-	-	-	Add sentence: Cost-competitiveness, particularly in relation to network integration, will be a key driver in determining the extent to which technical potential is realised.	Reworded
Kristin Seyboth (IPCC WG III TSU)	8	5	10	5	10	-	-	-	Clarify what are 'other energy markets'	Reworded
United States (U.S. Department of State)	8	5	27	5	30	-	-	-	Comment, p. 5, lines 27-30. Refer the reader to a chapter or appendix on case studies to keep the focus in this chapter on key elements of integration.	No refs in Exec summary
United States (U.S. Department of State)	8	5	20	-	-	-	-	-	Considerable investment in new infrastructure is something that is attempted to be minimized. The statement should acknowledge that the first solutions may make best use of existing infrastructures, such as the electric power grid (for example, as a higher priority than the development of a H2 transportation infrastructure)	Reworded
United States (U.S. Department of State)	8	5	36	-	-	-	-	-	Establish a definition for "smart grid" and/or "intelligent grid" and then cite the correct term for this context.	But reworded
United States (U.S. Department of State)	8	5	36	-	-	-	-	-	Establish a definition for "smart grid" and/or "intelligent grid" and then cite the correct term for this context.	relevant, considered in rewrite process of 8.2.1
United States (U.S. Department of State)	8	5	34	-	-	-	-	-	Given the differences in regional resource composition and the fact that the pace of renewable integration is happening quite rapidly in some areas< I think it is good and essential to maintain the wide band of variability around potential cost (7-32%) that is included in this passage. Insert a citation for the report referred to in this sentence.	Agree but no refs in Exec summary
Kristin Seyboth (IPCC WG III TSU)	8	5	46	-	-	-	-	-	How are capacity building and technology transfer considered to be risks and impacts? Is risks and impacts really the right wording here?	Reworded
United States (U.S. Department of State)	8	5	14	-	-	-	-	-	Recommend striking the sentence "It is claimed that some regions and towns already are close to 100% RE" because it misleads readers as to what is actually cost effective and feasible on a broader geographic scale.	Shows it is feasible for some situations
Kristin Seyboth (IPCC WG III TSU)	8	5	18	5	18	-	-	-	Replace 'the necessary transition will require' with 'Such a transition would require' to avoid policy-prescriptive language	Reworded
Kristin Seyboth (IPCC WG III TSU)	8	5	10	5	12	-	-	-	Sentences are unclear. Perhaps better to word as 'However, if greater shares of RE are to be accomodated, other energy markets may need adapting and expanding. To avoid continued growth of GHG emissions from fossil fuels, the rate of RE penetration will need...'	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	5	10	5	12	-	-	-	Sentences are unclear. Perhaps better to word as 'However, if greater shares of RE are to be accomodated, other energy markets may need adapting and expanding. To avoid continued growth of GHG emissions from fossil fuels, the rate of RE penetration will need...'	Reworded

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Kristin Seyboth (IPCC WG III TSU)	8	5	45	6	1	-	-	-	Sentences do not make sense together. Do you mean to say 'For each of the sectors, risks associated with integration and the deployment of RE (e.g. sustainable use of land) are reasonably well understood'?	Reworded
Australia (0)	8	5	1	5	4	-	-	-	Suggest " is likely to require a major paradigm shift" A major review of Australian energy markets indicated they would be generally be resilient to the challenges associated with the introduction of climate change policies. This includes a 20% RE target.	resolved by rewrite
Australia (0)	8	5	1	5	4	-	-	-	Suggest " is likely to require a major paradigm shift" A major review of Australian energy markets indicated they would be generally be resilient to the challenges associated with the introduction of climate change policies. This includes a 20% RE target.	Text amended
United States (U.S. Department of State)	8	5	13	5	17	-	-	-	Suggestion: a bar chart that shows the largest countries (India, China, the United States, Brazil, Mexico, the United Kingdom, etc.) and the current level of RE penetration and the RE penetration goals of each country.	Not in Exec summary. Such infor in REN 21 as referenced
United States (U.S. Department of State)	8	5	13	5	17	-	-	-	Suggestion: a bar chart that shows the largest countries (India, China, the United States, Brazil, Mexico, the United Kingdom, etc.) and the current level of RE penetration and the RE penetration goals of each country.	relevant, considered in rewrite process of 8.2.1
United States (U.S. Department of State)	8	5	13	-	-	-	-	-	The author(s) have missed an important point by stating that the RE has the long term technical potential to provide the major share of global energy. Most understand that as obvious, and the statement provides a false comfort to those less educated in this area. The primary issue is whether we can cost effectively accomplish this within a specified time range. The cost must be low enough to still allow other humanitarian needs to be met and sufficient economic growth.	resolved by rewrite
United States (U.S. Department of State)	8	5	13	-	-	-	-	-	The author(s) have missed an important point by stating that the RE has the long term technical potential to provide the major share of global energy. Most understand that as obvious, and the statement provides a false comfort to those less educated in this area. The primary issue is whether we can cost effectively accomplish this within a specified time range. The cost must be low enough to still allow other humanitarian needs to be met and sufficient economic growth.	Reworded
United States (U.S. Department of State)	8	5	32	5	35	-	-	-	The cost of wind penetration into a bulk grid is highly dependant on the amount of excess reserve capacity currently available. Fair comparisons between integration costs among different countries also need to reflect the cost of electricity to the consumer.	relevant, considered in rewrite process of 8.2.1

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United States (U.S. Department of State)	8	5	32	5	35	-	-	-	The cost of wind penetration into a bulk grid is highly dependant on the amount of excess reserve capacity currently available. Fair comparisons between integration costs among different countries also need to reflect the cost of electricity to the consumer.	Reworded
Hannele Holttinen (VTT)	8	5	-	7	-	-	-	-	The executive summary should be rewritten to bring out the results/information not just outlining the issues, f.ex. A short version of p 17-18, some engineering solutions from that section and some texts page 33 below fig 8.10	Was amended - but cannot get into details
United States (U.S. Department of State)	8	5	22	-	-	-	-	-	The real drivers for renewable energy often include government policies that are leading to significant increases in RE, such as renewable penetration requirements, and feed-in tariffs.	Reworded
United States (U.S. Department of State)	8	5	15	-	-	-	-	-	The section discusses 'few if any technical limits to the level of RE penetration...'. This statement is highly biased toward ignoring costs. Much of technology is pursued to reduced cost... and cost is a very large barrier to penetration, and the text should be modified to make this clear.	Is technical potential
United States (U.S. Department of State)	8	5	15	-	-	-	-	-	The section discusses 'few if any technical limits to the level of RE penetration...'. This statement is highly biased toward ignoring costs. Much of technology is pursued to reduced cost... and cost is a very large barrier to penetration, and the text should be modified to make this clear.	resolved by rewrite
United States (U.S. Department of State)	8	5	10	-	-	-	-	-	The term 'other' energy markets is not clear. Due to the wide applicability of this document and the large number of energy structures it should apply to, the comments should specify and example for 'other' markets	resolved by rewrite
United States (U.S. Department of State)	8	5	10	-	-	-	-	-	The term 'other' energy markets is not clear. Due to the wide applicability of this document and the large number of energy structures it should apply to, the comments should specify and example for 'other' markets	Reworded
Australia (0)	8	5	2	5	2	-	-	-	the words " large share" and "significant levels" are used through out the chapter, without an indication of what this actually means. Is it over 20%, 50% ? ¿. Are these levels defined elsewhere in the report	Try to quantify where possibl;e
David Clubb (European Environment Agency)	8	5	32	5	35	-	-	-	Unsupported assertions: Assertions about cost of integration need to be backed up by reference	Not in Exec summary
Kristin Seyboth (IPCC WG III TSU)	8	5	8	5	9	-	-	-	What are you saying here? That the policies depend on the RE cost-effectiveness, social acceptance, reliability and co-benefits of RE? Perhaps you mean that many examples of successful RE integration exist as a result of policies that SUPPORT RE cost effectiveness, etc?	Reworded
Kristin Seyboth (IPCC WG III TSU)	8	5	31	5	40	-	-	-	Would be useful to reader if all costs in paragraph were presented in either % or in 2005US\$	Reworded

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Trevor Demayo (Chevron Energy Technology Cvo.)	8	5	13	5	13	Exe. Sum.	-	-	Change 'the major' to 'a significant' in the statement of ""In the long-term, RE has the technical potential to provide a significant share of global energy""	Majority share used
Trevor Demayo (Chevron Energy Technology Cvo.)	8	5	13	5	13	Exe. Sum.	-	-	Change 'the major' to 'a significant' in the statement of ""In the long-term, RE has the technical potential to provide a significant share of global energy""	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	5	14	5	15	Exe. Sum.	-	-	including for heat and local transport"" --> does this include RE electricity as well??	Yes .Reworded
Trevor Demayo (Chevron Energy Technology Cvo.)	8	5	32	5	35	Exe. Sum.	-	-	List references; Check consistency of assumptions for the EU study showing 10% opex of total wind levelized (?) generation costs. A good study should typically report a mean +/- variation (standard deviation or range) in results.	Not in Exec summary
Trevor Demayo (Chevron Energy Technology Cvo.)	8	5	45	-	-	Exe. Sum.	-	-	Setence ""Several risksζ"" is poorly worded. Should reverse and say ""The integration and deployment of RE presents several risks and potential (environmental? Economic?) impacts.	Reworded
Trevor Demayo (Chevron Energy Technology Cvo.)	8	5	37	5	40	Exe. Sum.	-	-	Suggest removing the sentence: ""For RE heat, the additional cost of integrating biomethane into natural gas distribution systems can range between US\$ 5-15 /GJ varying with gas clean-up standards and whether transport is by pipeline or truck."" NO other direct costs are presented in the Exec summary. Better to express this as a % above/belowthe cost of operating fossil fuel based systems, including any fuel costs. Need to also include cost of biomass/biogas.	One of few direct costs that is in the literature
Trevor Demayo (Chevron Energy Technology Cvo.)	8	5	4	5	4	Exe. Sum.	-	-	The most prevalent RE source in the world is biomass which can operate as baseload givena steady biomass feed supply. Geothermal provides baseload power as well (e.g., Icelad is a good example). Thus not all RE systems have a low/varying capacity factor as is suggested. Although intermittency is certainly an issue, in many cases the challenge is high first cost.	Biomass varies with seasons
David Milborrow (Consultant)	8	6	31	-	-	-	-	-	"Few comparative cost assessments" Not understood. There have been several, in both EU and USA	Reworded
David Milborrow (Consultant)	8	6	7	-	-	-	-	-	"has proven to be challenging". Seems unduly negative, given that several grid operators are quite relaxed about integration	Not just electricity
Juan Llanes (Centre for Environmental Studies)	8	6	5	-	-	-	-	-	ζhigh levels of penetration (>20%)ζ ?	Accept
United States (U.S. Department of State)	8	6	17	-	-	-	-	-	ζserves a village or a continent ADD ζand stakeholder willingness to incur investment costs.ζ	Accept

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Emmanuel Branche (Electricité de France)	8	6	14	6	14	-	-	-	Add PSPP (pumped storage power plant) which is the only mature and large scale technology for energy storage. Proposition: "response, energy storage (pumped-storage), more flexible"	Included in other sections
Emmanuel Branche (Electricité de France)	8	6	8	6	9	-	-	-	Add PSPP, proposition: "in particular reservoir-hydro and pumped-storage, geothermal and bioenergy"	Accept
United States (U.S. Department of State)	8	6	13	-	-	-	-	-	Add: "reserve" before the word capacity	Accept
Kristin Seyboth (IPCC WG III TSU)	8	6	4	6	44	-	-	-	All sectors in chapter are covered as reflected in the table of contents. However, you're missing information on heating/cooling networks, gas grids and liquid fuels.	Reworded
Mark Fulton (Deutsche Asset Management, Deutsche Bank)	8	6	4	6	17	-	-	-	Identify agents of change and who controls/impacts the resource choice. In the US, Public Utility Commissions (PUCs) are the key stakeholders in that they dictate/determine the rate of returns and resource mix choices that utilities make in their long term integrated resource planning (IRP) process	Amended
Kristin Seyboth (IPCC WG III TSU)	8	6	45	-	-	-	-	-	If you're talking about energy supply systems, should stick to those outlined in the table of contents: electric power systems, h/c, gas grids, etc. If you're talking about sectors, should also stick to those outlined: transport, buildings and households, etc. This sentence is a funny mix of both.	Reworded
Kristin Seyboth (IPCC WG III TSU)	8	6	48	-	-	-	-	-	It is not the role of the IPCC to say 'increased RE integration with the existing system is desirable'. Rather it is to provide the information necessary to policy-makers for them to decide this themselves.	Reworded
United States (U.S. Department of State)	8	6	4	-	-	-	-	-	Modify the sentence beginning in line 4 to read "For the global electricity sector, it is not possible to standardize on a single organizing principle to guide the transition from a traditional system to a highly flexible one that would accommodate higher levels of RE."	Accept
United States (U.S. Department of State)	8	6	4	6	17	-	-	-	Page 6 Line 4 & 17 as well as case studies on electricity sector: "International experience of the integration of variable RE, 10 mainly wind, has shown that high levels of penetration (>20%) can be feasible if facilitated by methods and investments that increase the flexibility of a conventional system." This statement needs to be stronger-perhaps adding the word "Significant" in front of investments or as shown on page 11 of 133.	Amended
Christoph von Stechow (IPCC WGIII TSU)	8	6	8	6	9	-	-	-	Please consider replacing "and can be feasible as baseload options" by "and could thus complement more variable renewable energy sources", since "baseload" may also imply that the capacity factor has to be high for projects to run profitably. This is not really a positive attribute.	Accept

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Kristin Seyboth (IPCC WG III TSU)	8	6	25	6	32	-	-	-	So heating/cooling is the best way for buildings to incorporate RE? More information is needed than just 'examples exist'.	Reworded
United States (U.S. Department of State)	8	6	45	7	2	-	-	-	The sentence beginning in line 45 is confusing because it has multiple meanings. It could mean integration of the four sectors, or it could mean integration of RE into each sector individually. It is true that integration of the four sectors with each other would involve a paradigm shift. However, it is not obvious that such an integration would necessarily be desirable or beneficial. The paragraph beginning with line 45 should be deleted entirely, due to additional problems with the paragraph.	Reworded
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	6	24	-	-	-	-	-	With regard to hydrogen, the study 'GermanHy" (Dena et al 2009) explored how this transport fuel could be produced and distributed to meet expected future demand from vehicles. (It is not clear if the study should be mentioned at this place, but it is the most comprehensive and up-to-date study in the area.)	Reference to GermanHy inserted 8.3.1.3.3, p.75, line2
Kristin Seyboth (IPCC WG III TSU)	8	6	4	6	44	-	-	-	Would be useful if, under each of these bullets, a brief explanation was given outlining the means by which larger shares of RE can be integrated, as is described as the goal of Chapter in 8.1	Examples given where possible
Trevor Demayo (Chevron Energy Technology Cvo.)	8	6	22	6	24	Exe. Sum.	-	-	Another key challenge for Evs and PHEVs is battery reliability, safety, and lifetime	Reworded
Trevor Demayo (Chevron Energy Technology Cvo.)	8	6	26	-	-	Exe. Sum.	-	-	Cross-check with Chap.4 re heat pumps to make sure they are not described twice and to determine which terms they use to describe these systems. Note that hydrothermal geothermal plants are NOT the same as heat pumps.	Checked
Trevor Demayo (Chevron Energy Technology Cvo.)	8	6	19	6	20	Exe. Sum.	-	-	Rephrase ""Advanced biofuels are more fungible with petroleum production and distribution systems so once developed cost-effectively could encourage greater penetration."" to say ""Advanced biofuels more fungible with petroleum production and distribution systems are currently being developed and one day, if they, become cost competitive they could encourage greater penetration.	Reworded
United States (U.S. Department of State)	8	7	30	7	32	-	-	-	Change the statement to be "CCS <sub>i</sub> will likely have a role to play along with RE."	Reworded
David Clubb (European Environment Agency)	8	7	24	7	27	-	-	-	Irrelevant: some of these 'risks' apply equally to fossil fuel systems and need to be contextualised	Most don't but reworded

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Kristin Seyboth (IPCC WG III TSU)	8	7	6	7	9	-	-	-	It seems as if the goal of the figure (8.1) is to show a) the indirect or direct deployment options of RE; and b) the reasoning behind the structure of the chapter. Could this also be added to the supporting text? It is less clear how the figure shows the requirement of modification of conventional power systems.	Reworded
United States (U.S. Department of State)	8	7	1	-	-	-	-	-	It should be better stated that the policy framing is an integral part of the cost benefit evaluations... cost benefit does not imply least cost but rather least cost under specific policy mandates.	Reworded
United States (U.S. Department of State)	8	7	3	-	-	-	-	-	The executive summary should briefly cover renewable energy integration into distribution feeders and the challenges therein.	Already there but not too detailed
Antoine BONDUELLE (E&E Consultant)	8	7	40	8	9	-	-	-	The IAE World Energy Outlook has consistently erred in the evaluation of possible RE contributions. This source should not be used in the introduction as the main example to introduce projections...	Best source available to show sectors etc
Antoine BONDUELLE (E&E Consultant)	8	7	30	7	32	-	-	-	The point on nuclear power and capture and storage having ""a role to play"" has not been demonstrated in the present report. Thus it is irrelevant to this part of the text.	Setting RE in context
Emmanuel Branche (Electricité de France)	8	7	28	7	28	-	-	-	What is meant by "Conventional"? The sentence should not be limited on large hydro according to me. All hydro whatever the size are developed in existing electricity systems (transmission and distribution networks)	Therefore conventional
China (China Meteorological Administration)	8	7	30	7	32	8.1	-	-	The sentence ¿Nuclear power and carbon dioxide capture and storage (CCS) linked with coal- or gas-fired power generation as well as industry applications, will have a role to play alongside RE (IPCC, 2007). ¿ The main idea in this statement is not to strengthen the importance of RE. The low carbon nature of RE is very easy to understand, and many references are available. So the statement should be deleted or modified.	Setting RE in context
Glória Rodrigues (European Wind Energy Association (EWEA))	8	7	30	7	33	8.1	-	-	It should be doubted wheather CCS and Nuclear really needs to play a role or its to be conceived as hampering large scale RES deployment.	Setting RE in context
Kristin Seyboth (IPCC WG III TSU)	8	7	-	-	-	-	8.1	-	The flow of arrows could use more logic: e.g. the left most arrows could be replaced to read 'conventional fuels' and the right most arrows to read 'energy services'. Otherwise, you have arrows flowing from the left 'fossil fuels and nuclear' to the right ' efficient and sustainable energy services'.	Redrawn
Brazil (Ministry of Science and Technology)	8	8	22	8	23	-	-	-	It could also be said that Brazil has more than 80% of its electricity generated by hydro. Reference: National Energy Balance, 2009, from <a href="https://ben.epe.gov.br/default2009.aspx">https://ben.epe.gov.br/default2009.aspx</a> .	Added
Brazil (Ministry of Science and Technology)	8	8	22	8	23	-	-	-	It could also be said that Brazil has more than 80% of its electricity generated by hydro. Reference: National Energy Balance, 2009, from <a href="https://ben.epe.gov.br/default2009.aspx">https://ben.epe.gov.br/default2009.aspx</a> .	relevant, considered in rewrite process of 8.2.1

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Juan Llanes (Centre for Environmental Studies)	8	8	22	-	-	-	-	-	No proper Brazilian references?, please see Macedo and Horta.	Looking for journal references
Canada (Environment Canada)	8	8	29	8	30	-	-	-	Suggest that Canada and Norway could be added as to New Zealand and Iceland as two other countries where majority of electricity demand is met by hydro.	Also geothermal stated
Canada (Environment Canada)	8	8	29	8	30	-	-	-	Suggest that Canada and Norway could be added as to New Zealand and Iceland as two other countries where majority of electricity demand is met by hydro.	relevant, considered in rewrite process of 8.2.1
David Clubb (European Environment Agency)	8	8	22	8	30	-	-	-	Suggested addition: Portugal has increased its renewable electricity share from 17% to 45% in 5 years and could prove to be a useful case study (see <a href="http://www.nytimes.com/2010/08/10/science/earth/10portugal.html?_r=2&amp;pagewanted=1&amp;ref=earth">http://www.nytimes.com/2010/08/10/science/earth/10portugal.html?_r=2&amp;pagewanted=1&amp;ref=earth</a> )	Only need 2 electricity examples
David Clubb (European Environment Agency)	8	8	22	8	30	-	-	-	Suggested addition: Portugal has increased its renewable electricity share from 17% to 45% in 5 years and could prove to be a useful case study (see <a href="http://www.nytimes.com/2010/08/10/science/earth/10portugal.html?_r=2&amp;pagewanted=1&amp;ref=earth">http://www.nytimes.com/2010/08/10/science/earth/10portugal.html?_r=2&amp;pagewanted=1&amp;ref=earth</a> )	relevant, considered in rewrite process of 8.2.1
David Clubb (European Environment Agency)	8	8	2	8	5	-	-	-	Suggested alteration: Change increase in RE rate to % instead of EJ/yr (more accessible)	Deleted
Brazil (Ministry of Science and Technology)	8	8	24	-	-	-	-	-	The reference ""REN21, 2010"" is missing in the reference list.	Added
Kristin Seyboth (IPCC WG III TSU)	8	8	6	-	-	-	-	-	What is an 'acceptable' level of GHG concentration? Be careful to remain objective.	Reworded
Anca-Diana Barbu (European Environment Agency)	8	8	5	8	9	8.1	-	-	please state what is ""acceptable GHG atmospheric concentration levels""	Reworded
Antoine BONDUELLE (E&E Consultant)	8	8	-	-	-	-	8.2	-	The IAE World Energy Outlook has consistently erred in the evaluation of possible RE contributions. The figure 8.2 is not very clear and relies on a dubious resource for such projections	Only source for sectors
United States (U.S. Department of State)	8	9	4	-	-	-	-	-	Decreased demand is completely decoupled from the size of an RE resource.	Linked as explained
Kristin Seyboth (IPCC WG III TSU)	8	9	35	9	36	-	-	-	Drivers for RE policy are covered in depth in Ch. 11. Suggest to delete sentence 'Co-benefits can drive relative costs'. It is unnecessary here.	Reworded

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United States (U.S. Department of State)	8	9	47	10	1	-	-	-	It is possible to accurately represent the costs, as they have been represented over and over by the utilities themselves, the wind and solar plant owners, and the underwriters and financiers. Suggest changing the statement to reflect the complexity in representing a single representative cost across many different systems.	Reworded
Norway (Climate and Pollution Agency)	8	9	4	9	13	-	-	-	Suggested rewritten: "Lower energy demand reduces the required capacity, and hence cost, of a RE system. Many energy scenarios have shown a wide range of energy efficiency initiatives that will probably reduce future energy demand baseline projections significantly (Metz, Davidson et al. 2007). This might facilitate having a greater share of RE in a growing energy market (Verbruggen 2006). For example, before contemplating the installation of solar water heating, a wood pellet stove for space heating, or a small roof-mounted wind turbine for power generation, a building owner or developer should be encouraged to initially invest in energy saving measures and building design (IEA 2009)."	Reworded
United States (U.S. Department of State)	8	9	29	-	-	-	-	-	The term "conventional" should be defined.	Reworded
Kristin Seyboth (IPCC WG III TSU)	8	9	47	10	4	-	-	-	Was it an objective of the Ch to try and provide modelers with costs of system integration, though unsuccessful? Or why does this paragraph appear in 8.1.2 Objectives?	Partly but reworded
Kristin Seyboth (IPCC WG III TSU)	8	9	21	9	22	-	-	-	Why is sentence "The deployment of low-carbon win/win solution" necessary? Presents subjective information that could be perceived as advocacy. It is not necessary to include this in the discussion of regional differences of RE integration. Suggest to delete sentence.	Deleted
Anca-Diana Barbu (European Environment Agency)	8	9	14	8	16	8.1	-	-	please replace "" even where conditions are similar"" with ""where renewable conditions are similar"" as penetration of the same technology in different countries depends also on the enabling environment (e.g. existing structure of the system, support schemes, etc"". I understand that this is the meaning of the statement.	Reworded
Anca-Diana Barbu (European Environment Agency)	8	9	28	9	29	8.1.2	-	-	Please consider reformulating the phrase. I believe the chapter is about identifying challenges and through some examples, show how some these can be overcome. The current formulation has a rather negative conotation.	Reworded
David Clubb (European Environment Agency)	8	10	42	10	44	-	-	-	Incorrect assertion: Conventional energy systems are not, by and large, efficient. Thermal efficiency of electricity generation is about 35-40%, and similar efficiencies apply for final end use of fossil fuels for transport (see <a href="http://www.mdpi.com/1996-1073/2/1/25/pdf">http://www.mdpi.com/1996-1073/2/1/25/pdf</a> )	Agree ( see Fig 8.1) but is relevant here
Emmanuel Branche (Electricité de France)	8	10	5	10	17	-	-	-	This paragraph is true. However political decisions (on a national/regional scale) can not be criticised regarding competition between energy sources	Reworded

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Kristin Seyboth (IPCC WG III TSU)	8	10	5	10	17	-	-	-	Why a paragraph discussing flexibility of energy systems and competition among technologies in a section on objectives of the chapter?	Amended
Michael Power (University College Dublin)	8	11	23	-	-	-	-	-	"especially for countries with less political stability" should be removed.	resolved by rewrite
Paul Smith (University College, Dublin)	8	11	15	11	15	-	-	-	"generally above 20%" a citation is required to support this.	resolved by rewrite
Paul Smith (University College, Dublin)	8	11	29	11	32	-	-	-	"in a cost-effective manner" should be included in this sentence. The development of power systems since their inception has been driven by the need to deliver cost-effective electricity service, and maintaining cost-effectiveness is a key objective in integrating renewables.	resolved by rewrite
Peter Børre Eriksen (Energinet.dk)	8	11	24	-	-	-	-	-	"Increasing the.." Suggestion: " The consequences of increasing"	resolved by rewrite
Paul Smith (University College, Dublin)	8	11	39	-	-	-	-	-	"often" including large hydro is an overstatement. "which may include...." would be better	resolved by rewrite
ICHIRO MAEDA (The Federation of Electric Power Companies of Japan)	8	11	8	40	13	-	-	-	<p>&lt;comment&gt; As a footnote, "In order to reduce the costs of integrating a high share of intermittent renewable energy into the grid, heat pumps with thermal storage can be helpful as a form of energy storage" should be mentioned.</p> <p>&lt;reason&gt; The function where heat pumps with thermal storage can help reduce the cost of integrating a high share of intermittent renewable energy into the grid is very important, which leads to the promotion of introduction of not only intermittent renewable energy like photovoltaic, wind and renewable energy like ambient air etc.</p> <p>&lt;reference&gt; -Energy Technology Perspective 2010(IEA, 2010.7)</p>	relevant, considered in rewrite process of 8.2.1

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ICHIRO MAEDA (The Federation of Electric Power Companies of Japan)	8	11	7	-	-	-	-	-	-	<p>&lt;comment&gt;                      Insert the sentence "It should be noted that, when considering the possibility of renewable energy integration in certain area, national/regional circumstances including existing generation assets, their operation and flexibility, projected electricity demand, and resource availability as well as '3Es' (Energy security, Economy and Environment) must be taken into account. As a consequence, possible volume of renewable integration should vary region by region." after " ...in the heating and transport sectors."                      &lt;reason&gt;                      Descriptions which are based on mass-introduction of RE could be found largely in this document, but in the first place, the optimum amount of RE introduced in each country/region would be determined by the concept of '3Es'.</p>	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	11	32	11	37	-	-	-	-	A reference to Figure 8.10 would be useful here.	resolved by rewrite
Australia (0)	8	11	17	11	18	-	-	-	-	Change to "is likely to require a major paradigm shift"	resolved by rewrite
Richard Taylor (International Hydropower Association)	8	11	-	40	-	-	-	-	-	Comment: This whole section on electric power systems fails to acknowledge the increasingly important role hydropower has in enabling greater penetration of other renewables into the grid, and their integration and optimisation. This includes the ability of hydro to store surplus energy (pumped storage) generated by the other renewables and the ancillary services hydro provides to regulate the quality of electricity other renewables supply (voltage control, frequency regulation, black-start capability).	relevant, considered in rewrite process of 8.2.1
Norway (Climate and Pollution Agency)	8	11	13	11	25	-	-	-	-	Comment: Transition to a system with high degree of RE penetration, requires access to dispatchable production capacity. Within a single power system, this might be achieved by interconnection and imports from neighbouring systems, or it has to be constructed or maintained within the system, which is a more expensive option. In a future where RE penetration is high in all countries, the import option is hardly possible because all countries need their own reserves. This imply that the costs and potential for RE integration in each single country will be more demanding, and we have to ask; how and who is to supply dispatchable reserves?	the comment is specifically directed to e.g. a specific phrasing of the (old) section. Hence it is not relevant anymore due to the rewrite of the section.
Markus Haller (Potsdam Institute for Climate Impact Research)	8	11	15	-	-	-	-	-	-	footnote 1, regarding dispatchable/non-dispatchable: rewrite (very confusing). Also, I suggest to put this information into the main text, as the concept of dispatchability is very important for this section.	resolved by rewrite
Peter Bjarre Eriksen (Energinet.dk)	8	11	40	-	-	-	-	-	-	footnote 1: The first sentence is unclear to me.	resolved by rewrite

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Peter Bøvre Eriksen (Energinet.dk)	8	11	40	-	-	-	-	-	footnote 2: "¿ consumption." Suggestion: "¿.consumption covered by RE production."	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	11	40	-	-	-	-	-	Footnote terms 'non-dispatchable' and 'penetration' should be clearly defined in the SRREN glossary as well.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	11	13	11	25	-	-	-	I do not quite understand why the word "non-dispatchable" is used. It is, at least for me, a rather old word. One can not dispatch wind power higher than the actual available wind resource, but technically any level between this and zero are possible, but nearly always not interesting since the marginal cost is zero. Use the word "variable" which is much more correct. It is stated the "...generation system will require a major paradigm shift". If you study reality there is currently 20 percent wind power in Denmark and more than 10 in Portugal, Spain and Ireland. Perhaps one can say that they have performed a "major paradigm shift" but then this should be mentioned!!! It now looks like this shift is very complicated. It is also stated "...transition would need to be carefully managed over many years" ... "especially for countries with less political stability". All "transitions" should of course be "carefully managed" but that is valid for all transitions, introduction of markets, nuclear power, gas power, international open trading, etc. And why mention "political stability". That is always requested for all type of investments, not only RE (do you include hydro power also???). Both these sentences, without any scientific motivation, only provides the impression that this is very complicated (but they have succeeded in Norway, Iceland, Denmark, Portugal, Spain, Ireland.....	resolved by rewrite
Morgan Bazilian (UNIDO)	8	11	25	-	-	-	-	-	I would have thought a reference to chapter 7 here would be normal.	resolved by rewrite
Paul Smith (University College, Dublin)	8	11	23	11	25	-	-	-	Interconnection with other systems is also a key factor.	resolved by rewrite
Mark Fulton (Deutsche Asset Management, Deutsche Bank)	8	11	37	11	37	-	-	-	Might add another sentence on demand side management (DSM) which is becoming a larger resource in the US	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	11	37	-	-	-	-	-	proactive response' -> response to what?	resolved by rewrite
United States (U.S. Department of State)	8	11	4	-	-	-	-	-	Sentence beginning on page 11 line 4 should be rewritten as "Electricity systems could ultimately become the backbone of future RE-based energy supply as "green" electricity is substituted for fossil fuel demand in the heating and transport and other sectors."	relevant, considered in rewrite process of 8.2.1

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United States (U.S. Department of State)	8	11	14	-	-	-	-	-	Suggest replacing the term non-dispatchable, with 'semi-dispatchable', then include text regarding ability to self regulate by spilling wind, and limiting up-ramp rates, and other control mechanisms.	resolved by rewrite
HONGGUANG JIN (Thermophysics engineering ,Chinese Academy of Scinces)	8	11	38	12	12	-	-	-	The description about the traditional power plant technology may be removed.	resolved by rewrite
United States (U.S. Department of State)	8	11	40	-	-	-	-	-	The last sentence of footnote 1 is confusing and should be omitted. The entire footnote should be restructured to define "semi-dispatchable" as opposed to "non-dispatchable."	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	11	27	11	40	-	-	-	The overall aim of any power system is to keep the balance and keep the voltage. The second issue is not included. From line 38-40 a "modern power supply system" is mentioned, but I do not know what you mean here. Is Denmark "modern" is Switzerland "modern". What do you mean with "relatively small share of other RE".	resolved by rewrite
Paul Smith (University College, Dublin)	8	11	40	12	5	-	-	-	These sentences seem to give primacy to steam turbine plant. This is not universally true. Many systems are now dominated by gas turbine and combined-cycle plant.	resolved by rewrite
Morgan Bazilian (UNIDO)	8	11	37	-	-	-	-	-	This demand point needs much more attention in both chapters. Covered some in 8.2.1.1.2 (an absurd section number)	resolved by rewrite
Paul Smith (University College, Dublin)	8	11	8	11	25	-	-	-	This section does not mention grid capacity as a key issue. Given that in most countries/regions the integration of RE resources is likely to require grid expansion, the time required and cost of grid expansion and the likely extent of public resistance, this should be mentioned in the introductory remarks.	resolved by rewrite
Paul Smith (University College, Dublin)	8	11	8	11	25	-	-	-	This section does not mention grid capacity as a key issue. Given that in most countries/regions the integration of RE resources is likely to require grid expansion, the time required and cost of grid expansion and the likely extent of public resistance, this should be mentioned in the introductory remarks. This is a repeat of comment 1, where the text did not wrap	Included in other sections
Emmanuel Branche (Electricité de France)	8	11	9	11	12	-	-	-	This sentence does not match with all RE technologies, it is only true with intermittent/variable technologies (wind, solar, etc.) but not with controllable/dispatchable technologies (hydro, biomass, geothermal). Proposition: sentence to be removed	resolved by rewrite
Paul Smith (University College, Dublin)	8	11	36	11	37	-	-	-	This sentence seems out of place here.	resolved by rewrite
Morgan Bazilian (UNIDO)	8	11	36	-	-	-	-	-	very different tone and audience than chapter 7	resolved by rewrite

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Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	11	15	-	17	-	-	-	What is the denominator of 20%? Maximum load or instantaneous load?	resolved by rewrite
Paul Smith (University College, Dublin)	8	11	22	11	25	-	-	-	Why should the transition take "many years"? The reference to countries with "less political stability" is inappropriate.	resolved by rewrite
Hannele Holttinen (VTT)	8	11	1	-	7	8.2	-	-	remove	resolved by rewrite
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	11	8	-	-	8.2	-	-	Section 8.2: To clarify this discussion it could be added that the transmission grid need constant expansion and refurbishment to address the three pillars: Security of supply, integration of RES, and economic efficiency and realization of the internal energy market, therefore investments are always needed, see eg. ENTSO-E'S pilot project Ten-Year Network Development Plan, 2010: <a href="https://www.entsoe.eu/index.php?id=282">https://www.entsoe.eu/index.php?id=282</a>	relevant, considered in rewrite process of 8.2.1
Hannele Holttinen (VTT)	8	11	23	-	-	8.2.1	-	-	why is the politically unstable countries mentioned here, better take up deeped in the section.	resolved by rewrite
Hannele Holttinen (VTT)	8	11	23	-	-	8.2.1	-	-	word Challenges is missing here (they vary)	resolved by rewrite
Seppo Hänninen (VTT)	8	11	27	12	12	8.2.1.1	-	-	The chapter 8.2.1.1 is rewritten and its sub chapters rearranged and modified. However the basic schema is still missing and the role and importance of ICT are not illustrated. See the following attached Fig	resolved by rewrite
Seppo Hänninen (VTT)	8	11	27	12	12	8.2.1.1	-	-	The chapter 8.2.1.1 is rewritten and its sub chapters rearranged and modified. However the basic schema is still missing and the role and importance of ICT are not illustrated. See the following Figs.	resolved by rewrite
Hannele Holttinen (VTT)	8	12	25	-	-	-	-	-	"of future industry operations" some better formuation here	resolved by rewrite
Hannele Holttinen (VTT)	8	12	22	-	-	-	-	-	"the decision making process" some better formulation here	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	12	10	12	12	-	-	-	A reference to Figure 8.11 would be useful here.	resolved by rewrite
United States (U.S. Department of State)	8	12	47	-	-	-	-	-	Although many coal/thermal units run at constant output, many of them will follow the daily load cycle, moving up in the morning and ramping down in the evening so that the unit is at or above its minimum operating point.	resolved by rewrite
Paul Smith (University College, Dublin)	8	12	17	12	18	-	-	-	Box 8.1 describes the principles of power balancing. There is no need to repeat this in the main text.	resolved by rewrite
Richard Piwko (General Electric Company)	8	12	29	12	47	-	-	-	Box 8.1 describing power balancing is very confusing, amateurish, and partly in error. I suggest that this entire section be re-written by someone who understands the topic and who can write a clear and technically correct explanation.	resolved by rewrite

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Michael Power (University College Dublin)	8	12	29	13	10	-	-	-	Box 8.1 has a European tone. TSO, primary and secondary reserve are European terms. The US use terms such as RTO instead of TSO, regulating reserve, load following reserve and contingency reserve. Is the sentence spread over lines 40&41 necessary? It seems a little too dramatic! Pumped storage isn't mentioned on page 13 in lines 1,2 and 3. In line 10 it states bids are accepted or rejected - I would say they are ordered.	resolved by rewrite
Paul Smith (University College, Dublin)	8	12	23	12	24	-	-	-	Is this really a relevant citation?	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	12	14	12	17	-	-	-	It is true that electricity is not storable. However pumped storage power plant (PSPP hydro) is a proven cost-effective technology that is used by transmission system operators (TSO) to balance the system, especially where intermittent energy sources are developed. For instance within the Iberian peninsula (e.g. Spain and Portugal have limited electrical interconnections capacities with France and all Europe) several PSPP are developed in order to balance the development of wind (and also solar).	relevant, considered in rewrite process of 8.2.1
Paul Smith (University College, Dublin)	8	12	5	12	6	-	-	-	It would be more correct to say that transmission networks evolved to serve geographic regions rather than nations or states. Many transmission networks straddled national boundaries before serving an entire nation, a prime example being US and Canada.	resolved by rewrite
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	12	1	12	12	-	-	-	Line 1 - 12: Could be deleted	resolved by rewrite
Morgan Bazilian (UNIDO)	8	12	24	-	-	-	-	-	nice description, but this chapter is going to have a lot of repetition with 7	resolved by rewrite
Antoine BONDUELLE (E&E Consultant)	8	12	15	-	-	-	-	-	not storable in a cost effective manner"" is too blunt and thus incorrect. Pumping-storage stations are common in Western Europe (about 10% of power requirements and several percent of energy transits). Such stations are a feature in any state of the art utility there. The sentence could read ""extensive storage is uneconomic""...	resolved by rewrite
Hannele Holttinen (VTT)	8	12	20	-	-	-	-	-	remove end of long sentence "and the quality..."	resolved by rewrite
Hannele Holttinen (VTT)	8	12	38	-	-	-	-	-	secondary reserves are not only held for contingencies	resolved by rewrite
Peter Børre Eriksen (Energinet.dk)	8	12	13	-	-	-	-	-	subsection 8.2.1.1.1 : With 5 digits subdivision, the reader loses the overview.	Accepted

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United States (U.S. Department of State)	8	12	16	-	-	-	-	-	-	Suggestion: remove the phrase "electric energy is not storable in a cost-effective manner." The cost effectiveness of energy storage today is less important than its effectiveness during a high RE penetration. It may have broad application in the future, and is being used now at a lesser degree.	resolved by rewrite
Paul Smith (University College, Dublin)	8	12	31	-	-	-	-	-	-	The term Transmission System Operator (TSO) is not universal. The assignment of functions related to system operation can vary from country to country or region to region. The term TSO originated in European legislation. For example in the USA the responsibility for balancing rests with the "Balancing Authority" which may not be the body known as the system operator. It would be better to say that "it is the responsibility of the system operator or other balancing authority to...", and elsewhere to replace references to the TSO with the more general term "system operator".	resolved by rewrite
United States (U.S. Department of State)	8	12	31	-	-	-	-	-	-	The term TSO is used for transmission system operator. However, TSO tends to be used in some parts of the world (e.g. Europe, where system operators usually own the transmission network) and not in other parts (e.g. the US, where the terms ISO/RTO is typically used and the system operators typically do not own the network). I suggest using SO (system operator) instead, since this is a more general term. This term SO should then be added to a glossary of definitions.	resolved by rewrite
Morgan Bazilian (UNIDO)	8	12	29	-	-	-	-	-	-	This box needs some references	resolved by rewrite
Paul Smith (University College, Dublin)	8	12	17	12	24	-	-	-	-	This needs to be re-written. Short-term operation and long-term investment planning are mixed up in one sentence. The description of "spinning reserve plants" is not correct. Operation of the power system involves balancing supply and demand over a time scale that ranges from seconds to one year or more, taking account of short-term demand and supply fluctuations, longer-term plant scheduling, including multi-annual maintenance scheduling and hydrological cycles. Investment planning must be carried out for periods of ten years or more because of the long lead time to permit, design and construct new facilities. As well as balancing supply and demand at all times, power systems must have reserves to deal with supply and demand fluctuations including transmission system faults and tripping of large generators. These reserves (sometimes called spinning reserves) may be provided by partly-loaded hydro or thermal plants.	the comment is specifically directed to e.g. a specific phrasing of the (old) section. Hence it is not relevant anymore due to the rewrite of the section.

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Paul Smith (University College, Dublin)	8	12	21	12	24	-	-	-	This piece on ancillary services should be deleted or expanded. For the reader who understands ancillary services it is unnecessary; for the reader who doesn't, it conveys nothing. A number of other services which may be delivered by generators or other providers are required to ensure reliable power system operation. As well as short-term operating reserves mentioned above, these include longer term reserves, voltage control and reactive power, black start to re-start the power system in the event of a complete shut-down. (Many power plants cannot start without an external power supply.)	resolved by rewrite
Paul Smith (University College, Dublin)	8	12	7	12	9	-	-	-	This sentence should be re-written. The key components of transmission systems are the High Voltage (HV) and Extra-High Voltage (EHV) overhead lines, underground cables and transformers. The reference to specialised switches is probably unnecessary. They should be described as transferring electric power or electrical energy rather than current. It would be worth adding that transmission networks enable the most cost-effective generation sources to be used to meet demand, and that they enable pooling of generation resources over a wide area to ensure reliability of supply.	resolved by rewrite
Paul Smith (University College, Dublin)	8	12	5	12	12	-	-	-	This should be a separate paragraph.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	12	1	12	5	-	-	-	too much detail on generation technologies here (gas turbines etc.)	resolved by rewrite
Greece (National Observatory of Athens)	8	12	19	-	-	8.2.1.1.1	-	-	The phrase "hydro or thermal plants " to be replaced with " hydro together with thermal plants"	resolved by rewrite
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	12	45	12	45	8.2.1.1.1	-	-	Conventional Power Plants (coal, gas, nuclear) can in many cases be operated much more flexible with respect to ramp up and ramp down time and minimum power output for example by adding power plant control technologies.	resolved by rewrite

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Lennart Söder (KTH, Royal Institute of Technology)	8	12	29	13	10	Box 8.1	-	-	The notation "TSO" is used. This is a European notation for deregulated markets, where the normal situation is the it is an organization responsible for keeping the short term balance and they also own the transmission grid. In not vertically integrated markets there is no TSO and in many other countries (e.g. US) one have the ISO and private grid owners. It is also important to note that a TSO is often NOT responsible for the trading on the exchanges, but they can be involved in different ways. The trading on the exchanges is very important for the balancing and pricing on the market, but in the text one gets the impression that the TSO is responsible for everything. It is also stated that "... or the tripping of a major transmission line. Secondary reserves are held to deal with such contingencies." This is NOT CORRECT! There is not enough room here to explain in detail the chain from primary-sedondary-tertiary-etc and how they are managed in different systems and related market. But it is of course an important issue for power systems! Further down the term "base load" is used. I think the most important issue is that one use the power plants in their loading order according to marginal cost. The challenge in, when one explain this, is how to treat hydro power with reservoirs (a RE) since their marginal costa are the shadow prices, the so-called water value which is related to future use of water. Further down (page 13) it is stated: "Plant with more rapid response times, such as gas turbines or reservoir-hydro, are generally used for meeting peak loads as needed." The driving force is also her the cost minimization! A gas turbine should be used as "base load" if the operating cost was low, but it is not! In reality the cost structure is the main driving force for how to schedule the units. Then there are technical limitations to be considered. The meaning of hte last section is rather unclear. What do you mean with "or up to days whn dispatching balancing reserve power". This is NOT correct	resolved by rewrite
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	12	30	12	34	8.2.1.1	Box 8.1	-	The essential paramters for the TSO are system frequency and voltage profile Maintaining system voltage by proper reactive power support is one of the important tasks of a TSO (the main reason for blackouts has been voltage collapse).	resolved by rewrite
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	12	29	13	10	-	-	Box 8.1	Box 8.1: This box could be deleted	resolved by rewrite

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Peter Børre Eriksen (Energinet.dk)	8	13	37	-	-	-	-	-	"Critical evaluations" etc. This is an open and undisputed remark, which must be further elaborated in the text.	resolved by rewrite
Michael Power (University College Dublin)	8	13	37	13	38	-	-	-	"Critical evaluations" etc. strikes me as a very odd sentence - remove it?	resolved by rewrite
Greece (National Observatory of Athens)	8	13	38	13	38	-	-	-	Although the text says "evaluation in progress", it should be useful to add a relevant reference from literature.	resolved by rewrite
United States (U.S. Department of State)	8	13	34	-	-	-	-	-	As stated above, the term "smart grid" should also be defined in this context.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	13	37	13	38	-	-	-	critical evaluations...' -> the meaning of this sentence is very unclear. Be more specific!	resolved by rewrite
Hannele Holttinen (VTT)	8	13	9	-	-	-	-	-	day-ahead markets are most common so should be mentioned that bids day-ahead are made (now 5-60 min)	resolved by rewrite
Michael Power (University College Dublin)	8	13	16	-	-	-	-	-	Distribution networks are discussed in chapter 8 but were not discussed in chapter 7 - is this inconsistent? I understand wind generators are connected at distribution level in Denmark and Ireland but not in the US.	resolved by rewrite
Hannele Holttinen (VTT)	8	13	31	-	36	-	-	-	DSM/DSR should be mentioned here	resolved by rewrite
Michael Power (University College Dublin)	8	13	39	14	6	-	-	-	I'm not sure what 8.2.1.1.3 adds to the document - should this paragraph be removed?	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	13	19	13	21	-	-	-	It is stated: "It also highlights the need to move away from traditional system balancing, when load control is a last resort, to a situation where, to a significant extent, load is designed and controlled to follow available variable generation." Where is the scientific motivation? In Norway, Iceland, Spain, Ireland, Germany, Denmark etc, with comparatively large amounts of RE (100% in Iceland and Norway) the load participation is marginal!	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	13	15	-	-	-	-	-	It is stated: "Traditionally, the design and operation of a power system has been centrally managed by the TSO.". I think you mean that "Traditionally" was "before deregulation" and at that time there was no TSO at all. Please rewrite.	resolved by rewrite
Australia (0)	8	13	22	13	38	-	-	-	It would be worth explaining that pricing electricity differently at different times would allow for electricity loads to be more stabilised across time, as higher prices during higher load periods would provide incentives for electricity users to stabilise their consumption.	relevant, considered in rewrite process of 8.2.1

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Paul Smith (University College, Dublin)	8	13	25	13	36	-	-	-	phrases like "engaging consumers in operational and investment decision making" are inappropriate. What is being discussed here is (1) influencing consumer behaviour through economic/pricing signals and (2) possible direct control of consumer equipment by or on the instructions of system operators. So-called "smart" electricity meters may facilitate these concepts. The widely used term "Smart Grid" should be avoided as there is no consensus with regard to its precise meaning.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	13	1	13	2	-	-	-	plants with more rapid response times' - how does this compare with the 'spinning reserve plants' from p. 12 line 18/19? Are they the same thing? If so, why not use the same terminology?	resolved by rewrite
Peter Børrre Eriksen (Energinet.dk)	8	13	2	-	-	-	-	-	Reservoir hydro is base load in some hydro-based countries. Not peak production.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	13	46	14	6	-	-	-	row 45: It is stated: "thereby adding additional complexity and risks", row 2: "ç could add further complexity". Row 4-6: "It remains unproven whether markets can deliver stable low electricity costs to consumers and to this is added the challenge of moving power systems to a more environmentally sustainable basis.". Of course one can have this opinion but there are also benefits with an open market including, e.g., efficient pricing and competition concerning balancing resources. But this is not a place for a discussion, but I do not understand why this kind of opinions should be mentioned here without any scientific references.	resolved by rewrite
Paul Smith (University College, Dublin)	8	13	44	-	-	-	-	-	See also comment 3 above. While the transition may have taken decades in some countries this is not generally true. Many countries and regions have achieved successful transition in a much shorter time. To state that the transition can take decades, while it may be true in some jurisdictions, is misleading.	resolved by rewrite
Peter Børrre Eriksen (Energinet.dk)	8	13	7	10	-	-	-	-	The day ahead market is missing in the text?	resolved by rewrite
United States (U.S. Department of State)	8	13	20	13	21	-	-	-	The last phrase of the sentence on lines 20-21 should be restated as follows: "Load is designed and controlled to contribute towards system needs, including balance, to some extent."	resolved by rewrite
Paul Smith (University College, Dublin)	8	13	31	13	33	-	-	-	The Lund 2007 reference is to the Danish "cell project" which is based on direct control of embedded generators and distribution feeders. It is aimed more at "emergency control" during grid disturbances rather than normal minute-to-minute balancing. It is not directly relevant to consumer participation in system balancing.	resolved by rewrite

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Paul Smith (University College, Dublin)	8	13	29	13	31	-	-	-	The reference to "tariffs" should be replaced. In many markets, industrial users do not pay for electricity on the basis of a published tariff. It would be better to say that for industrial consumers more attention has been paid to pricing mechanisms or other financial incentives to influence electricity consumption patterns.	resolved by rewrite
United States (U.S. Department of State)	8	13	6	-	-	-	-	-	The sentence beginning on page 13 line 4 is a run-on sentence and should be broken up into smaller sentences.	resolved by rewrite
United States (U.S. Department of State)	8	13	42	13	43	-	-	-	The term 'state owned' should be replaced with 'state owned or regulated'. As stated in the document, the statement does not apply to the US.	resolved by rewrite
Paul Smith (University College, Dublin)	8	13	19	13	21	-	-	-	This is a gross over-statement of the potential participation of the demand side in system balancing. It is misleading to say that there is a "need to move away from traditional system balancing". It is certainly desirable to develop mechanisms for demand side participation, but there are always other solutions, such as flexible plant and storage.	resolved by rewrite
Paul Smith (University College, Dublin)	8	13	14	13	21	-	-	-	This is more about changing requirement for system operation than about demand characteristics. It doesn't belong in this section. Also see previous comments about the use of the term TSO.	resolved by rewrite
Antoine BONDUELLE (E&E Consultant)	8	13	27	-	-	-	-	-	This sentence estimates that "'little attempt has been made'" to influence the individual consumers by tariff design. This is incorrect in most European countries. Although influencing seasonal behaviour has generally failed, many attempts have been made, including active ones in France since the eighties. The sentence should be corrected.	resolved by rewrite
Hannele Holttinen (VTT)	8	13	14	-	21	-	-	-	Traditionally, ζ. This part of the text could be removed (or moved to deeper in the section)	resolved by rewrite
United States (U.S. Department of State)	8	13	36	13	37	-	-	-	Using demand response to manage high consequence low probability ramping events is a tested concept, and has executed well in Texas.	resolved by rewrite
Matt Davison (University of Western Ontario)	8	13	40	14	6	8.2.1.1.3	-	-	I agree that the uncertainty of a half completed transition between a fully regulated electricity system and a market based system is unfavourable to all power systems investment, including green power. I also agree that it is not clear that a market system delivers lower cost electricity to consumers. However, it is harder to manipulate a market to systematically underprice electricity in response to political pressure. Such underpricing is, of course, a major contributor to waste of electricity and removing it is a good way to reduce carbon emissions.	resolved by rewrite
Peter Børre Eriksen (Energinet.dk)	8	14	32	-	-	-	-	-	"..in the RE resource at any given moment". Suggestion: "..in the RE resource in time and space".	resolved by rewrite
United States (U.S. Department of State)	8	14	14	-	-	-	-	-	ζ increase grid flexibility (IEA 2008) ADD ζ although the required capital investment could be significant. ζ	resolved by rewrite

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Markus Haller (Potsdam Institute for Climate Impact Research)	8	14	12	14	14	-	-	-	A major issues is...' -> I suggest to skip this sentence. Before even explaining the integration issues in detail, you tell the reader that they can largely be accommodated. This is a conclusion that should be drawn later and be backed up with references.	resolved by rewrite
United States (U.S. Department of State)	8	14	8	14	16	-	-	-	A reference to the inherent uncertainty of forecasts should be added to the passage, specifically on line 13.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	14	31	-	-	-	-	-	aggregation is small'? meaning of that is unclear! maybe you mean 'correlation'?	resolved by rewrite
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	14	21	-	22	-	-	-	Delete optimistic opinion about output prediction of wind energy - it is, at least, region specific. Distinction between the westerlies and monsoonal region have to be made. In the monsoonal region, output prediction of wind turbine, wind farm is very difficult. For example, in NEDO project report intra-day and day-ahead prediction of wind power of a wind farm and wind farms located in a control area of Japan were examined. By improving prediction method, they could decrease intra-day (day-ahead) prediction error from about 30% to less than 15% (20%). Explanation PPT file is here (in Japanese); <a href="http://app3.infoc.nedo.go.jp/gyouji/events/FF/nedoevent.2008-03-31.8093938166/8cc765998_98a8529b5b895b9a5316(6c178c61PJ).pdf">http://app3.infoc.nedo.go.jp/gyouji/events/FF/nedoevent.2008-03-31.8093938166/8cc765998_98a8529b5b895b9a5316(6c178c61PJ).pdf</a> This is the result in Tohoku area, which is near the zone fo the westerlies. In other area in Japan, it's more difficult to predict.	resolved by rewrite
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	14	21	-	22	-	-	-	Evaluate whether accuracy of prediction is enough or not prediction.	resolved by rewrite
Michael Power (University College Dublin)	8	14	7	14	16	-	-	-	I think all of 8.2.1.2 has been outlined in Chapter 7.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	14	10	14	21	-	-	-	In both row 10 and 20-21 the word "non-dispatchable" should be changed to "variable"	resolved by rewrite
Hannele Holttinen (VTT)	8	14	3	-	6	-	-	-	is this text needed?	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	14	3	-	-	-	-	-	market regulation is critical...' -> reference please!	resolved by rewrite
Morgan Bazilian (UNIDO)	8	14	4	-	-	-	-	-	Needs some references to big statements	resolved by rewrite

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Hannele Holttinen (VTT)	8	14	33	-	-	-	-	-	RE generation WILL fluctuate less	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	14	33	14	34	-	-	-	Refer to aggregation effects discussion on p. 33	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	14	8	14	8	-	-	-	Remove "large hydro". Indeed, hydro is a RE (chapter 5 of this special report). Furthermore it is not true that only large hydro have been developed so far in existing systems (in number there are more small hydro projects than large ones).	resolved by rewrite
United States (U.S. Department of State)	8	14	1	14	6	-	-	-	Remove all text in this paragraph including and after the sentence which begins, "This may allow". Statements are not supported by any references and are redundant, and in the case of the last sentence, not credible.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	14	12	14	14	-	-	-	Sentence 'A major issue; increase grid flexibility' should be cut to 8.2.1.2.1 variability. It doesn't belong in introductory paragraph.	resolved by rewrite
Antoine BONDUELLE (E&E Consultant)	8	14	32	15	5	-	-	-	The rest of the paragraph is clear and useful.	Thank you.
Antoine BONDUELLE (E&E Consultant)	8	14	31	14	32	-	-	-	The sentence is difficult to understand. It reads ""the aggregation of output (Δ) is often small"" due to variation in RE resource. This has either no meaning or contradicts the next sentence. To be rephrased?	resolved by rewrite
Paul Smith (University College, Dublin)	8	14	34	15	5	-	-	-	This is unnecessary and should be deleted. If people don't like the word "intermittent" then don't use it. There is no need for this type of polemic in this report. (And there is no escaping the fact that RE such as wind, solar and wave are intermittent).	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	14	8	14	16	-	-	-	This paragraph introducing the sentence could be cut to two sentences: "Typically, the technical characteristics of RE generation can differ from conventional generation with respect to variability and predictability; resource location; electrical conversion system characteristics and power plant capabilities. Understanding these characteristics and their integration and impacts with other parts of the power system is the basis for successful RE system integration."	resolved by rewrite
Paul Smith (University College, Dublin)	8	14	31	14	32	-	-	-	This sentence almost certainly does not say what was intended. The intended point probably is that aggregation over a wide geographic area smooths the effect of more rapid fluctuations of output, as is stated in the next sentence, lines 32-34..	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	14	31	14	31	-	-	-	What is the definition for "large areas" ? It is very important to be more accurate in that report, even I agree with the sentence (reference are missing)	resolved by rewrite

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Paul Smith (University College, Dublin)	8	14	20	14	21	-	-	-	wind, solar plants etc. are non-dispatchable not because of their variability but because the primary energy must be harnessed when it is available and cannot be stored, and because of their highly dispersed nature with in many cases no arrangements for real-time control. Therefore their output is normally determined by the availability of the resource.	resolved by rewrite
China (China Meteorological Administration)	8	14	8	-	-	8.2.1.2	-	-	¿There are differences between RE and ¿conventional¿ (thermal, nuclear and large hydro) generation¿¿. Large hydro is also kind of RE.	resolved by rewrite
Richard Taylor (International Hydropower Association)	8	14	8	14	8	8.2.1.2	-	-	Rephrase sentence. Incorrectly implies that hydro is not a renewable energy. Note also that the classification of hydropower by scale is out of step with the SRREN SOD Hydropower Chapter (5).	resolved by rewrite
Paul Smith (University College, Dublin)	8	14	-	-	-	8.2.1.2.1	-	-	This section fails to make the conclusion that whatever the time scale and size of the variations, they must be balanced by the power system.	resolved by rewrite
Leif Snderberg Petersen (Ris National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	14	-	-	-	-	8.3	-	Figure 8.3: This figure could be left out, I find it a little confusing in relation to the discussion, eg. you could argue, that solar also should be filled in for Decades	resolved by rewrite
Paul Smith (University College, Dublin)	8	15	41	-	-	-	-	-	"A major part" is an overstatement. "some of the control and performance requirements" would be better	resolved by rewrite
Emmanuel Branche (Electricit de France)	8	15	44	15	44	-	-	-	"virtual power plants VPP" should be explained. Or refer to 8.2.1.6 which provides only an example	resolved by rewrite
Paul Smith (University College, Dublin)	8	15	10	-	-	-	-	-	A 2003 citation (especially one which is a literature overview) is hardly appropriate to support a statement about the performance of modern forecasting methods.	resolved by rewrite
Lennart Sder (KTH, Royal Institute of Technology)	8	15	17	15	27	-	-	-	A rather unclear section. What is the definition of "small scale", "hydro power plants" and "reservoir-hydro plants". If you do not understand the difference between small-scale/large-scale and size of hydro plants, the information in this section is limited	resolved by rewrite
United States (U.S. Department of State)	8	15	42	-	-	-	-	-	At line 42, insert a new sentence after "...2003)": "For example, some wind turbine manufacturers have introduced a way to simulate inertia on wind turbines thru the control system. These systems typically require a continuous spill of a small amount of wind in order to make increased output available for synthetic inertia effects."	resolved by rewrite

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Markus Haller (Potsdam Institute for Climate Impact Research)	8	15	44	16	2	-	-	-	Be more specific!	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	15	21	-	-	-	-	-	Define 'reasonably close'	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	15	1	-	-	-	-	-	definition of frequently-used terms: maybe earlier, at the beginning of the chapter.	resolved by rewrite
Australia (0)	8	15	1	15	5	-	-	-	Discussing RE only in aggregate ignores network constraint issues. Network constraints mean that the predictability/variability of RE may still have impacts on a local level.	relevant, considered in rewrite process of 8.2.1
Lennart Söder (KTH, Royal Institute of Technology)	8	15	40	15	45	-	-	-	Here (and in many other places) you must separate between different RE. Norway has 100% hydro power (RE) and all their controllability is in hydro power!. VPP may be interesting, but the idea of VPP is controllability (put bids for many decentralized power plants) and that is mainly interesting for fuel-based plants, i.e., not wind- solar or wave). For wind it is theoretically possible using the benefit of smoothing effects. But then it is not controllable. Please clarify.	resolved by rewrite
Paul Smith (University College, Dublin)	8	15	13	15	15	-	-	-	I question this assertion, which is not supported by a citation. This sentence implies that the models used are perfect and that all the necessary input data is available, both of which are doubtful.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	15	29	15	39	-	-	-	It is here important that the reader gets some information what is research, established knowledge, a large real challenge, daily work etc. In I do not see anything in the section that is no already solved and you have today power systems (Western Denmark) with sometimes more than 100 % wind power and iT WORKS. This should be mentioned. This is NOT future challenges!	resolved by rewrite
Paul Smith (University College, Dublin)	8	15	13	-	-	-	-	-	It is incorrect to say that diurnal tidal variations are fully predictable being deterministic. It is well known that tide levels and tidal stream rates and directions can be affected by weather.	resolved by rewrite
Paul Smith (University College, Dublin)	8	15	40	16	2	-	-	-	It is not made clear that just some RE may be developed to deliver some ancillary services, but perhaps not in the right place or with the best characteristics.	resolved by rewrite
Paul Smith (University College, Dublin)	8	15	21	15	23	-	-	-	It is very rare that distributed non-dispatchable RE generation can be regarded as being beneficial to a distribution network. Secondly, such generation may require upgraded metering, and so-called "Smart Meters" may be beneficial, it cannot be said that embedded RE generation requires Smart Meters and Intelligent Grids.	resolved by rewrite

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United States (U.S. Department of State)	8	15	6	15	9	-	-	-	Please remove the words 'and economic' from line 7. There has certainly been shown a decrease in costs by using forecasts in operations, but the costs of improving forecasts (as suggested in the text) are unknown, as are the results. The possible benefits of improved forecasting should be considered in comparison to other solutions listed in comment 76. Also, taking full advantage of the forecasts often implies a change in operations, and such changes may or may not be possible.	resolved by rewrite
Hannele Holttinen (VTT)	8	15	44	-	-	-	-	-	remove However	resolved by rewrite
United States (U.S. Department of State)	8	15	15	-	-	-	-	-	Suggest additional sentence at the end of this paragraph: ζAchieving geographical diversity may come at significant transmission cost and requires electrical integration of adjacent systems in order to leverage the diversity over shorter time scales.ζ	resolved by rewrite
Paul Smith (University College, Dublin)	8	15	29	15	39	-	-	-	The recently published report "ALL ISLAND TSO FACILITATION OF RENEWABLES STUDIES Final Report for Work Package 3", prepared by Ecofys Germany gmbh for EirGrid plc, June 2010 (available at <a href="http://www.eirgrid.com/renewables/facilitationofrenewables/">http://www.eirgrid.com/renewables/facilitationofrenewables/</a> ) should also be cited.	resolved by rewrite
Greece (National Observatory of Athens)	8	15	40	15	42	-	-	-	The term 'new' should be deleted as a determinant of technology innovation as it does not add anything and in addition the relevant reference was published in 2003.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	15	11	-	-	-	-	-	The wording "integration cost" is used here. This term can be used for any system effects of a power system investment. If one build a new wind power plant, nuclear plant, transmission line, coal plant, etc it will always affect the operation conditions in the system. This must be mentioned somewhere. For more information see: "On methodology for modelling wind power impact on power systems" Soder, L.1; Holttinen, H. Source: International Journal of Global Energy Issues, v 29, n 1-2, 181-98, 2008 ISSN: 0954-7118 CODEN: IJGIE7 Publisher: Inderscience Enterprises Ltd., Switzerland	resolved by rewrite
Paul Smith (University College, Dublin)	8	15	18	15	21	-	-	-	These sentences are not correct. Run-of-the-river hydro can obviously only be installed on a river with the required flow and head. While this may happen to be close to a demand centre, it is misleading to imply that one can choose to install it near a load centre. The second sentence about medium scale wind etc. is even more misleading. It is incorrect to say that these can "usually be located reasonably close to demand centres". Their location is primarily dictated by the resource.	resolved by rewrite

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Kristin Seyboth (IPCC WG III TSU)	8	15	6	15	15	-	-	-	This paragraph discusses options for managing variability: accurate forecasts. On. P. 14 line 13/14 you also mentioned that variability can be accomodated with increased grid flexibility. Both of these points would better belong in 8.2.1.6. This section should rather focus strictly on characheristics of RE generation. Otherwise you confuse the reader with short bits of solutions here and there.	resolved by rewrite
Hannele Holttinen (VTT)	8	15	13	-	-	-	-	-	tidal could be taken as a separate sentence somewhere else	resolved by rewrite
Hannele Holttinen (VTT)	8	15	15	-	-	-	-	-	wave variations explanation is somewhat vague and needs a reference	resolved by rewrite
Paul Smith (University College, Dublin)	8	15	42	15	44	-	-	-	What "experiences"? I suggest that the VPP is a concept that has been proposed, rather than an "experience". Some of the citations referred to in this paragraph are incomplete.	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	15	12	15	12	-	-	-	What is the definition for "wide geographic area" ? It is very important to be more accurate in this report, whatever the principe is understandable	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	15	33	15	36	8.2.1.2.3	-	-	Might provide some explanation in footnote for why ""RE generation does not inherently provide the rotating mass inertia of large conventional turbines that is important for stabilizing the grid in the case of faults or 36 changes in frequency""	resolved by rewrite
Paul Smith (University College, Dublin)	8	15	23	-	-	-	8-10	-	there are 7 IEA 2009 citations. Which one is referred to here?	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	16	6	-	-	-	-	-	"primarily dependent on the penetration level of RE". This is of course one important issue, but the question is which area you study! In some areas (where there is a wind farm and nearly no load) you can get 10000% of the demand from wind power, while it is very different in a rather isolated area (such as Ireland). What I mean is that the interconnection capacity is extremely important! This is mentioned, and the ipact of it is also shown in the final report of IEA Annex XXV.	resolved by rewrite

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ICHIRO MAEDA (The Federation of Electric Power Companies of Japan)	8	16	6	16	8	-	-	-	<comment> It's appropriate to delete "in the long-term, up to 100% may be possible (Greenpeace 2007)". Otherwise, you should insert the prerequisite that you here explain about community/region level. Proposed amendment: "On several systems in the mid-term, this may each more than 20-30% of total annual electricity demand (EWEA 2009). And, in several communities and regions (not wider area such as countries), up to 100% may be possible in the long run (Greenpeace 2007)." <reason> It seems that this description contradicts the message from Line19-22 page81 of 135 in Technical Summary (In this part, you explain about wider area such as countries).	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	16	5	16	5	-	-	-	It is not true for dispatchable RE (hydro, biomass, geothermal), but only for variable RE. Proposition: "The magnitude and type of impact that variable RE generaion ζ"	resolved by rewrite
Paul Smith (University College, Dublin)	8	16	7	16	9	-	-	-	Lobby group publications should not be cited as references.	resolved by rewrite
Hannele Holttinen (VTT)	8	16	1	-	2	-	-	-	point out that to be used only in critical situations for the power system where no other more cost effective sources	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	16	6	16	8	-	-	-	Rather than quote 2 NGO studies, refer to scenarios in Ch. 10 and present numbers consistent with the numbers in that chapter.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	16	8	16	11	-	-	-	Sentence claims that analyses provided an overview of the effects from increasing RE generation and the contriution toward mitigation strategies, but doesn't explain what those effects or contributions actually were.	resolved by rewrite
David Clubb (European Environment Agency)	8	16	6	16	8	-	-	-	Suggested addition: See comment about Portugal 2 rows up; already significantly above 20-30%	resolved by rewrite
Antoine BONDUELLE (E&E Consultant)	8	16	8	-	-	-	-	-	The European Climate Foundation (ECF) has commissiond such a 100% renewable report in 2009 to groups such as Mc-Kinsey. Could this work be integrated, at least from preliminary results published last year ?	resolved by rewrite
Richard Piwko (General Electric Company)	8	16	7	-	8	-	-	-	The terms mid-term and long-term are used without any context. What do these terms mean? Is it weeks or months or years or decades?	resolved by rewrite
Paul Smith (University College, Dublin)	8	16	25	-	-	-	-	-	There are two Eenrginet.dk 2009 references.	resolved by rewrite

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United States (U.S. Department of State)	8	16	8	-	-	-	-	-	-	There is a Greenpeace reference to the possibility of up to 100% RE integration. This statement undermines the credibility of the report, and it misleads the reader about the magnitude of the potential for wide-scale deployment. The reference to 100% penetration should be removed and the sentence should end after "...(EWEA 2009)."	resolved by rewrite
Michael Power (University College Dublin)	8	16	8	-	-	-	-	-	-	This citation is incomplete. The statement is also very significant. Do we know if a power system with 100% asynchronous generators can be built and then operated? This is a major issue and should be considered very carefully before inclusion.	resolved by rewrite
Morgan Bazilian (UNIDO)	8	16	21	-	-	-	-	-	-	This section needs a considerable refinement. It has all sorts of information coupled together without a narrative	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	16	6	16	8	8.2.1.3.1	-	-	-	Define 'mid-term' and 'long-term' here or at the beginning of this chapter/report. Mention what levels of efforts and costs are needed to achieve ""Up to 100% may be possible"", e.g., if all RE integration issues are solved and RE becomes cost competitive. Greenpeace reference is questionable. Is this peer-reviewed????	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	16	-	-	-	8.2.1.3.1	-	-	-	This section misses an explanation of what impacts actually ARE. Often it is claim that impacts have been studied, without giving any explanation of the results of those studies. An explanation of the terms in Figure 8.4 would be useful.	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	16	24	17	22	8.2.1.3.2	-	-	-	Check consistency: Wind penetration of up to 50% is mentioned at Page 16 line 24, and up to 40% is mentioned at page 17 line 22. In which year/over what timeframe?	resolved by rewrite
Leif Sønnderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	16	-	-	-	8.2.1.3.2	-	-	-	Section 8.2.1.3.2: I suggest that an overview figure from energinet.dk could be used to give a better structure on this part of the chapter, see <a href="http://www.energinet.dk/NR/rdonlyres/BF59EBA9-5C47-4809-A359-695045E01EA7/0/TheDanishWindCaseFastFactsUKversion.pdf">http://www.energinet.dk/NR/rdonlyres/BF59EBA9-5C47-4809-A359-695045E01EA7/0/TheDanishWindCaseFastFactsUKversion.pdf</a>	the comment is specifically directed to e.g. a specific phrasing of the (old) section. Hence it is not relevant anymore due to the rewrite of the section.
Lennart Söder (KTH, Royal Institute of Technology)	8	16	-	-	-	-	8.4	-	-	This figure has nothing to do with wind power! This is a general description of the different areas in power system analysis. You can use exactly the same description if you study nuclear, HVDC, grid companies, etc. But it is a good graph!	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	16	-	-	-	8.2.1.3.1	8.4	-	-	Some of the terms in this figure are not explained/defined. Which impacts and challenges can be solved based on current technologies? Which are not and have to be addressed further? How are the impacts and challenges of wind power compared to conventional power generation?	resolved by rewrite

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Peter Børrre Eriksen (Energinet.dk)	8	17	19	-	-	-	-	-	-	"load". Explain why load fluctuations increase!	resolved by rewrite
Paul Smith (University College, Dublin)	8	17	44	-	-	-	-	-	-	"Reduce" or "minimise" rather than "avoid".	resolved by rewrite
Peter Børrre Eriksen (Energinet.dk)	8	17	44	-	-	-	-	-	-	"to avoid spilling..". Comment: the optimal solution is generally to allow for some spilling!	resolved by rewrite
United States (U.S. Department of State)	8	17	17	-	-	-	-	-	-	A distinction should be made between the service of balancing and the infrastructure required to provide such service. In most instances the need for balancing service will increase as wind penetration increases. However, additional infrastructure may or may not be needed to provide a given level of service.	resolved by rewrite
Hannele Holttinen (VTT)	8	17	26	-	-	-	-	-	-	add text that despite of some results of high increase in reserve requirement for the system, balancing costs wer not increased because usually the existing conventional power plant could supply the extra reserve (no investment cost, just increased use of reserve capacity)	resolved by rewrite
Paul Smith (University College, Dublin)	8	17	36	-	-	-	-	-	-	As before, replace the term "TSO" with "System Operator"	resolved by rewrite
Hannele Holttinen (VTT)	8	17	20	-	-	-	-	-	-	capacity --> use of capacity	resolved by rewrite
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	17	23	-	24	-	-	-	-	Clarify the 14 references.	resolved by rewrite
United States (U.S. Department of State)	8	17	41	17	44	-	-	-	-	Comment, p. 17 lines 41-44: Mention that storage options are one solution for managing excessive RE production.	resolved by rewrite
Hannele Holttinen (VTT)	8	17	16	-	-	-	-	-	-	design, stability words could be taken away from the subheading	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	17	13	-	-	-	-	-	-	footnote 3, on capacity value: I suggest to put a more detailed discussion of the capacity value in the main text, as it is an important topic.	resolved by rewrite
Peter Børrre Eriksen (Energinet.dk)	8	17	44	-	-	-	-	-	-	footnote 3: This is not a clear definition as conventional generation is not well defined.	resolved by rewrite
Paul Smith (University College, Dublin)	8	17	16	18	10	-	-	-	-	Frequency stability is a major issue at the generation level, and is likley to limit RE penetration in many systems, but is not even mentioned here. This must be remedied.	resolved by rewrite
Michael Power (University College Dublin)	8	17	16	-	-	-	-	-	-	Heading not coherent with line 10 on page 17	resolved by rewrite

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Emmanuel Branche (Electricité de France)	8	17	3	17	3	-	-	-	It is not true for dispatchable RE (hydro, biomass, geothermal), but only for variable RE. Proposition: "integration issues for variable RE penetration levels higher $\zeta$ "	resolved by rewrite
Michael Power (University College Dublin)	8	17	10	-	-	-	-	-	Not clear as to the meaning of "both generation and transmission levels". It would be better to remove these words. This heading does not line up with later headings 8.2.1.3.2	resolved by rewrite
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	17	13	-	-	-	-	-	Note 3: This note should be moved to chapter 7, where the capacity value is introduced.	resolved by rewrite
Hannele Holttinen (VTT)	8	17	37	-	-	-	-	-	remove also	resolved by rewrite
Hannele Holttinen (VTT)	8	17	35	-	-	-	-	-	remove Such forecasts	resolved by rewrite
Hannele Holttinen (VTT)	8	17	17	19	-	-	-	-	rewrite	resolved by rewrite
United States (U.S. Department of State)	8	17	21	-	-	-	-	-	Rewrite the sentence as "...cycling of thermal plants." (s missing in plants).	resolved by rewrite
United States (U.S. Department of State)	8	17	21	-	-	-	-	-	Rewrite the sentence as "...increased cycling of thermal AND HYDROELECTRIC plants."	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	17	31	17	40	-	-	-	Section on 'Need for short-term forecasting' does not clearly explain why this is a challenge, i.e. why this appears under 8.2.1.3. Rather, the paragraph currently focuses on why forecasting helps to integrate RE, in which case it would be better in 8.2.1.6. Either rephrase to clarify why forecasting is a challenge (e.g. does it incur extra cost? are accurate forecasts difficult to come by), or cut this to 8.2.1.6. Perhaps title could be amended to read 'Unreliable forecasting methods', or something of the like.	resolved by rewrite
Greece (National Observatory of Athens)	8	17	18	17	19	-	-	-	Some references are needed. In addition, perhaps a distinction should be made between wind and PV-CSPs without storage regarding their relationship with electricity load.	resolved by rewrite
Paul Smith (University College, Dublin)	8	17	41	18	2	-	-	-	Storage could be mentioned in this paragraph.	resolved by rewrite
United States (U.S. Department of State)	8	17	15	-	-	-	-	-	Suggest adding a new bullet: "Flexibility of existing and future generation."	resolved by rewrite
United States (U.S. Department of State)	8	17	41	-	-	-	-	-	Text should include a comment that generation flexibility heavily impacts excess RE spill.	resolved by rewrite
Paul Smith (University College, Dublin)	8	17	1	17	6	-	-	-	The Irish report referred to in comment 44 could also be cited here.	resolved by rewrite

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United States (U.S. Department of State)	8	17	17	-	-	-	-	-	The text seems to indicate that RE makes load forecasting itself more complex, rather than the combination of load and renewable energy. May be worth a minor clarification.	resolved by rewrite
United States (U.S. Department of State)	8	17	4	-	-	-	-	-	The western wind and solar integration study is completed, and the statement should be in the past tense. It should also include key findings on the topic discussed here. Contact National Renewable Energy Laboratory in Golden, CO, USA for more detailed information on the results of the report.	resolved by rewrite
Australia (0)	8	17	17	17	30	-	-	-	This section should note that the impact of RE on reserves will be dependant on local power system structures and how reserves are calculated in each system.	resolved by rewrite
Paul Smith (University College, Dublin)	8	17	12	-	-	-	-	-	This should be re-phrased as the design of RE plants suitable for integration on a large scale. It's not just a matter of changing grid codes to suite the renewables industry. "Grid friendly" RE plants must be developed.	resolved by rewrite
Hannele Holttinen (VTT)	8	17	2	-	6	-	-	-	US WWSIS has been published - but not very detailed for the system so perhaps not the best example. The Irish All Island study and its recently published continuation part should be mentioned, up to 40 %	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	17	3	17	6	-	-	-	Why do you focus on one study of a current US project here, when on p. 16 line 24 you quote another examining up to 50% levels and on p. 17 line 22 another up to 40%? A general statement explaining the current knowledge would be more useful here, and also detailing what exactly needs more research to fill the knowledge gap.	resolved by rewrite
United States (U.S. Department of State)	8	17	31	-	-	-	-	-	You should define short-term forecasting. Most of the research shows that the day-ahead forecast is important because of its impact on unit commitment, which is an irreversible decision/action. There are other issues surrounding other short-term forecasts ; e.g.. How does a 1 hour or even 15-minute forecast influence economic dispatch and the resulting impact on balancing needs?	resolved by rewrite
Richard Taylor (International Hydropower Association)	8	17	41	18	2	8.2.1.3.2	-	-	Insert reference to the energy storage capacity of hydropower (pumped storage) which is unique among RES	resolved by rewrite
Paul Smith (University College, Dublin)	8	18	26	18	27	-	-	-	"similar effects" This is wrong! Changing direction and quantity happens all the time on transmission networks. Distribution networks are different in that this does not happen without embedded generation. It would be correct to say that connecting re generation to distribution networks has similar impacts	resolved by rewrite

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ICHIRO MAEDA (The Federation of Electric Power Companies of Japan)	8	18	17	18	25	-	-	-	<comment> Delete "priority access for RE plants". <reason> Whether priority access is applied for RE or not should be judged by each authority taking into consideration the equality between RE and other types of generation. What is more, it is not a part of operational (technical) issues.	resolved by rewrite
United States (U.S. Department of State)	8	18	34	-	-	-	-	-	Add the following sentence after RE variability: "Capability of distributed generation to ride through transmission level faults needs to be addressed at higher penetration levels to ensure there is no adverse impact on voltage stability."	relevant, considered in rewrite process of 8.2.1
Hannele Holttinen (VTT)	8	18	11	-	-	-	-	-	again the words design and stability in the subheading, are they necessary?	resolved by rewrite
Paul Smith (University College, Dublin)	8	18	21	-	-	-	-	-	As written, this reads "Operational issues include the need for...priority access for RE plants" This is clearly wrong. See also point 57 (1) above.	resolved by rewrite
United States (U.S. Department of State)	8	18	5	-	-	-	-	-	At line 5 after RE plants insert "(both distributed and central)."	resolved by rewrite
Michael Power (University College Dublin)	8	18	4	-	-	-	-	-	Care should be taken with the wording so as not to imply RE can provide black start services.	resolved by rewrite
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	18	33	-	34	-	-	-	Clarify the definition of DG used in this reference.	resolved by rewrite
Michael Power (University College Dublin)	8	18	11	-	-	-	-	-	Heading not coherent with line 10 on page 17	resolved by rewrite
Glória Rodrigues (European Wind Energy Association (EWEA))	8	18	36	18	47	-	-	-	Here, the creation of ENTSO-E as the first continental TSO association with legal obligations to establish binding rules for cross-border network management and a Pan-European Grid plan should be mentioned, the same applies to 8.2.1.6.2 Institutional approaches and market reforms.	relevant, considered in rewrite process of 8.2.1
Michael Power (University College Dublin)	8	18	14	18	25	-	-	-	I'm not sure this section is good for the document.	resolved by rewrite
Michael Power (University College Dublin)	8	18	36	18	47	-	-	-	I'm not sure this section is good for the document.	resolved by rewrite

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Paul Smith (University College, Dublin)	8	18	19	-	-	-	-	-	Improved congestion management is needed wherever widespread congestion occurs. This is not a "renewables" issue. It is closely related to point 57 (1) above.	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	18	3	18	10	-	-	-	In France hydropower plays an important and increasing role for ancillary services. This paragraph is therefore not always true.	resolved by rewrite
Hannele Holttinen (VTT)	8	18	30	-	31	-	-	-	In general --> traditionally	resolved by rewrite
United States (U.S. Department of State)	8	18	9	-	-	-	-	-	In the sentence on line 9, "should" should be replaced with "must."	resolved by rewrite
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	18	26	-	35	-	-	-	Include Japanese validation test named "Demonstrative Project on Power Network Technology" ? They keep the voltage of the distribution line by using the control devices such as the static var compensator and the loop balance controller. Ref.; H. Hatta, S. Uemura and H. Kobayashi: "Demonstrative Study of Control System for Distribution System with Distributed Generation", IEEE PES General Meeting, (2009); it is attached as SRREN_Draft2_Review_Sugiyama-Taishi_Material_11	relevant, considered in rewrite process of 8.2.1
United States (U.S. Department of State)	8	18	14	-	-	-	-	-	Institutional factors can reduce (or in the extreme eliminate) access to the physical flexibility in the generation mix. Large electrical balancing areas and frequent sub-hourly economic dispatch and scheduling provide for an increased ability to manage variability as compared to small balancing areas and infrequent dispatch. See <a href="http://www.nrel.gov/docs/fy09osti/46273.pdf">http://www.nrel.gov/docs/fy09osti/46273.pdf</a> , page 23 for an example of a simple tool that shows other factors necessary for successful integration of wind into the bulk power system. These same factors are relevant for solar, or other variable renewable generation resources.	relevant, considered in rewrite process of 8.2.1
Hannele Holttinen (VTT)	8	18	42	-	45	-	-	-	long list but the most important is the planning with generation that has low average generation compared to nameplate capacity, so probabilistic tools will be needed, as well as the evaluation of the load and other generation using the same transmission line	resolved by rewrite
Hannele Holttinen (VTT)	8	18	38	-	40	-	-	-	long sentence should be shortened	resolved by rewrite
Hannele Holttinen (VTT)	8	18	31	-	35	-	-	-	mention smart grids here, and text that TSO/DSO collaboration is critical	resolved by rewrite
United States (U.S. Department of State)	8	18	21	-	-	-	-	-	Priority access for RE plants is a policy option that would conflict with an open access paradigm where open access to transmission has been adopted by governmental institutions.	resolved by rewrite
Hannele Holttinen (VTT)	8	18	21	-	-	-	-	-	priority access perhaps needs some explanations (in markets where bids at 0 price there is access to produce	resolved by rewrite

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Hannele Holttinen (VTT)	8	18	1	-	-	-	-	-	remove taking operational and infrastructure measures and write there "requires more flexible operation of conventional generation as well as $\lambda$ . Ancillary services provided by RE generators will be one part of solving the problem as then more conventional generation can be shut down in times of excess RE generation"	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	18	28	18	28	-	-	-	Replace "real" by "active"	resolved by rewrite
Hannele Holttinen (VTT)	8	18	7	-	10	-	-	-	rewrite to separate reactive power provision and active power provision as operating reserve. I suggest: "If active power is provided as reserve this is at the cost of lost production. Hence RE is not normally one of the last resources to be used. Still, appropriate equipment should be maintained for RE to be able to participate in critical situations"	resolved by rewrite
Dara O'Sullivan (University College Cork)	8	18	26	18	35	-	-	-	The important issue of islanding protection in 'Management of Distribution Networks' is not addressed here. I would recommend that it be referred to in terms of the need to standardise the islanding detection method utilised by RE generators connected to the distribution network, and also to standardise the network maintenance procedures in order to ensure the safety of line workers in the presence of an energised islanded network. A useful reference is BOWER, W. and ROPP, M., 'Evaluation Of Islanding Detection Methods For Photovoltaic Utility Interactive Power Systems,' International Energy Agency March 2002,	the issue is indeed relevant but too detailed compared to other more important issues of integration
Paul Smith (University College, Dublin)	8	18	26	18	35	-	-	-	The significant issues for distribution networks may be missed here. Embedded RE generation can lead to changes in flow magnitude and direction. This has significant issues for network control and protection, and will require more extensive metering and control facilities throughout distribution networks. Furthermore control and metering of aggregated embedded generation may be required for the secure and economic operation of the transmission grid. Depending of the level of embedded generation related to demand, connection of generation to distribution networks may reduce or increase losses. Connection of embedded generation to distribution networks can also lead to public, staff and plant safety issues if the distribution network becomes isolated from the grid.	relevant, considered in rewrite process of 8.2.1

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Paul Smith (University College, Dublin)	8	18	14	18	25	-	-	-	There is too much reference to short term issues; the big picture is missing. For large scale integration of RE (1) timely and efficient extension and reinforcement of transmission grids will be required, to deliver renewable power reliably to demand centres, and to extend and interconnect power systems to benefit from geographical diversity. This may involve the deployment of novel technologies, as well as overcoming public opposition. Methods to determine optimal network expansion to cater for stochastic and relatively low-load factor generation sources must be developed; (2) the question of reactive power and voltage control and stability must be addressed and solutions developed and deployed. (3) the performance of RE plants during system disturbances and outages must be assessed.	resolved by rewrite
Paul Smith (University College, Dublin)	8	18	46	19	14	-	-	-	These paragraphs encompass the key messages under the title on line 36, provided lines 37 to 45 are deleted.	resolved by rewrite
Paul Smith (University College, Dublin)	8	18	22	18	23	-	-	-	This is a short term operational and market issue and does not merit reference in a report such as this.	resolved by rewrite
Paul Smith (University College, Dublin)	8	18	24	18	25	-	-	-	This is an interesting question, but it is completely irrelevant to the integration of high levels of renewables.	resolved by rewrite
Paul Smith (University College, Dublin)	8	18	37	18	45	-	-	-	This paragraph must be deleted. It is utterly wrong to suggest that network planners do not take account of the factors listed in lines 42 to 45. As stated before, the term TSO is not universal and should not be used, and the division of responsibility for functions related to system planning and operation varies from jurisdiction to jurisdiction. Regional or national divisions of responsibility have not prevented past development of transboundary networks, and there is no reason why they should do so in future.	resolved by rewrite
Paul Smith (University College, Dublin)	8	18	3	18	10	-	-	-	this section of the report is supposed to be about challenges. The matters mentioned in this paragraph are not significant challenges as far as the generation level is concerned. Black Start capability is largely irrelevant to RE integration, although RE would affect system restoration. Reactive power is largely a network issue and not relevant in this section. It is clear from the last sentence that this paragraph is pointless. Therefore it should be deleted.	resolved by rewrite
Paul Smith (University College, Dublin)	8	18	18	-	-	-	-	-	Transmission networks generally have widespread monitoring facilities. Where is increased monitoring needed? Any extension of monitoring and supervision is not a major issue and does not merit specific mention in this report.	resolved by rewrite

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Paul Smith (University College, Dublin)	8	18	33	18	35	-	-	-	While embedded generation may in special circumstances have the potential to support weak distribution grids and improve power quality, this is not true for most embedded RE generation because of its stochastic nature. The distribution grid must still be able to deliver the required reliability and quality in the absence of the embedded generation.	resolved by rewrite
Paul Smith (University College, Dublin)	8	18	28	-	-	-	-	-	While harmonic distortion must be considered when connecting power electronic converters the techniques for mitigating harmonics are well known so this is not a significant challenge.	resolved by rewrite
United States (U.S. Department of State)	8	18	3	-	-	-	-	-	Why are ancillary services separated from reserves? The latter is part of the former.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	18	36	18	47	-	-	-	Why is network reinforcement and extension of networks a challenge? 'Limited transmission capacity in current systems' may be a better header here.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	18	21	-	-	-	-	-	You state that "priority access for RE plant" is important. What is the scientific background for this. And what do you mean? Do you mean all RE or only some? Do you mean in the local grid or on a transmission level? Is this really an operational issue? It seems more to be an economic issue. At least it has to be motivated (preferable with reference)	resolved by rewrite
Richard Taylor (International Hydropower Association)	8	18	3	18	10	8.2.1.3.2	-	-	Insert reference to ancillary services of hydropower (voltage control, frequency regulation, energy storage, black-start capability) which are unique among RES	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	18	5	18	8	8.2.1.3.2	-	-	Simplify or clarify "RE plants can provide some of these services such as reactive power control, although if operating reserve is provided by variable RE, it is at the cost of lost production." Sentence is confusing.	resolved by rewrite
Seppo Hänninen (VTT)	8	18	26	18	35	8.2.1.3.2	-	-	The chapter does not deal with the challenges of demand response and aggregator operation: Full business separation can make it difficult to justify the business case for demand response due to the fact that the potential The current lack of existing demand response providers The balance settlement process highlights the complexity of the relationship between demand aggregators, the customers and their energy suppliers.	resolved by rewrite
Peter Børrre Eriksen (Energinet.dk)	8	19	1	-	-	-	-	-	"..add..". The reverse is also true in some systems.	resolved by rewrite
Peter Børrre Eriksen (Energinet.dk)	8	19	40	-	-	-	-	-	"demand response". I would suggest "flexible demand", as demand response is normally something else.	resolved by rewrite
Paul Smith (University College, Dublin)	8	19	16	-	-	-	-	-	"specify requirements" rather than "impose constraints".	resolved by rewrite

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Lennart Söder (KTH, Royal Institute of Technology)	8	19	34	-	-	-	-	-	"Variable RE" is of course correct. But why is this term not used consequently and defined clearly when it is used?	resolved by rewrite
United States (U.S. Department of State)	8	19	32	-	-	-	-	-	Add "although this would be a significant coordination effort."	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	19	29	19	32	-	-	-	Again, a very useful solution (sentence 'Internationally harmonized manufacturers and operators). Why not move this to 8.2.1.6?	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	19	31	19	31	-	-	-	ENTSO-E is an association of European TSO, which was issued from the integration of former ATSOI, BALTSO, ETSO, NORDEL, UCTE and UKTSOA.	resolved by rewrite
Paul Smith (University College, Dublin)	8	19	32	-	-	-	-	-	Harmonisation of Grid Codes might not lead to avoidance of costs, as the harmonised code would have to cover all possible situations. The Ciupuliga et al reference makes it clear that a harmonised, uniform and transparent structure is what is required to enhance understanding and facilitate comparison of requirements. The reference does not state that costs would be reduced by harmonisation of codes.	resolved by rewrite
Paul Smith (University College, Dublin)	8	19	35	-	-	-	-	-	I don't understand what the phrase in parenthesis is intended to mean.	resolved by rewrite
Michael Power (University College Dublin)	8	19	33	19	41	-	-	-	I think the contents of these lines need to be expanded to discuss issues such as flexibility more extensively.	resolved by rewrite
United States (U.S. Department of State)	8	19	5	-	-	-	-	-	In the U.S. and perhaps elsewhere, grid codes may need revision to reduce unnecessary barriers to integration of distributed RE. In particular, they should include the ability to provide support to the bulk power system during normal and contingency conditions.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	19	3	-	-	-	-	-	It is stated "The extent to which transmission upgrades are required depends on the effectiveness of congestion management". It must be clearly stated that "congestion management" is a market method to handle situations when there is an economic interest to transmit more than what is physically possible. This is NOT an alternative to "transmission upgrade"!	resolved by rewrite
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	19	27	-	-	-	-	-	Line 27: What percentage corresponds to very low penetration levels?	resolved by rewrite

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Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	19	4	-	-	-	-	-	Line 4: Dynamic line rating should be explained in a note here, instead of later in the chapter as it is now.	resolved by rewrite
United States (U.S. Department of State)	8	19	35	-	-	-	-	-	On page 19 line 35 there is a statement: ‘Consequently, when deploying variable RE at a large scale, existing conventional thermal or nuclear plants may have to be retained in the system before gradually being replaced with more efficient and flexible dispatchable RE plants.’ This implies assumptions that conventional thermal and nuclear plants are not desirable in the long term as more RE becomes available. This assumption has not been previously stated and I do not believe it to be true. Case in point: France and Japan’s nuclear power generation seems to suit their needs well. Also, important to deploying variable RE is storage capability. The subsection beginning on page 19 line 33 titled "System generation adequacy" and ending on page 20 line 2 should be removed because it has little to do with RE adequacy.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	19	34	19	35	-	-	-	RE capacity can only replace a minor portion...’ does this refer to low capacity credits for high RE share? in this general form, the statement is misleading!	resolved by rewrite
Hannele Holttinen (VTT)	8	19	3	-	-	-	-	-	see above??	resolved by rewrite
Michael Power (University College Dublin)	8	19	34	-	-	-	-	-	Statement re "minor portion" needs a citation or other supporting documentation.	resolved by rewrite
Hannele Holttinen (VTT)	8	19	9	-	-	-	-	-	The examples from US (Texas CREZ, California) should be mentioned here	resolved by rewrite
Paul Smith (University College, Dublin)	8	19	42	20	2	-	-	-	The fact that the capacity contribution of RE may be affected by network limitations is not metioned.	resolved by rewrite
United States (U.S. Department of State)	8	19	25	19	27	-	-	-	The first sentence on line 25 should be deleted completely. It is not factual.	resolved by rewrite
Paul Smith (University College, Dublin)	8	19	12	19	14	-	-	-	The message from this sentence is that there should be no public consultation or participation in planning processes. It suggests that dictatorship and imposing developments on the public is the way to go. This is utterly unacceptable. This sentence must be re-written to highlight the risk of delay and the importance of effective public consultation and communication, and the vital role of opinion formers.	resolved by rewrite

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United States (U.S. Department of State)	8	19	38	19	39	-	-	-	The phrase "especially when aiming at 100% penetration in the long term" should be deleted. This statement undermines the credibility of the report, and it misleads the reader about the magnitude of the potential for wide-scale deployment.	resolved by rewrite
Paul Smith (University College, Dublin)	8	19	29	19	32	-	-	-	the qualification "to the extent allowed by the specifics of the control area" (text taken from the Ciupuliga et al reference) should be included.	resolved by rewrite
Paul Smith (University College, Dublin)	8	19	6	19	14	-	-	-	This paragraph fails to mention the challenge of determining the optimum level of investment in network expansion to accommodate low load factor renewable generation, ensure reliability of power supply and deliver on sustainability objectives.	resolved by rewrite
Paul Smith (University College, Dublin)	8	19	16	19	24	-	-	-	This paragraph would benefit from some citations.	resolved by rewrite
Paul Smith (University College, Dublin)	8	19	25	19	27	-	-	-	This sentence adds little and should be deleted.	resolved by rewrite
Paul Smith (University College, Dublin)	8	19	20	19	21	-	-	-	This sentence is back to front. Grid faults lead to network voltage depression not vice versa.	resolved by rewrite
David Clubb (European Environment Agency)	8	19	33	19	35	-	-	-	Unsupported assertion: this assertion is not borne out by the evidence (see previous comment)	resolved by rewrite
Paul Smith (University College, Dublin)	8	19	35	19	38	-	-	-	What is the point being made here? What is "more efficient and flexible dispatchable RE plant?" The point is that variable RE such as wind, solar and wave must be complemented by a portfolio of plant, controllable demand, interconnection, storage etc. with the required capacity, flexibility etc. to ensure that energy users' reasonable requirements are met in a cost-effective manner while delivering on sustainability objectives.	resolved by rewrite
Michael Power (University College Dublin)	8	19	46	-	-	-	-	-	Where is the capacity value as high as 40%?	resolved by rewrite
Anca-Diana Barbu (European Environment Agency)	8	19	12	19	14	8.2.1.3.1	-	-	Public opposition to new transmission lines has been traditionally linked with visual impacts and the perceived impacts of the electromagnetic field on human health. Underground cables are being currently used (also in Denmark) to alleviate this problem and it proves successful. The downside is that it renders the project more expensive (real case studies conducted in Scotland for instance showed that the line should be at least 700 km long for the project to break even at current levels of willingness to pay of the consumers. this is why in Denmark alternative solutions are found, for instance to place only parts of the transmission cable underground in areas with higher population density.	relevant, considered in rewrite process of 8.2.1

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Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	19	40	19	41	8.2.1.3.2	-	-	instead of "energy storage where cost-effective to do so": energy storage at 100% penetration rate of RE storage will be required	resolved by rewrite
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	19	34	19	34	8.2.1.3.2	-	-	RE capacity may replace a substantial portion of conventional power plant capacity. This depends on the specific regional grid, load infrastructure, available energy storage such as pumped hydro and the interconnection strength to neighboring grids.	resolved by rewrite
Michael Power (University College Dublin)	8	20	46	-	-	-	-	-	"Fairly moderate" isn't a great description. Can a % be used?	resolved by rewrite
Peter Børre Eriksen (Energinet.dk)	8	20	1	-	-	-	-	-	"negatively". Is negative correlation a necessity? It's not obvious.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	20	40	20	47	-	-	-	"penetration level": of energy, or capacity etc?	resolved by rewrite
ICHIRO MAEDA (The Federation of Electric Power Companies of Japan)	8	20	45	20	46	-	-	-	<comment> Delete the sentence below "However, where grid reinforcements benefit the whole system, their costs should not be allocated solely to wind power." <reason> Grid reinforcement costs allocation should be judged by each authority reflecting specific conditions and circumstances in each area or country.	resolved by rewrite
Hannele Holttinen (VTT)	8	20	46	-	-	-	-	-	a new paragraph with "overall a fairly moderate"	resolved by rewrite
Dara O'Sullivan (University College Cork)	8	20	24	-	-	-	-	-	An additional benefit of RE is its potential to catalyse economic renewal in remote, undeveloped regions	resolved by rewrite
Paul Smith (University College, Dublin)	8	20	38	-	-	-	-	-	and network augmentation costs.	resolved by rewrite
Michael Power (University College Dublin)	8	20	35	20	39	-	-	-	Citation required to support the assertion in the last sentence of the section.	resolved by rewrite
United States (U.S. Department of State)	8	20	5	-	-	-	-	-	Comment, p. 20 line 5. long gate closure time. This is not a self-descriptive term, and should be put in layman terms.	resolved by rewrite
Norway (Climate and Pollution Agency)	8	20	16	21	20	-	-	-	Comment: Higher degree of RE penetration implies a less predictable power system with less dispatchable nature. This means we can expect more night hours with very low prices (even negative power prices) caused by wind power, and peak hours with even higher prices due to lack of wind production.	resolved by rewrite

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Norway (Climate and Pollution Agency)	8	20	22	20	23	-	-	-	Comment: If all countries in, let's say Europe, is to make an export earning from RE production, it means that all countries have a power surplus, who is the importer?	resolved by rewrite
Hannele Holttinen (VTT)	8	20	38	-	-	-	-	-	context specific connection costs - network extensions can be needed for these as well	resolved by rewrite
Hannele Holttinen (VTT)	8	20	29	-	-	-	-	-	could be written more clearly. Network extension perhaps better as first point	resolved by rewrite
Morgan Bazilian (UNIDO)	8	20	17	-	-	-	-	-	I would have like to have seen some benefits from portfolio theory here.	resolved by rewrite
Hannele Holttinen (VTT)	8	20	12	-	-	-	-	-	Important to mention here that for RE to be able to participate, with inherently more imbalances occurring, the imbalances should not be penalized more than what is actual cost of imbalances for the system (transparent and cost reflecting system for balance settlement)	resolved by rewrite
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	20	39	-	-	-	-	-	Line 39: The possibilities in chemical storage via electrolysis cells should be mentioned here. An overview from Risø is found here: New electrolytic cells to play a role in tomorrow's local energy supply ( <a href="http://www.risoe.dtu.dk/News_archives/News/2010/0427_CASE.aspx">http://www.risoe.dtu.dk/News_archives/News/2010/0427_CASE.aspx</a> ) Some references: Rau, GH: Electrochemical CO2 Capture and Storage With Hydrogen Generation, Energy Procedia, 1 (1): 823-828 2009; Zhan, Z; Kobsiriphat, W; Wilson, JR; et al.: Syngas Production By Coelectrolysis of CO2/H2O: The Basis for a Renewable Energy Cycle, ENERGY & FUELS, 23: 3089-3096 MAY-JUN 2009; Mignard, D; Pritchard, C: Processes for the synthesis of liquid fuels from CO2 and marine energy, CHEMICAL ENGINEERING RESEARCH & DESIGN, 84 (A9): 828-836 Sp. Iss. SI SEP 2006	relevant, considered in rewrite process of 8.2.1
Hannele Holttinen (VTT)	8	20	6	-	-	-	-	-	load forecasts do not improve much for shorter gate closures	resolved by rewrite
Juan Llanes (Centre for Environmental Studies)	8	20	46	-	-	-	-	-	Please if possible provide available information for other RE technologies as additional system operating costs (arising from wind variability and uncertainty) for around 10%?	resolved by rewrite
Paul Smith (University College, Dublin)	8	20	36	-	-	-	-	-	Pumped storage plants are just storage facilities. They cannot be classified as RE generation.	resolved by rewrite
David Clubb (European Environment Agency)	8	20	35	20	39	-	-	-	Repetition: this information is provided earlier	resolved by rewrite
Australia (0)	8	20	12	20	13	-	-	-	see comments on page 17 line 17	resolved by rewrite

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United States (U.S. Department of State)	8	20	45	20	47	-	-	-	Sentence on lines 45-46 beginning "However..." is a policy statement and should be deleted. For the sentence beginning on lines 46-47, we suggest a bit more context for this sentence. Compared to what? Total wind generation costs? Other resource alternatives? This is a very assumption driven statement and has the potential to alienate readers. Dealing with this, however, may raise issues with substitutions or changes to Figure 8.5.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	20	5	20	11	-	-	-	The entire discussion about forecasting and forecasting errors should be cut to p. 17 under 'need for short-term forecasting'	resolved by rewrite
United States (U.S. Department of State)	8	20	35	20	39	-	-	-	The paragraph on lines 35-39 should be deleted. As written, the paragraph has accuracy problems, and even if corrected, it would not add any significant value to the chapter.	resolved by rewrite
Michael Power (University College Dublin)	8	20	22	20	23	-	-	-	There will be benefits from RE in certain countries but not in all.	resolved by rewrite
Paul Smith (University College, Dublin)	8	20	22	20	23	-	-	-	This benefit can apply to very few countries/regions, essentially to first movers/risk takers. It is hardly worth mentioning in an international report such as this.	resolved by rewrite
Paul Smith (University College, Dublin)	8	20	3	20	15	-	-	-	This is an inadequate treatment of the market issues that arise in the context of wind integration. At high levels of integration can the complementary portfolio that is necessary earn enough revenue to remain in business? Is there a need for capacity or flexibility payments to cover the fixed costs (or variable costs dependent on parameters other than energy exported) of the necessary flexible plant? Issues like insufficient aggregation or long gate closure times may affect the cost of wind integration, but do not affect the feasibility of integration. The Poyry Study of the Impact of Intermittency in Britain and Ireland (June 2009) may be a useful reference.	relevant, considered in rewrite process of 8.2.1
Lennart Söder (KTH, Royal Institute of Technology)	8	20	27	20	39	-	-	-	This is correct but not only for RE!!!! This is valid for all type of power plants. One example: When we in Sweden installed a lot of hydro power, we had to build lines to these hydro stations. When we in Sweden installed a large amount of nuclear power, we had to install more capacity in the hydro and more lines to these hydro plants in order to handle balancing and nuclear outages. I am sure that a large amounts of lines have been installed to make it possible for France to export power! All power system investments always require some kind of changes in the rest of the system. It is of course a difference in the amount of impact, but it is a general issue and there is NOT an "integration cost" only for variable RE !!!	resolved by rewrite

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Paul Smith (University College, Dublin)	8	20	40	20	47	-	-	-	this paragraph appears to be about transmission reinforcement costs, but there is an apparently concluding sentence ("Overall...") about balancing costs. This needs to be re-written.	resolved by rewrite
Paul Smith (University College, Dublin)	8	20	20	20	21	-	-	-	This should be expressed as a reduction in primary fuel (gas, coal, oil) imports, with consequent benefits for energy security. RE deployment could lead to increased imports of electricity from neighbours during periods of low production.	resolved by rewrite
Morgan Bazilian (UNIDO)	8	20	16	-	-	-	-	-	This whole section needs to be refined. It is a key section looking at costs of integration but does not seem to have enough lit review nor come to a conclusion.	resolved by rewrite
Greece (National Observatory of Athens)	8	20	2	-	3	8.2.1.3.2	-	-	To add a new paragraph named " energy storage " completed by the following : There are two very important functions for RE storage systems, with respect to the present and future electricity networks, that is the balance of energy flow and the providing of ancillary services(frequency control,voltage control,spinning reserve,standing reserve,black start capabilities,grid loss compensation and emergency control action). The RE storage capability has a significant interest for RE sources, as they offer a technological solution that maximises the usage and benefit of them, without having recourse to fossil fuel-based back up capacity and curtailment measures in low consumption periods in order to be accomodatet the variability of the sypply and the demand of the power systems.	resolved by rewrite
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	20	37	-	38	8.2.1.4	-	-	Add explanation of the definition of "additional technology" and "context-specific connection cost".	resolved by rewrite
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	20	35	20	36	8.2.1.4	-	-	H2, CAES, Redox flow and other storage technologies to be added as valuable option for storage	relevant, considered in rewrite process of 8.2.1
Paul Smith (University College, Dublin)	8	21	8	-	-	-	-	-	"for" should probably be "of"	resolved by rewrite
David Clubb (European Environment Agency)	8	21	21	21	21	-	-	-	Comment: Repeat my comment that perhaps Portugal is worth of a case study	resolved by rewrite
Michael Power (University College Dublin)	8	21	16	21	20	-	-	-	I'm not sure this section is good for the document.	resolved by rewrite

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Lennart Söder (KTH, Royal Institute of Technology)	8	21	7	21	11	-	-	-	Is this percentage of yearly energy cost, investment cost, or how do you compare?	resolved by rewrite
Brazil (Ministry of Science and Technology)	8	21	11	-	-	-	-	-	The reference ""USDOE, 2008a"" is missing in the reference list.	resolved by rewrite
Hannele Holttinen (VTT)	8	21	22	-	26	-	-	-	too long sentence	resolved by rewrite
Hannele Holttinen (VTT)	8	21	9	-	11	-	-	-	what is this US study, not clear how this relates to all the studies referred to in this sentence and fig 8.5, does not look clear	resolved by rewrite
Paul Smith (University College, Dublin)	8	21	13	21	15	-	-	-	What's the basis for this assertion?	resolved by rewrite
China (China Meteorological Administration)	8	21	21	28	23	8.2.1.5	-	-	Country case studies:1.The countries selected as cases should have some features that can represent some types of countries, for example, OECD or Non OECD, Developing or Developed. 2. To save words, each case should be shortened and simplified and only the features of this case country on integration are important.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	21	24	21	26	8.2.1.5	-	-	For each of the case studies, it would be useful to define the terms presented here as specific variables, so that the reader has some kind of common ground for comparison. I.e. define the existing system design, local RE resource availability, current market shares and targets, type of market, cost comparisons with conventional generation and government policies for all cases, then explain what is unique about that situation and why it has been a successful approach for integrating RE. There is currently no coherent, consistent structure to the case studies.	resolved by rewrite
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	21	-	-	-	8.2.1.5	-	-	Include Japanese NEDO projects. demonstration projects to investigate technological issues regarding the large penetration of PV generation systems and to develop new technologies for using PV generation systems effectively. One of NEDO's demonstration grid-connected PV projects is the Ohta Project, a cluster of PV systems in a residential development. Another is the Wakkanai Project, the largest centralstation PV system in Japan. Ref.; R. Hara, H. Kita, T. Tanabe, H. Sugihara, A. Kuwayama, and Shuya Miwa: "Testing the Technologies -Demonstration Grid-Connected Photovoltaic Projects in Japan-", IEEE Power & Energy Magazine, may/june (2009)	relevant, considered in rewrite process of 8.2.1

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Paul Smith (University College, Dublin)	8	22	20	-	-	-	-	-	-	"no operational problems" This could be because no contingencies occurred at this time. This sentence needs to be qualified. Furthermore, this appears to relate to a region of a synchronous system rather than an entire synchronous system. There are many places where a boundary could be drawn to demonstrate over 100% wind penetration.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	22	19	-	-	-	-	-	-	13.1 TWh should be presented in EJ (SRREN standard)	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	22	17	-	-	-	-	-	-	210 TWh figure should be presented in EJ (SRREN standard)	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	22	-	24	-	-	-	-	-	Concerning Australia, Ireland and Denmark, the studies consider only wind. As I understand it this chapter should be general, and talk about all types of RE for electricity. What is the division between this part and chapter 7?	resolved by rewrite
Mark Fulton (Deutsche Asset Management, Deutsche Bank)	8	22	6	28	45	-	-	-	-	General comment: these case studies are all small countries with relatively little "peakiness" in their load profiles; might want to make this more explicit	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	22	5	23	4	-	-	-	-	In the Australia case study it is unclear how inter-state connection has facilitated penetration of RE.	resolved by rewrite
Michael Power (University College Dublin)	8	22	5	-	-	-	-	-	-	It would be useful to know if Australia put any additional operational procedures in place or created any new categories of ancillary services to deal with RE. I assume the 57% penetration occurred due to a combination of low load and high wind and lasted for a brief period. I think it is too early to draw too many conclusions from examples such as this.	resolved by rewrite
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	22	5	-	-	-	-	-	-	Line 5: This example could be deleted, it is not as interesting as the other examples below	resolved by rewrite
Paul Smith (University College, Dublin)	8	22	8	-	-	-	-	-	-	Reads more like a press release than an objective report.	resolved by rewrite
Australia (0)	8	22	17	22	18	-	-	-	-	References for the figures related to electricity generation and actual and predicted wind capacity are missing.	resolved by rewrite
Australia (0)	8	22	2	22	2	-	-	-	-	Spot market price cap should be renamed to 'Market Price Limit' and it is currently set at AUD\$12,500.	resolved by rewrite
United States (U.S. Department of State)	8	22	5	-	-	-	-	-	-	The Australian case study seems a bit rosy, especially with respect to high wind penetration events (57%) and emerging geographic diversity. I hope someone from the utility sector in Australia gets a chance to review the report.	resolved by rewrite

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Paul Smith (University College, Dublin)	8	22	5	23	4	-	-	-	This piece on Australia is heavy on PR speak and light on facts and explanations. It needs to be much more specific about policy objectives, measures taken and outcomes.	resolved by rewrite
Australia (0)	8	22	20	22	24	-	-	-	This sentence is confusing - please clarify	resolved by rewrite
Paul Smith (University College, Dublin)	8	22	24	22	26	-	-	-	This sentence is prefixed with "as a result"; it is not clear why the shift in focus of South Australian wind developers follows from the material in the preceding sentences. There is something missing in the logical flow.	resolved by rewrite
Australia (0)	8	22	15	22	15	-	-	-	this sentence should read "However, wind farm operators, as with all generators, have to pay <sub>z</sub> "	resolved by rewrite
Paul Smith (University College, Dublin)	8	22	11	-	-	-	-	-	Why is there a footnote rather than a citation?	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	22	20	22	21	8.2.1.5	-	-	Explain why ""When wind penetration in the NEM is high, electricity prices tend to be low and vice versa"". Is it because wind power is not firm?	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	22	7	-	-	8.2.1.5	-	-	Fully spell Mkm2 to million km2 to avoid confusion (people often use MM as million and M as thousand). Same applies to other similar references (unless unit conventions are clearly defined in the SRREN appendices <sub>z</sub> )	resolved by rewrite
Australia (0)	8	22	-	-	-	-	8,6	-	Australia's target for renewable electricity generation is 20% by 2020 - this could be clearer in this figure, as at the moment it looks like it is less than 20%.	resolved by rewrite
Anca-Diana Barbu (European Environment Agency)	8	22	1	22	1	8.2.1.5	8.6	-	It is not clear what is the measurement unit on the Yaxis of the graph. For instance for Denmark, the renewable share in 2007 in gross final consumption was 18.1% and the target for 2020 is 30%. Please see more information at: <a href="http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-QA-10-030/EN/KS-QA-10-030-EN.PDF">http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-QA-10-030/EN/KS-QA-10-030-EN.PDF</a>	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	23	12	-	-	-	-	-	"11 %" of electric energy per year or capacity?	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	23	15	23	16	-	-	-	28 TWh should be presented in EJ (SRREN standard)	resolved by rewrite
Michael Power (University College Dublin)	8	23	22	-	-	-	-	-	As with Australia these high penetration levels occurred at low load and high wind periods.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	23	5	-	-	-	-	-	For consistent standard in case study titles it may be better to focus on the steps Ireland has taken to integrate more RE: 'investing in transmission reinforcement, additional interconnections, demand-side management and electricity storage in vehicles'.	resolved by rewrite

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Hannele Holttinen (VTT)	8	23	-	-	-	-	-	-	Ireland - could be shortened leaving the first sentences and rows 23-25 away. State size of system by load (peak MW and annual TWh). 2009 13 % penetration has been reported (?). Write what the challenges (first two ones) are in practice (more CCGTs?)	resolved by rewrite
Peter Børre Eriksen (Energinet.dk)	8	23	2	-	-	-	-	-	price cap: The unit must be US dollars per energy unit (MWh).	resolved by rewrite
Paul Smith (University College, Dublin)	8	23	35	23	36	-	-	-	Reference to the EirGrid Facilitation of Renewables Study and the key conclusions that the target of 40% of electricity from renewables can be met but changes are required to current industry practice. these changes relate to frequency stability, reactive power and voltage control. See <a href="http://www.eirgrid.com/renewables/facilitationofrenewables/">http://www.eirgrid.com/renewables/facilitationofrenewables/</a>	relevant, considered in rewrite process of 8.2.1
Paul Smith (University College, Dublin)	8	23	5	-	-	-	-	-	Should the title be changed. "Exploit Ireland's rich RE resource in a small system with limited interconnection."	resolved by rewrite
David Clubb (European Environment Agency)	8	23	23	23	30	-	-	-	Suggested additional reference: <a href="http://www.sciencedirect.com/science?_ob=ArticleURL&amp;_udi=B6V2S-4YH92HM-1&amp;_user=1577609&amp;_coverDate=05%2F31%2F2010&amp;_rdoc=1&amp;_fmt=high&amp;_orig=search&amp;_sort=d&amp;_docanchor=&amp;view=c&amp;_acct=C000053846&amp;_version=1&amp;_urlVersion=0&amp;_userid=1577609&amp;md5=2362d94a8447b295f759cd9f45abfcc2">http://www.sciencedirect.com/science?_ob=ArticleURL&amp;_udi=B6V2S-4YH92HM-1&amp;_user=1577609&amp;_coverDate=05%2F31%2F2010&amp;_rdoc=1&amp;_fmt=high&amp;_orig=search&amp;_sort=d&amp;_docanchor=&amp;view=c&amp;_acct=C000053846&amp;_version=1&amp;_urlVersion=0&amp;_userid=1577609&amp;md5=2362d94a8447b295f759cd9f45abfcc2</a>	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	23	31	23	45	-	-	-	These points should also be clearly reflected in 8.2.1.6 Options. It would be useful to reader to insert references to the sections of 8.2.1.6 where more explanation on these options can be found.	resolved by rewrite
Paul Smith (University College, Dublin)	8	23	19	23	20	-	-	-	voltage levels should be 110 kV and above, and 38 kV and below.	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	23	15	-	-	8.2.1.5	-	-	The peak demand on the network is just over 5 GW""--Does 'network' refer to Ireland nationwide? Please specify.	resolved by rewrite
Michael Power (University College Dublin)	8	24	25	-	-	-	-	-	".. could need.." seems weak in light of what follows. Should it just be "needs"?	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	24	16	-	-	-	-	-	"cross-boundary". Should it be "cross-border"?	resolved by rewrite
United States (U.S. Department of State)	8	24	20	-	-	-	-	-	Add sentence: ¿These are significant and potentially costly changes.¿	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	24	1	24	7	-	-	-	Concerning electric cars. How many MW is this? 10% (line 4) does not provide so much information if one can not see the amount of MW it could contribute to the balancing	resolved by rewrite

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Hannele Holttinen (VTT)	8	24	-	-	-	-	-	-	Denmark - State size of system (peak and annual load). List experience with current 20 % wind - several cases of more than 100 % of load by wind power, handled by the strong connections, export to Nordic countries, this means that the system has worked well with high amounts of wind power. One interesting experience is that the thermal plants minimum points to still stay on-line has been altered and CHP plants have made to operate by market price signals	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	24	8	25	8	-	-	-	Denmark has developed many wind farms. However this development relies on increasing power exchanges with its neighbouring countries (in particular thanks to Nordic countries with their peaking electricity based on hydro) and on thermal power plants as back-up (some CHP and other thermal units which are heavy CO2 emitters). This idea should be reflected for this example, as this situation is unfortunately not necessarily replicable worldwide. Refer chapter 11, box 11.14 for reference hydro Norway to sustain wind Denmark	relevant, considered in rewrite process of 8.2.1
Michael Power (University College Dublin)	8	24	15	24	20	-	-	-	I don't understand this sentence. Also it is very long.	resolved by rewrite
Paul Smith (University College, Dublin)	8	24	9	-	-	-	-	-	Is it not Energinet.dk?	resolved by rewrite
Paul Smith (University College, Dublin)	8	24	9	25	8	-	-	-	It would be worth including some remarks about what measures have been necessary to achieve the present wind penetration of 20% of electricity consumption.	resolved by rewrite
Antoine BONDUELLE (E&E Consultant)	8	24	15	24	19	-	-	-	Sentence is too long, could be cut in three	resolved by rewrite
Antoine BONDUELLE (E&E Consultant)	8	24	19	-	-	-	-	-	The word ""vital"" is excessive and does not reflect the original study quoted. This is an economic and engineering challenge, not a ""life"" challenge because there are many ways to come to the results, and thus not all solutions have to be used at once. Suggestion, replace this word by ""important"" or ""key"".	resolved by rewrite
Michael Power (University College Dublin)	8	24	28	24	29	-	-	-	What are regulating resources? Generators? What new types of plant are being referred to?	resolved by rewrite
Michael Power (University College Dublin)	8	24	-	-	-	-	8.7	-	I don't understand this figure.	resolved by rewrite
Peter Børre Eriksen (Energinet.dk)	8	25	30	-	-	-	-	-	"48.8 GWh" must be TWh?	resolved by rewrite

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Peter Børrre Eriksen (Energinet.dk)	8	25	33	-	-	-	-	-	"55.4 GWh" must be TWh?	resolved by rewrite
Peter Børrre Eriksen (Energinet.dk)	8	25	42	-	-	-	-	-	"hydro enhances the capacity value of wind". Unclear due to the definition of capacity value.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	25	21	25	22	-	-	-	"Several wind farm and landfill developers, such as Palmerston North City Council, (IEA 2009) have sold carbon credits to support project costs." If wind farms have sold carbon credits, then it seems to be some kind of "supporting policies". Or what do you mean?	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	25	35	-	-	-	-	-	"the potential could reach". I assume, but I am not sure, that this relates to only wind power, but the previous sentence discusses several types of RE.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	25	12	-	-	-	-	-	43.7 GWh should be presented in EJ (SRREN standard)	resolved by rewrite
Michael Power (University College Dublin)	8	25	5	25	6	-	-	-	Are "sharing reserves" and "exchange of ancillary services" not the same thing?	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	25	33	25	36	-	-	-	GWh figures should be presented in EJ (SRREN standard)	resolved by rewrite
United States (U.S. Department of State)	8	25	43	-	-	-	-	-	Hydro does not enhance the capacity value of wind. If they are combined, then the combined resource has a higher capacity value, but the wind itself does not have a higher capacity.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	25	42	25	44	-	-	-	It is first stated "Hydro enhances the capacity value of wind (which is relatively high due to the high load factors)." How can one source increase the capacity value for another source? This is not correct if one use the definition of "equivalent carrying capability". It is then stated: "The total additional generation costs attributed to wind at 20% penetration ..." What do you mean with "additional generation costs"? Does only wind power have this? How it is defined?	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	25	16	-	-	-	-	-	No supporting policies exist, though there is a government target to reach 90% RE by 2025 (p. 25 line 36)	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	25	10	25	45	-	-	-	NZ plans to increase wind from 3-8%, but are there plans to build additional back-up? Additional transmission capacity? I.e. how specifically will higher penetration of variable RE be handled? If this question isn't clearly answered, would recommend cutting NZ case study.	resolved by rewrite

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United States (U.S. Department of State)	8	25	39	25	40	-	-	-	Page 25 lines 39-40 (and other places in the report): "firming wind" and "backing up wind" (or solar) are incorrect terms and operating procedures. See the many publications on www.uwig.org including the 2007 IEEE Transactions paper on uwig.org by Smith et al. Also see the IEA Task 25 report (you already have this cited)	resolved by rewrite
Michael Power (University College Dublin)	8	25	9	25	45	-	-	-	Should all GWh references not be TWh in this section?	resolved by rewrite
Dara O'Sullivan (University College Cork)	8	25	25	45	45	-	-	-	The case study for New Zealand is of less interest than the others, since high penetration of hydro power is well known. This could be removed in the context of chapter length reduction.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	25	46	26	37	-	-	-	The Chile case study give zero explanation of what Chile aims to do in terms of amending the electricity grid to support more RE. They only aim to increase RE by 3% by 2020 with variable wind. What is being done to the grid in response? If this question can't be answered, would recommend cutting Chile case study.	resolved by rewrite
Paul Smith (University College, Dublin)	8	25	9	25	45	-	-	-	This section does not address integration issues for wind and any other variable RE sources. (See for example Ancell and Clarke paper at 2008 IEEE-PES General Meeting)	resolved by rewrite
United States (U.S. Department of State)	8	25	20	-	-	-	-	-	Wind power capacity factors above 50% sounds high. Confirm that this is correct. Could a reference be added?	resolved by rewrite
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	25	15	25	15	8.2.1.4	-	-	Inter-connection to Australia may be practical in the future depending on the evolution of HVDC technology.	resolved by rewrite
Anca-Diana Barbu (European Environment Agency)	8	25	12	25	13	8.2.1.5	-	-	8508 MW installed capacity of what?	resolved by rewrite
Anca-Diana Barbu (European Environment Agency)	8	25	23	25	28	8.2.1.5	-	-	The values of CO2 emission intensity of the electricity generation (per kWh) seem erroneous for the European countries. According to the EEA indicators, the values are: 527.73gCO2emissions/kWh for Ireland, 521.87gCO2emissions/kWh for Germany, 4.1gCO2emissions/kWh for Norway. The EEA's indicator is calculated based on Eurostat/IEA data. differences may occur for instance due to the treatment of CHP production. At teh EEA we ensure consistency with IEA figures. I suggest for this type of data to use data sources that are internationally accepted and used.	resolved by rewrite
Paul Smith (University College, Dublin)	8	26	19	26	20	-	-	-	Citation needed	resolved by rewrite

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Kristin Seyboth (IPCC WG III TSU)	8	26	14	-	-	-	-	-	Does the 26% RE figure presented here excluding hydro? If it's not, the number presented doesn't match those in figure 8.8 with 39% large hydro.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	26	7	-	-	-	-	-	How does this 75% fossil fuels compare with the 26% RE quoted on p. 26 line 14? Are we off by some decimals somewhere?	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	26	7	26	14	-	-	-	On line 7 it is stated "75%" and on line 14 "26%". I think these should add to 100%, but the figures are not totally clear to me. The section is about electricity, but I assume that here at least some of the figures realates to all energy (transport, electricity, heating) etc. There are so many figures, and it is not clear what the aim is to mention all of them.	resolved by rewrite
Michael Power (University College Dublin)	8	26	37	-	-	-	-	-	Replace "give" with "generate"?	resolved by rewrite
Antoine BONDUELLE (E&E Consultant)	8	26	1	26	4	-	-	-	The competitive nature of the electricity sector in Chile is irrelevant to the financing of connections for the rural poor. This was more due to its regulatory process and the tariff structure. The sentence could be altered to avoid being misleading and out of topic.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	26	21	26	22	-	-	-	The most useful bit of information from the figure for the purpose of this case study is that wind is expected to increase by 5%, creating new integration challenges for Chile. Would add this in text where figure is referenced.	resolved by rewrite
Wilfredo Jara Tirapegui (Endesa Eco S.A.)	8	26	29	-	31	-	-	-	The penalties referred are really not an incentive to renewable energy in Chile. It will promote lower cost technologies such as carbon thermal stations than renewable energy.	resolved by rewrite
United States (U.S. Department of State)	8	26	19	26	20	-	-	-	The stated technical potential for wind power appears low, whereas the potential for solar PV and CSP appears high. Confirm that numbers are correct.	resolved by rewrite
Paul Smith (University College, Dublin)	8	26	14	26	22	-	-	-	there is a confusion of numbers here, with total energy, electricity generation capacity but no mention of total electricity demand. The potential contribution of renewables to electrical energy demand should be made clear.	resolved by rewrite
Paul Smith (University College, Dublin)	8	26	1	26	4	-	-	-	These sentences are inappropriate.	resolved by rewrite
Paul Smith (University College, Dublin)	8	26	-	-	-	-	-	-	This case description is not relevant to Chapter 8. It says nothing about integration issues.	resolved by rewrite
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	26	19	26	19	8.2.1.4	-	-	1.500 MW seems to be too low, need to be verified	resolved by rewrite

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United States (U.S. Department of State)	8	27	17	-	-	-	-	-	-	"Oil and gas dominated (Fig. 8.9). This sentence should be extended. Also, from the figure it seems like coal/peat is the largest source.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	27	2	27	11	-	-	-	-	It is not totally clear here when you discuss "all energy" and when it is only the electricity part. "RE generation" could more than double to 11,9%. I assume that this is share of electricity?	resolved by rewrite
Paul Smith (University College, Dublin)	8	27	1	28	23	-	-	-	-	Likewise, this description does not address integration issues.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	27	12	27	14	-	-	-	-	Very good, clear explanation of the integration problems existing in Indonesia. However, the rest of the case study does not explain what efforts are being made in attempt to solve those problems.	resolved by rewrite
United States (U.S. Department of State)	8	28	3	-	-	-	-	-	-	"However a new law...." This sentence does not read well.	resolved by rewrite
Paul Smith (University College, Dublin)	8	28	38	-	-	-	-	-	-	As before, replace the term "TSO" with "System Operator"	resolved by rewrite
United States (U.S. Department of State)	8	28	37	28	39	-	-	-	-	Comment, p. 28 lines 37-39: Change this sentence to read "Most present systems have a significant proportion of generation coming from thermal power plants which if made more flexible at acceptable cost, could assist TSOs in achieving higher RE penetration levels."omment, p. 28: The sections under 8.2.1.6 should include a discussion of smart grids in a separate subsection and how they can enable RE integration. This entire section seems disjointed and strays from the focus on integration. Some details could be omitted for more concise presentation of the concepts and types of technologies that promote integration of RE.	resolved by rewrite
Hannele Holttinen (VTT)	8	28	45	-	-	-	-	-	-	electricity market reform --> integration	resolved by rewrite
Hannele Holttinen (VTT)	8	28	-	-	-	-	-	-	-	footnote - schedulable, not clear why this word is chosen, does not seem to clarify the text for the reader	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	28	5	28	16	-	-	-	-	Here there is also sometimes a discussion of "energy supply" (seems to be all energy) and sometimes only the electric part.	resolved by rewrite
Hannele Holttinen (VTT)	8	28	35	37	-	-	-	-	-	It should be pointed out that with high penetration of var RE also the base plant should be flexible to some extent (f.ex.daily flexibility if not hourly/minute time scales)	resolved by rewrite

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Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	28	23	-	-	-	-	-	Line 23: The cases above could be supplemented with a case from one of the fast-growing economies.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	28	33	-	-	-	-	-	schedulable': the explanation for using this term instead of dispatchable is unsatisfactory. I suggest to stick to the same nomenclature throughout the whole section to make it easier for the reader to follow you.	resolved by rewrite
Mark Fulton (Deutsche Asset Management, Deutsche Bank)	8	28	32	28	37	-	-	-	Suggest explicitly stating that natural gas-fired generation is the only flexible baseload and midmerit resource to complement renewables. Coal, especially in the US, faces significant environmental retrofits for Nox, SO2 and acid gases. Once scrubbed, these midmerit load following plants will become less flexible since their are specific steam temperatures that must be adhered to for the environmental control technology to work; hence their may be a change in the dispatch order with natural-gas fired generation dispatching ahead of higher heat rate coal in certain circumstances.	the comment is specifically directed to e.g. a specific phrasing of the (old) section. Hence it is not relevant anymore due to the rewrite of the section.
United States (U.S. Department of State)	8	28	33	-	-	-	-	-	The term "schedulable" is introduced. How does this term differ from dispatchable? Suggest to go with the latter for consistency and to avoid introducing too many terms. There should be a glossary of terms.	resolved by rewrite
Youba SOKONA (Sahara and Sahel Observatory)	8	28	25	28	29	-	-	-	There is no indication from your assessment that this will happen. In a contrary RE penetration is in a progress in many industrialised countries and emerging economies.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	28	39	28	45	-	-	-	This detailed assessment of biomass co-firing does not belong into the introduction section of the options chapter!	resolved by rewrite
Paul Smith (University College, Dublin)	8	28	39	28	44	-	-	-	This piece seems to highlight co-firing of biomass in thermal plants which is likely to make no more than a marginal contribution and poses few if any integration issues. It should be deleted.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	28	37	-	-	-	-	-	What does 'cykling' mean in this context? this is unclear.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	28	-	-	-	8.2.1.6	-	-	I assume that you mean "integration of variable RE". What are the specific challenges concerning, e.g., geothermal power and run-of-the-river? Most examples concerns wind power.	resolved by rewrite
Peter Bjarre Eriksen (Energinet.dk)	8	29	19	-	-	-	-	-	"wind tends to be stronger at night". This is not generally correct. Is strongly site and climate specific.	resolved by rewrite

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Paul Smith (University College, Dublin)	8	29	42	29	45	-	-	-	A more general statement about co-ordination of grid development on a continental scale rather than national would be more useful than citing specific European initiatives. The term TSO is inappropriate here. A TSO is an institution, not a network.	resolved by rewrite
United States (U.S. Department of State)	8	29	20	-	-	-	-	-	Add reference to document discussing DLR currently in use by industry.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	29	31	-	-	-	-	-	Are 'voltage regulation technologies' the same as 'power flow control devices'? If so, why switch terminology here?	resolved by rewrite
Hannele Holttinen (VTT)	8	29	5	-	8	-	-	-	clarify	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	29	15	29	22	-	-	-	Dynamic line rating: reference needed!	resolved by rewrite
Michael Power (University College Dublin)	8	29	47	-	-	-	-	-	Explain "super-grid" or provide citation.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	29	47	-	-	-	-	-	Explanation of acronym HVDC does not belong in footnote.	resolved by rewrite
Paul Smith (University College, Dublin)	8	29	5	29	33	-	-	-	Far too much attention is given here to technical measures that are (1) well known and (2) at best provide small increases in transmission capacity.	resolved by rewrite
Paul Smith (University College, Dublin)	8	29	47	30	1	-	-	-	HVDC, line commutated or VSC, offers controllability advantages when compared with AC.	resolved by rewrite
Paul Smith (University College, Dublin)	8	29	5	29	7	-	-	-	I don't understand this sentence	resolved by rewrite
Hannele Holttinen (VTT)	8	29	4	-	-	-	-	-	I would put the storage to the end of the list	resolved by rewrite
Michael Power (University College Dublin)	8	29	23	29	33	-	-	-	It should be emphasised that this is only a possible solution and will not be available to all networks and could also be very expensive to implement and difficult to operate.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	29	10	29	14	-	-	-	low sag lines': reference needed!	resolved by rewrite
Hannele Holttinen (VTT)	8	29	36	-	39	-	-	-	not clear	resolved by rewrite
United States (U.S. Department of State)	8	29	17	29	20	-	-	-	Page 29 lines 17-20 suggests that it is acceptable to exceed transmission line limits if closely monitored. Rewrite to state that "limits may be adjusted on the basis of dynamic information about line capacities but under no circumstances exceeded."	resolved by rewrite

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United States (U.S. Department of State)	8	29	38	29	41	-	-	-	Page 29 Lines 38-41 ¿ Planning, upgrading and building in advance of need is not only difficult in ¿politically unstable¿ countries, it has proven close to impossible in the United States over the past 10-15 years.	resolved by rewrite
Hannele Holttinen (VTT)	8	29	20	-	-	-	-	-	point out that for wind there is even higher potential to increase the transmission compared to if only worst case temperature assumptions are used	resolved by rewrite
Hannele Holttinen (VTT)	8	29	40	-	-	-	-	-	political unstableness - move to other than engineering approach section	resolved by rewrite
Paul Smith (University College, Dublin)	8	29	23	29	33	-	-	-	Power flow control does not merit this much attention. It is only applicable in very particular circumstances. Power flow control is often used more to shift a problem to someone else than as an appropriate technical and economic solution to a problem.	resolved by rewrite
Michael Power (University College Dublin)	8	29	40	29	41	-	-	-	Remove bracketed reference to unstable countries.	resolved by rewrite
Michael Power (University College Dublin)	8	29	10	-	-	-	-	-	Replace "rewiring" with "re-conductoring"	resolved by rewrite
Michael Power (University College Dublin)	8	29	13	-	-	-	-	-	Replace "rewiring" with "re-conductoring"	resolved by rewrite
United States (U.S. Department of State)	8	29	11	-	-	-	-	-	Rewiring can increase line capacity by up to 50%. Could a reference be added for this statement?	resolved by rewrite
Paul Smith (University College, Dublin)	8	29	35	-	-	-	-	-	See previous comments about the use of the term TSO.	resolved by rewrite
United States (U.S. Department of State)	8	29	5	-	-	-	-	-	The appropriately detailed section on technical options for the transmission system could be strengthened by adding material on distributed resources.	resolved by rewrite
Paul Smith (University College, Dublin)	8	29	45	30	14	-	-	-	The discussion about VSC-HVDC is about connection of offshore windfarms, not about provision of transmission capacity, which is the general topic on page 29/30.	resolved by rewrite
Paul Smith (University College, Dublin)	8	29	2	29	4	-	-	-	The most obvious option - flexible, efficient, emission controlled generation resources - is missing and must be included.	resolved by rewrite
Paul Smith (University College, Dublin)	8	29	40	29	41	-	-	-	These remarks are completely inappropriate and also misleading. Making long-term provision by constructug new transmission is perhaps more difficult in open democratic societies that are regraded as stable.	resolved by rewrite

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Kristin Seyboth (IPCC WG III TSU)	8	29	10	29	22	-	-	-	These two paragraphs seem confusing to reader. In the first 'low-sag, high-temperature conductors' seems to argue that high temperature increases efficiency of carrying capacity, whereas in the second 'dynamic line rating' it seems that high temperature lowers transmission capacity, and therefore needs to be controlled. Please clarify.	resolved by rewrite
Paul Smith (University College, Dublin)	8	29	5	30	14	-	-	-	This entire discussion on transmission design lacks focus and does not address the transmission issues raised in aiming for integration of high levels of RE.	resolved by rewrite
Paul Smith (University College, Dublin)	8	29	12	29	15	-	-	-	This is dependent on jurisdiction. The intention is to increase greatly the current carried by overhead lines. This will result in a corresponding increase in magnetic field. Since EMF are seen by many as the major unacceptable impact of overhead lines, it cannot be said without qualification that this offers a fast method of transmission capacity enhancement. Furthermore in many cases, the use of a larger conventional conductor may be a more economic solution, or an improvement may be obtainable by increasing line clearances. This paragraph should be reduced to a statement that some additional capacity may be obtainable by increasing the capacity of existing overhead lines.	resolved by rewrite
Paul Smith (University College, Dublin)	8	29	46	30	14	-	-	-	This technical discussion is pointless in this report. It is also poorly focussed and misleading. It reads almost like a manufacturers marketing brochure.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	29	6	-	-	2	-	-	"transmission upgrades often coincide with methods for congestion management". What do you mean with this? "transmission upgrades" means that one with some methods increases the amount of MW that can be transmitted on a line or a section while "congestion management" means an economical market treatment to make the grid users actions result in a transmission level which does not exceed what is technically possible.	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	29	10	29	10	8.2.1.6.1	-	-	Add the key challenges and status of the high temperature conductor technology	resolved by rewrite

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Lennart Söder (KTH, Royal Institute of Technology)	8	29	-	30	-	8.2.1.6.1	-	-	I think the content is relevant, but the structure is rather unclear. There are three levels (simplified) if one want to transfer more power. 1) Check the methods for calculation of stability limits, measure more (e.g. PMU) to exactly define the state of the system in order to operate closer to limits; 2) Invest in, e.g., FACTS and control the system to limit stability problems, 3) Invest in new lines. 1) is the cheapest and 3) normally the most expensive. It is rather unclear in the text, where the costs come from. And on page 29, row 44, "coordinating network planning" is mentioned, but in what way does this increase the MW transfer capacity? Why not make a table concerning the different methods?	resolved by rewrite
Peter Bøvre Eriksen (Energinet.dk)	8	30	24	-	-	-	-	-	" so are not used just to stabilize voltage". Self-evident.	resolved by rewrite
Peter Bøvre Eriksen (Energinet.dk)	8	30	19	-	-	-	-	-	"but if located near to a RE". Not clear to me why storage on system level is less attractive.	resolved by rewrite
Paul Smith (University College, Dublin)	8	30	26	-	-	-	-	-	"plentiful" doesn't fit well in this sentence.	resolved by rewrite
Hannele Holttinen (VTT)	8	30	2	-	-	-	-	-	...point to point HVDC (?) transmission...	resolved by rewrite
Paul Smith (University College, Dublin)	8	30	7	-	-	-	-	-	As stated on line 11 of this page, Meshed HVDC networks are not yet an engineering reality. Therefore "become attractive" is not an appropriate phrase.	resolved by rewrite
Hannele Holttinen (VTT)	8	30	24	-	-	-	-	-	clarify not just for stabilizing voltage	resolved by rewrite
Hannele Holttinen (VTT)	8	30	36	-	-	-	-	-	clarify that pumped hydro already cost effective and in use throughout the world where there are possibilities to build this - requires hydro power plant with upper storage level and considerable height difference. Also clarify row 27 that CAES not yet as cost effective (?)	resolved by rewrite
Hannele Holttinen (VTT)	8	30	21	-	-	-	-	-	demand --> net load (combined load and RE variations)	resolved by rewrite
Michael Power (University College Dublin)	8	30	5	-	-	-	-	-	Explain "out-performs" or provide a comparison between HVAC and HVDC.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	30	1	-	-	-	-	-	HVAC has not yet been introduced in Chapter. To what does it refer?	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	30	5	30	6	-	-	-	HVDC outperforms HVAC...: reference needed!	resolved by rewrite
Michael Power (University College Dublin)	8	30	26	-	-	-	-	-	I didn't think sites for reservoir-hydro were still plentiful. I thought nearly all of the good sites were now occupied.	resolved by rewrite

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Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	30	15	-	30	-	-	-	Include Japanese validation test named "Demonstrative Project on Power Network Technology" ? They also keep the voltage of the distribution line and minimize power loss by using high COP hot water supply system and battery. Ref.; H. Kobayashi and I. Kurihara: "Research and Development of Grid Integration of Distributed Generation in Japan", IEEE PES General Meeting, (2009), SRREN_Draft2_Review_Sugiyama_Taishi_Material_10	relevant, considered in rewrite process of 8.2.1
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	30	9	-	-	-	-	-	Line 9: For a concrete example you could refer to the Kriegers Flak project connecting a new offshore wind farm to Denmark, Sweden and Germany, see eg. <a href="http://www.energinet.dk/en/menu/Transmission/New+projects/New+electricity+transmission+installations/Kriegers+Flak/Kriegers+Flak.htm">http://www.energinet.dk/en/menu/Transmission/New+projects/New+electricity+transmission+installations/Kriegers+Flak/Kriegers+Flak.htm</a>	resolved by rewrite
Hannele Holttinen (VTT)	8	30	10	-	-	-	-	-	market areas - also point out that interconnection between countries	resolved by rewrite
United States (U.S. Department of State)	8	30	15	-	-	-	-	-	More information should be added about the integration and use of storage in operations. For example, a single storage resource could be used for price arbitrage as well as balancing services. A discussion on this topic would be useful.	resolved by rewrite
Paul Smith (University College, Dublin)	8	30	5	30	6	-	-	-	On what criteria is HVDC said to "out-perform" HVAC?	resolved by rewrite
Paul Smith (University College, Dublin)	8	30	21	30	22	-	-	-	Over-simplification, Depends on the type of storage, the level in the store and the control system.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	30	26	-	-	-	-	-	plentiful, low cost reservoir hydro': reservoir hydro power is constrained by limited resources and has non-negligible costs like any other technological option. Better refer to the hydro technology chapter for a more refined comparison of the pumped storage and reservoir hydro options.	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	30	18	30	18	-	-	-	Pumped storage power plants (PSPP) is a mature and economically viable technology. Proposition: "Storage, except PSPP, is not ç"	resolved by rewrite
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	30	15	-	30	-	-	-	Review Japanese large scale PV system validation test named "Clustered Residential PV systems in Ohta Project" and "Large scale Central-Station PV(Wakkanai)". They used battery to control voltage of distribution line. Ref.; R. Hara, H. Kita, T. Tanabe, H. Sugihara, A. Kuwayama, and Shuya Miwa: "Testing the Technologies -Demonstration Grid-Connected Photovoltaic Projects in Japan-", IEEE Power & Energy Magazine, may/june (2009) , attached as SRREN_Draft2_Review_Sugiyama_Taishi_Material_9	relevant, considered in rewrite process of 8.2.1
Hannele Holttinen (VTT)	8	30	-	31	-	-	-	-	storage - make the point that requiring storage for RE generation is very costly and not needed for the system - storage should be used when system needs it (price differences a good signal) not to smooth out any single item in the system	resolved by rewrite

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Canada (Environment Canada)	8	30	15	31	15	-	-	-	Suggest considering mention of hydrogen storage. While still very expensive and inefficient, its potential is high and, coupled with cogeneration, it could become efficient. Japan has expertise in demand-side management using hydrogen to heat water and store electricity.	relevant, considered in rewrite process of 8.2.1
Kristin Seyboth (IPCC WG III TSU)	8	30	27	-	-	-	-	-	Suggest replacing 'energy storage is also site-specific but with ζ' with 'energy storage is another site-specific option, but ζ'	resolved by rewrite
Paul Smith (University College, Dublin)	8	30	15	31	15	-	-	-	There is too much space devoted to electricity storage.	resolved by rewrite
Michael Power (University College Dublin)	8	30	21	30	24	-	-	-	This is an unusual comparison. I've never heard of a storage facility being built to provide reactive power.	resolved by rewrite
United States (U.S. Department of State)	8	30	19	-	-	-	-	-	Unless there are specific constraints in place at the RE location, storage is likely to be more cost effective as a power system resource rather than being linked to a specific RE plant.	resolved by rewrite
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	30	15	30	35	-	-	-	Various new studies compare the energy storage potential of a range of alternatives (including pumped hydro and compressed air) and conclude that hydrogen, especially if stored compressed in underground caverns, offers storage capacities exceeding the ones of most alternatives by far, and at competitive costs. The studies point to the advantages of hydrogen especially where seasonal storage of large volumes of fluctuating energy is concerned. Hydrogen caverns and related infrastructure are currently operated in the USA (Gulf Coast) and the UK (Teesside). Three (out of more) relevant studies are referenced in the following: 1) Verband der Elektrotechnik Elektronik Informationstechnik [VDE] (2008): Energiespeicher in Stromversorgungssystemen mit hohem Anteil erneuerbarer Energieträger: Bedeutung, Stand der Technik, Handlungsbedarf, Dezember; 2) BMWi-Auftragsstudie 08/28 (2009): Stand und Entwicklungspotenzial der Speichertechniken für Elektroenergie ζ Ableitung von Anforderungen an und Auswirkungen auf die Investitionsgüterindustrie, June; 3) NREL (2009): Technical Report NREL/TP-560-46719, Lifecycle Cost Analysis of Hydrogen Versus Other Technologies for Electrical Energy Storage, November. None of the three studies has been considered in the IPCC draft report.	relevant, considered in rewrite process of 8.2.1
Hannele Holttinen (VTT)	8	30	19	-	-	-	-	-	what is the point in making the storage close to RE generation? Only if bad transmission bottlenecks. Storage has a point if there are price differences, and RE will most probably increase these.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	30	38	-	-	-	-	-	When is storage integration unbeneficial? Do you mean to say that there are several examples when storage has been built into integration systems for specific purposes (though not always cost-effectively)?	resolved by rewrite

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Paul Smith (University College, Dublin)	8	30	22	30	24	-	-	-	Why would storage technologies be deployed just to stabilise voltage? In fact devices such as Stacoms do use capacitors as very short term energy stores.	resolved by rewrite
Michael Power (University College Dublin)	8	30	2	-	-	-	-	-	Word required between "expensive," and "point-to-point".	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	30	27	-	-	8.2.1.6.1	-	-	Above-ground compressed air energy storage (CAES) can be less site-specific than conventional underground CAES, though the technology is less mature and typically is smaller in scale	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	30	16	30	18	8.2.1.6.1	-	-	Incorrect!!! Electricity can be stored in a battery, flow battery, or capacitor as electrons, albeit generally on a distributed generation scale (1kW ~ 5 MW)	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	30	36	30	37	8.2.1.6.1	-	-	It is not accurate to mention ""It is uncertain which, if any, of the alternative energy storage systems could eventually become commercially viable"". Some of the energy storage technologies, e.g., lead acid battery, pumped hydro, have been well commercialized	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	30	26	-	-	8.2.1.6.1	-	-	Reservoir-hydro' can be more site-constrained than 'pumped-hydro', though with lower cost when available	resolved by rewrite
ICHIRO MAEDA (The Federation of Electric Power Companies of Japan)	8	30	-	-	-	-	-	8.1	<comment> Sodium Sulfur (NAS) battery should be added. <reason> Nowaday around 310MW of Sodium Sulfur batteries are installed globally. <reference> NGK Insulators, LTD., <a href="http://www.ngk.co.jp/english/products/power/nas/index.html">http://www.ngk.co.jp/english/products/power/nas/index.html</a>	relevant, considered in rewrite process of 8.2.1
Kristin Seyboth (IPCC WG III TSU)	8	30	-	-	-	-	-	8.1	Costs in table will need to be converted to 2005 US\$	resolved by rewrite
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	30	-	-	-	-	-	8.1	Energy density per volume is for stationary storage a more applicable parameter than energy density per mass unit kg. Hydrogen to be included. Hydrogen storage: Power rating: 50MW - 1000MW; Discharge time: Days - weeks, Cost: 1100 USD/kW, Energy density: 30 - 300 kW/m <sup>3</sup> , Life years: > 20	resolved by rewrite
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	30	-	-	-	-	-	8.1	Reconfirm the values in this table, especially Cost. It's too cheap. And add the cost of battery per capacity (kWh).	resolved by rewrite

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Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	30	31	-	-	-	-	8.1	Table 8.1: Electrolysis for production of hydrogen, syngas and other fuels should be mentioned in this table	relevant, considered in rewrite process of 8.2.1
Emmanuel Branche (Electricité de France)	8	30	-	-	-	-	-	8.1	The maturity for all presented technologies is different. It could be relevant to add a maturity column. Discharge time is not correct for pumped hydro	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	30	-	-	-	8.2.1.6.1	-	8.1	Specify assumptions for number of cycles (e.g., Depth of Discharge, temperature); Better to cross-check the numbers for accuracy with data from other reliable and well-known references (e.g., Electricity Storage Association, Advanced Automotive Batteries (AABC)). For example, 200-500 Wh/kg energy density for lithium ion batteries seems high. 100-250 Wh/kg is normally reported.	resolved by rewrite
Peter Børrre Eriksen (Energinet.dk)	8	31	16	-	-	-	-	-	"..is the time shifting of ζ". I don't remember this as the normal use of the word DR. Check.	resolved by rewrite
Peter Børrre Eriksen (Energinet.dk)	8	31	9	-	-	-	-	-	"distributed energy systems". Not limited to distributed systems.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	31	15	-	-	-	-	-	"In isolated power systems with high RE penetration there is a greater need for dedicated energy storage" No, storage should ALWAYS be seen as a SYSTEM issue and NOT for a certain plant. This is the same strategy, no matter the size of the system (small-isolated or multi-national)	resolved by rewrite
ICHIRO MAEDA (The Federation of Electric Power Companies of Japan)	8	31	16	31	18	-	-	-	<comment> Demand response (DR) is the time-shifting of power demand in response to an institutional incentive to improve demand/supply balance by responding to variations in RE generation. The power demand ... could all become responsive. -> Insert "by simply responding to Time of Use rate, or" between "demand/supply balance" and "by responding to variations in RE generation." -> Add "To which of Time of Use rate or variations in RE generation power demand is to be respond has to be studied carefully based on customers' allowance and cost-effectiveness; the former reponse requires less installation cost than the latter." after "could all become responsive." <reason> Time of Use rate can contribute to time-shifting and might be enough to offset supply/demand imbalance due to surplus wind generation at night by shifting peak demand to night.	resolved by rewrite

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Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	31	18	31	23	-	-	-	Also electrolyzers (producing hydrogen) could be used to reduce peak loads and are important elements of wind-hydrogen-systems.	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	31	24	31	24	-	-	-	Choose "s" or "z" for the words centralised or decentralised	resolved by rewrite
Hannele Holttinen (VTT)	8	31	29	-	35	-	-	-	clarify or remove	resolved by rewrite
Michael Power (University College Dublin)	8	31	9	31	10	-	-	-	Could the second part of this sentence starting with "depending on battery" be removed?	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	31	45	32	12	-	-	-	Except for bullets #4 and #6, list is in large part summarizing the technical options outlined in 8.2.1.6.1. To reduce repetition and focus on institutional approaches in this section, perhaps summarize these points in one bullet, e.g. "Target engineering options outlined above with decisive, long-term planning".	resolved by rewrite
Hannele Holttinen (VTT)	8	31	17	-	-	-	-	-	institutional incentive not clear language here (remove)	resolved by rewrite
Paul Smith (University College, Dublin)	8	31	37	31	41	-	-	-	It is far from clear what message these sentences are trying to convey.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	31	4	-	-	-	-	-	It is stated "to add value by improving RE generation predictability in order to obtain higher tariffs (e.g. wind for pumped-hydro to enable power to be dispatched during peak periods)" It is not clear if you mean that one should have a dedicated pumping power plant to balance some wind power. It is NEVER rational from the system point of view to have dedicated storage!	resolved by rewrite
Hannele Holttinen (VTT)	8	31	38	-	41	-	-	-	long sentence make two: industries. Also in competitive industries (markets?) regulation will be needed as advisory functions.	resolved by rewrite
United States (U.S. Department of State)	8	31	13	-	-	-	-	-	O'Malley 2008 reference appears to be missing from references.	resolved by rewrite
Hannele Holttinen (VTT)	8	31	4	-	5	-	-	-	point is price differences - and RE will increase them	resolved by rewrite
Hannele Holttinen (VTT)	8	31	17	-	-	-	-	-	remove by responding to variations in RE generation	resolved by rewrite
Hannele Holttinen (VTT)	8	31	15	-	-	-	-	-	remove dedicated	resolved by rewrite
Hannele Holttinen (VTT)	8	31	37	-	38	-	-	-	remove first sentence of 8.2.1.6.2	resolved by rewrite
Hannele Holttinen (VTT)	8	31	18	-	-	-	-	-	remove water or put to parenthesis electric (water) heaters	resolved by rewrite
United States (U.S. Department of State)	8	31	17	31	42	-	-	-	Replace the word "to" on page 31 line 17 with "that can." On line 42, delete "can" after "decision-making" and substitute "are necessary to."	resolved by rewrite

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Hannele Holttinen (VTT)	8	31	24	-	28	-	-	-	Spain/Portugal experience here with their energy management centres is very important (I would propose to add Iberian peninsula as one example of integration in 8.2.1.5, also pumped hydro increases planned there)	resolved by rewrite
United States (U.S. Department of State)	8	31	6	-	-	-	-	-	The mini-grids are more likely to use natural-gas fired peaking engines instead of back-up diesel engines. The fuel is both cheaper and cleaner; and because it's cleaner, air permits are less subject to emission constraints as compared to diesel engines.	resolved by rewrite
United States (U.S. Department of State)	8	31	17	-	-	-	-	-	The purpose of DR is not only to respond to fluctuations in RE generation. This is just one of multiple purposes. Also, in this section, it would make sense to briefly discuss the impact of smart grid technologies on the DR potential.	resolved by rewrite
Brazil (Ministry of Science and Technology)	8	31	13	-	-	-	-	-	The reference ""O'Malley, 2008"" is missing in the reference list.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	31	24	31	35	-	-	-	there seems to be a mixing up of the two issues of decentralized energy management and decentralized generation.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	31	16	31	23	-	-	-	There should be more information given on demand side management - technological prerequisites, objectives, costs, and incentive schemes.	resolved by rewrite
Paul Smith (University College, Dublin)	8	31	42	32	12	-	-	-	These bullet points should form the core of 8.2.1.6. They are universally applicable and address technical, commercial and regulatory issues. 8.2.1.6 should be completely re-written around these points.	resolved by rewrite
Paul Smith (University College, Dublin)	8	31	16	31	17	-	-	-	This is an inadequate and restrictive description of demand response.	resolved by rewrite
Hannele Holttinen (VTT)	8	31	42	32	12	-	-	-	This list now overlaps with the engineering section. Only list the clearly institutional aspects here.	resolved by rewrite
Paul Smith (University College, Dublin)	8	31	29	31	35	-	-	-	This paragraph is largely irrelevant to the integration of renewables.	resolved by rewrite
Paul Smith (University College, Dublin)	8	31	24	31	28	-	-	-	This sentence doesn't make sense, and needs to be re-written.	resolved by rewrite
Michael Power (University College Dublin)	8	31	14	31	15	-	-	-	This statement re isolated power systems must be supported by a citation or supporting text.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	31	25	-	-	-	-	-	What is 'system monitoring of energy management'? I.e. what does centralized or decentralized energy management entail exactly that will help integrate increasing levels of RE?	resolved by rewrite

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Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	31	18	31	20	8.2.1.6.1	-	-	add air conditioning, cooling houses	resolved by rewrite
Greece (National Observatory of Athens)	8	31	26	-	11	8.2.1.6.1	-	-	The main services that a wind energy storage system can provide to the present electricity systems relate to (i) the avoidance of transmission curtailment when the wind power is constrained by the transmission lines capacity (ii)time shifting to store energy generated during the periods of low demand for discharge during periods of high demand,(iii) grid frequency support for a short period, giving the necessary power for the frequency stability and (iv) voltage stabilization support.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	31	-	32	-	8.2.1.6.2	-	-	In this section, institutional options are not clearly outlined. Based on the text, it seems that the main institutional options are: 1) systematic and coherent decision making (toward technical/engineering options outlined above); 2) improved market design; 3) coordination of supporting policies; and 4) support mechanisms to provide local incentives. Section could be restructured to clearly focus on and explain these options.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	31	-	32	-	8.2.1.6.2	-	-	Missing any discussion of intra-day markets for cross-border trade, which is outlined on p. 35, line 42 as 'of key importance for market efficiency'	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	31	-	31	-	8.2.1.6.2	-	-	The title is relevant, i.e. to discuss institutions and markets, but there are many items in this subsection that do not relate to this. There is a discussion on, e.g. ramping, voltage control, demand response, transmission extension, etc. I assume that you mean that "institutions and markets" must handle this, but that is rather unclear in the text. With this title one expects some conclusions at the end such as "increase the size of the control areas", "design the market so the units with lowest operation costs will always be used, no matter ownership, country etc" What are the conclusions / recommendations?	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	32	16	-	18	-	-	-	"non-storable" probably means "variable" (or something else?) You refer to "similar conclusions were made" but then one expects a reference.	resolved by rewrite
Peter Bøvre Eriksen (Energinet.dk)	8	32	29	-	-	-	-	-	"speculative". I suggest to let this word out of the text.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	32	16	32	18	-	-	-	A reference to the Australian case study would be useful here	resolved by rewrite
Hannele Holttinen (VTT)	8	32	31	-	38	-	-	-	add to list using all flexibility available in generation units - and improving these where technically possible	resolved by rewrite
Hannele Holttinen (VTT)	8	32	26	-	27	-	-	-	clarify - this should be explained in a more concrete way	resolved by rewrite

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Paul Smith (University College, Dublin)	8	32	32	-	-	-	-	-	-	DLR 2005 is an irrelevant reference. What does "being planned" mean? The fact that one or more agencies suggest something cannot be taken to mean it is "being planned".	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	32	37	32	38	-	-	-	-	How is providing incentives for building flexible generation capacity part of future power systems design? Suggest to delete this and reword the bullet as follows: 'market structures that combine balancing solutions'	resolved by rewrite
Michael Power (University College Dublin)	8	32	8	-	-	-	-	-	-	I would include "control" in this bullet point.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	32	39	-	46	-	-	-	-	It seems to be the same type of text again? Why is it needed here again?	resolved by rewrite
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	32	38	-	-	-	-	-	-	Line 38: Somewhere it should be mentioned that there is a need for considerable welfare gains to motivate the end-user to use peak electricity production from wind. This could be obtained by switching to percentage-type of additives, variable grid payment according to grid loads, variable tariffs and taxes as methods for stimulating flexible demand and demand shifting.	resolved by rewrite
Hannele Holttinen (VTT)	8	32	20	-	-	-	-	-	-	need for more cross border interconnection - this is result for many wind integration studies	resolved by rewrite
Hannele Holttinen (VTT)	8	32	41	33	4	-	-	-	-	no list of challenges is needed anymore at this section but visions for solutions (perhaps the last bit on smoothing could be moved to previous section, note subhourly variations relatively smaller than hourly variations)	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	32	44	33	1	-	-	-	-	Sentence beginning "Specific technical challenges <sub>2</sub> " - how do these challenges relate to those presented in 8.2.1.3? Recommend assuring that these points are included in 8.2.1.3 and including a simple reference here to all technological challenges. There is no need to list them all again here.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	32	22	32	25	-	-	-	-	Sentence beginning "It has been suggested <sub>2</sub> " outlines challenges. It therefore belongs in 8.2.1.3, not here in options.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	32	17	32	18	-	-	-	-	similar conclusions were reached' - to what conclusions does this refer? Do you mean to say ' <sub>2</sub> showed that long-term planning to incorporate RE can be successful in assuring increased penetration of RE'?	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	32	29	-	-	-	-	-	-	The term "speculative approaches" is used. But I do not see so many radical proposals. The proposals are in many ways more standard modern solution. "speculative" seems to mean that one do not know if the work?	resolved by rewrite
Paul Smith (University College, Dublin)	8	32	19	32	27	-	-	-	-	This material is largely repetitive. As stated in comment 132 above, 8.2.1.6 must be completely re-written in a more logical and objective manner.	resolved by rewrite

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Paul Smith (University College, Dublin)	8	32	13	32	14	-	-	-	This statement is based on the Tradewind report which refers specifically to Europe. It is inappropriate to quote 20% as a break point or the need for "new" directions for the design and operation of a power system and electricity markets without making it clear that this observation refers specifically to Europe. The citation should be changed to the final TradeWind report, if it is retained at all. The principal author and project co-ordinator is technical advisor to a major lobby group with respect to renewable energy. It would be preferable to quote more objective sources.	resolved by rewrite
Hannele Holttinen (VTT)	8	32	40	-	-	-	-	-	wave and tidal relevant to mention here?	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	32	1	-	-	8.2.1.6.2	-	-	Might define 'reversible energy storage'.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	33	19	-	-	-	-	-	"Power systems can benefit from the aggregation of a large number of different generation resources": It must be clearly stated in what way this is connected to RE. For variable RE (wind, solar, tide) the value is very limited, since one should always produce as much as possible. "aggregation" normally means "control". It is correct that one, e.g., can down-regulate wind power, but it is not an attractive solution.	resolved by rewrite
Hannele Holttinen (VTT)	8	33	12	-	-	-	-	-	could --> should or will	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	33	1	33	4	-	-	-	Discussion of aggregation effect is also covered in more detail lower down on the page (lines 19-25), though in another section, as well as on p. 14 line 31-34. Recommend compiling the discussion in one specific place. At the very least, it should be decided if aggregation effects should appear in the section 'integration of large scale RE' or 'distributed generation'.	resolved by rewrite
United States (U.S. Department of State)	8	33	10	-	-	-	-	-	Page 33 line 10 replace "taking over from" with "displacing." In line 11 replace "unlikely to happen" with "may not happen."	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	33	2	33	4	-	-	-	Please be more specific here! If a knowledge gap and requirement for further research exists here, than define it clearly. State which effects occur on a time scale below hourly resolution, and explain the merits of studies that examine time series with such high resolutions.	resolved by rewrite
Paul Smith (University College, Dublin)	8	33	19	33	20	-	-	-	Power systems do benefit from aggregation. That is why interconnected power systems exist throughout the world.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	33	25	34	13	-	-	-	Recommend cutting the smart-grid discussion to p. 34 line 28/29, and keeping the entire discussion on smart-grids together. It is currently scattered throughout the section in a way that is confusing to the reader.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	33	6	33	7	-	-	-	Reference to 8.2.1.1 would be useful here.	resolved by rewrite

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Dara O'Sullivan (University College Cork)	8	33	6	35	7	-	-	-	The vision of a future distributed generation based network should incorporate the provision for deliberate islanding of sections of the network in order to enhance overall system stability and avoid system blackout in extreme situations.	resolved by rewrite
Paul Smith (University College, Dublin)	8	33	20	33	22	-	-	-	This is a questionable assertion, and it is certainly not universally true. The Awerbuch 2006 citation is incomplete.	resolved by rewrite
Hannele Holttinen (VTT)	8	33	27	-	-	-	-	-	to use all flexibility and this can be enhanced by deploying innovative and effective $\zeta$ .	resolved by rewrite
Seppo Hänninen (VTT)	8	33	19	35	7	8.2.1.6.3	-	-	The aggregator role should be illustrated more clearly in the future smart gridsa	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	33	-	35	-	DG	-	-	In the section "distributed generation" I think one have to clearly state when this is relevant for Renewable energy. A lot of the discussion concerning DG is often when natural gas is available, which is a controllable, non-RE source.	resolved by rewrite
Paul Smith (University College, Dublin)	8	34	31	35	2	-	-	-	A statement such as this cannot be made unless it is clearly understood what a smart grid is. An assertion like this must be supported by a citation, if one exists.	resolved by rewrite
Hannele Holttinen (VTT)	8	34	21	-	22	-	-	-	At this stage $\zeta$ clarify this sentence or remove. Point out the TSO/DSO interface and collaboration will be needed and re-thought.	resolved by rewrite
Hannele Holttinen (VTT)	8	34	29	-	-	-	-	-	clarify harmonising load demand	resolved by rewrite
Mark Fulton (Deutsche Asset Management, Deutsche Bank)	8	34	5	34	13	-	-	-	Note: in the US the American Recovery and Reinvestment Act (ARRA) funneled some \$20 billion into smart grid investments; China and Korea, too, are rapidly deploying smart grids	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	34	18	-	26	-	-	-	On both line 18 and 26 there is a discussion of "dynamic loads". Please check the whole text in order to have a structure concerning where to write about this.	resolved by rewrite
Michael Power (University College Dublin)	8	34	23	-	-	-	-	-	Replace "excited" by "triggered".	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	34	8	34	8	-	-	-	Replace "programme" by "program"	resolved by rewrite
Paul Smith (University College, Dublin)	8	34	21	-	-	-	-	-	See previous comments about the use of the term TSO.	resolved by rewrite

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Paul Smith (University College, Dublin)	8	34	5	34	6	-	-	-	The EU is a political institution. It is incorrect to say that it has been investigating anything. If something is to be said about the European Technology Platform "SmartGrids" it should reference the platform's own publications. (see www.smartgrids.eu) The platform has set out a vision, a strategic research agenda, and a strategic deployment document for future electricity networks. This is not "investigation". Research work in Europe into the elements of a future electricity network has been in progress since well before 2005.	resolved by rewrite
Paul Smith (University College, Dublin)	8	34	26	34	28	-	-	-	this is far from certain. Use "may" rather than "will"	resolved by rewrite
Hannele Holttinen (VTT)	8	34	5	-	13	-	-	-	this text is not necessary, some of it can be merged to following text	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	34	27	34	28	-	-	-	to achieve improved environmental sustainability'. You can't assume that environmental sustainability is the driver in every case for integrating RE. Suggest deleting phrase.	resolved by rewrite
Seppo Hänninen (VTT)	8	34	-	34	-	-	8.11	-	The figure 8.11 should be replaced with new figure which illustrates better of operation of future smart grid.	resolved by rewrite
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	34	-	34	-	-	Figure 8.11	-	Energy storage will be applied at all voltage levels	resolved by rewrite
Peter Børre Eriksen (Energinet.dk)	8	35	18	35	19	-	-	-	"of possible borders". Unclear to me.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	35	4	-	-	-	-	-	"Virtual Power Plant" is mainly of interest when one wants to control. It has mainly been discussed concerning controllable power plants, which means a limited amount of RE applications, especially when one study variable RE. But, e.g., bio-gas plants could be of some interest (perhaps???)	resolved by rewrite
Peter Børre Eriksen (Energinet.dk)	8	35	29	-	-	-	-	-	1730 million dollars per year?	resolved by rewrite
United States (U.S. Department of State)	8	35	8	-	-	-	-	-	Comment p. 35 line 8: The addition of more case studies to this chapter distracts from key points that can be made about integration of RE. Put case studies in an appendix with references to them as appropriate, or in separate chapter. (In earlier comments, this review group has advocated putting case studies into appendix form.)	resolved by rewrite
Morgan Bazilian (UNIDO)	8	35	8	-	-	-	-	-	I would be very careful with this section in an IPCC report.	resolved by rewrite
Michael Power (University College Dublin)	8	35	18	-	-	-	-	-	Not sure what "grid dimensions" are. Should this be "grid capacity"?	resolved by rewrite

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United States (U.S. Department of State)	8	35	27	35	30	-	-	-	Page 35 lines 27-30, one U.S. utility executive reviewer found these savings figures to be unrealistically high.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	35	27	-	-	-	-	-	phased upgrade of 42 inter-connectors': is that what the study recommended as a solution to be able to manage 300 GW of wind, or was this one option that was examined in the model? I.e. from where does this statement originate?	resolved by rewrite
Michael Power (University College Dublin)	8	35	29	-	-	-	-	-	Should "1730/yr" be "1730M/yr"? Would it be better to express all figures in this line in billions?	resolved by rewrite
Hannele Holttinen (VTT)	8	35	20	-	-	-	-	-	state wind penetration as % of gross demand	resolved by rewrite
Paul Smith (University College, Dublin)	8	35	13	-	-	-	-	-	The acronym IEE needs to be explained.	resolved by rewrite
United States (U.S. Department of State)	8	35	8	-	-	-	-	-	The selected case studies are heavily Europe dominated. Could case studies from other parts of the world be included?	resolved by rewrite
United States (U.S. Department of State)	8	35	30	-	-	-	-	-	The text should clarify exactly what this \$25.4 billion investment obtained, and exactly what was justified.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	35	5	35	7	-	-	-	VPP discussion could use it's own paragraph.	resolved by rewrite
Michael Power (University College Dublin)	8	35	-	-	-	8.2.1.6.4	-	-	As with 8.2.1.5, I think a summary of the case studies would be very helpful.	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	35	42	-	-	8.2.1.6.4	-	-	Briefly explain 'intra-day markets' concept in a footnote	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	35	29	-	-	8.2.1.6.4	-	-	Change US\$(2005)1730/yr to US\$(2005) 1730 million/yr	resolved by rewrite
Peter Børre Eriksen (Energinet.dk)	8	36	18	36	19	-	-	-	"16 % share, 80 % in 2050". These figures seem not to be in agreement with line 14: "15 % of Europe..".Check.	resolved by rewrite
Hannele Holttinen (VTT)	8	36	16	-	-	-	-	-	clarify that hydro and wind not part of desertecproject/ investment	resolved by rewrite
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	36	10	37	26	-	-	-	Delete the section on Desertec. It's only a vision and unsubstantial.	resolved by rewrite

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Michael Power (University College Dublin)	8	36	16	-	-	-	-	-	I think the "and" in this line can be removed.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	36	31	37	3	-	-	-	It is not necessary to describe the experience of one Desertec partner. Suggest deleting these lines.	resolved by rewrite
United States (U.S. Department of State)	8	36	5	-	-	-	-	-	Page 36 Line 5 ¿ Dollar reference of 300 is incomplete. Millions? We have the same comment with respect to page 35 line 29, figure of 1730 per year.	resolved by rewrite
Michael Power (University College Dublin)	8	36	13	36	14	-	-	-	Replace "to produce" with "of producing".	resolved by rewrite
Ernst Rauch (Munich Reinsurance Company (Munich Re))	8	36	11	30	17	-	-	-	replace lines 11-17 with: ""The Dii GmbH (often referred to as ¿Desertec Industrial Initiative¿) was initiated in 2009 by Munich Re (Munich Reinsurance Company) and the DESERTEC Foundation (DF) to accelerate the industrial rollout of the DESERTEC concept, which was formulated since 2003 by the Club of Rome ¿- a global think tank - and TREC (Trans-Mediterranean Energy Cooperation). The Dii GmbH started as a consortium of 12 German, Spanish and Algerian industrial partners together with the DF as a non-governmental organization (NGO) and plans to increase the number of shareholders to some 20-25, with all additional owners coming from either southern European, North African or Middle East countries. The concept aims to harness solar energy from the desert areas of Middle East and North Africa (MENA) using solar or wind power and inter-connect these plants with hydro generation plants and other sources of renewable energies (Fig. 8.12).""	resolved by rewrite
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	8	36	11	-	-	-	-	-	This is wrong. The "Desertec Foundation" was initiated in 2003. The "Desertec Industrial Initiative" in 2009, like it is written in the next line.	resolved by rewrite
Paul Smith (University College, Dublin)	8	36	10	37	26	-	-	-	While this Desertech case study may be interesting, it offers no new insights on the issue of integration and so should not be included.	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	36	1	-	-	8.2.1.6. 4	-	-	Check if '1.15-2.30 billion /yr' really refers to savings of system cost, not actually operational savings	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	36	5	-	-	8.2.1.6. 4	-	-	Check units for 'US\$(2005) 300 /yr reduction'	resolved by rewrite

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Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	36	11	36	14	8.2.1.6.4	-	-	Distinction between Desertec Foundation (2003) founded by Club of Rome and Desertec Industrial Initiative (DII, 2009) founded by 12 industrial companies; Foundation is partner in DII; An important objective of DII is also to provide RE for the local demand	resolved by rewrite
Trevor Demayo (Chevron Energy Technology Cvo.)	8	36	14	36	19	8.2.1.6.4	-	-	If Europe's goal is to produce 15% of EU's electricity by 2050, then explain why the project is aiming for 80% RE.	resolved by rewrite
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	36	21	36	21	8.2.1.6.4	-	-	replace curved solar mirror with parabolic trough	resolved by rewrite
China (China Meteorological Administration)	8	36	10	37	26	8.2.1.6.4	-	-	This sentence should be deleted since it is only very preliminary concept project. Lack of sound evidence.	resolved by rewrite
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	36	5	36	5	8.2.1.6.4	-	-	USD 300 /yr reduction in operational costs: Seems to be the wrong order of magnitude	resolved by rewrite
Peter Børre Eriksen (Energinet.dk)	8	37	46	-	-	-	-	-	"to compare the model results using real power plant output data". Compare with WHAT? unclear !	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	37	6	37	9	-	-	-	Assure that all MWh/TWh figures are presented in EJ (SRREN standard)	resolved by rewrite
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	8	37	27	38	2	-	-	-	It would be helpful if the VPP is not only discribed but there would also be a figure about the size. In the report single examples and case studies were mentioned in many occasions. But these small scale test solutions are sometimes not to be transformed 1:1 for the needed solutions on the large-scale basis.	resolved by rewrite
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	8	37	-	-	-	-	-	-	Line 18: The security of supply aspect should be discussed in connection with intercontinental projects like this "Desertec"	resolved by rewrite
Hannele Holttinen (VTT)	8	37	1	-	7	-	-	-	perhaps this text better to CSP chapter	resolved by rewrite
Juan Llanes (Centre for Environmental Studies)	8	37	27	-	-	-	-	-	Please provide costs references or information for developing and operation of vpp.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	37	30	-	-	-	-	-	The acronym VPP has already been introduced in Ch. 8, p. 35. Do not need to reintroduce it here.	resolved by rewrite

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Brazil (Ministry of Science and Technology)	8	37	7	-	-	-	-	-	The reference ""IEA, 2009a"" is missing in the reference list.	resolved by rewrite
Paul Smith (University College, Dublin)	8	37	27	39	12	-	-	-	The renewable VPP concept is interesting, but it could be described in a single paragraph as a possible approach to integration, with an appropriate citation. It does not merit inclusion as a case study.	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	37	27	39	12	-	-	-	This concept is not easy to understand. Furthermore, is the German Renewable VPP only a model or has it been implemented	resolved by rewrite
China (China Meteorological Administration)	8	37	27	39	12	8.2.1.6.4	-	-	This case study should be simplified.	resolved by rewrite
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	8	37	28	37	29	8.2.1.6.4	-	-	Virtual Power Plant is a general concept and not limited to one project: delete "¿, an initiative of several German manufacturers of RE technologies,"	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	37	-	39	-	VPP	-	-	This is in general an interesting research project, but I do not think it should be mentioned here. The set-up is very strange with wind power spread out over a large area and it is said that they should supply only 12000 households in an area (Figure 8.13) where there must line more than 30 million inhabitants. If the wind power was more concentrated, the variation should be much higher. For a so large area, why should one have specific storage? One can absolutely not draw any general conclusions about this! All this kind of specific plants for specific consumers balanced with specific power plants, but still integrated in a large multi-national power system. I must say it is difficult to draw any general conclusions concerning that to be used in this report. If you do not agree, the text must be much clearer.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	38	28	-	29	-	-	-	"When supply exceeded demand, the surplus could be shed, stored or exported to neighbours through ENTSO-E.".Comment: "ENTSO-E" is not a grid, trader or a grid owner.	resolved by rewrite
United States (U.S. Department of State)	8	38	4	-	-	-	-	-	In the figure caption, what do the numbers (1-3), (4-23), (24-27) refer to? How do they relate to the figure.	resolved by rewrite
Peter B¿rre Eriksen (Energinet.dk)	8	38	6	11	-	-	-	-	It is unclear to me if anything in the model also took place for real (except for the pumped storage plant??	resolved by rewrite
Hannele Holttinen (VTT)	8	38	2	-	12	-	-	-	rewrite or remove	resolved by rewrite
Michael Power (University College Dublin)	8	38	28	38	29	-	-	-	This sentence isn't clear to me. Are there two cases be considered? When supply exceeds demand and vice versa?	resolved by rewrite

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Michael Power (University College Dublin)	8	38	-	-	-	-	8.13	-	This figure is difficult to understand. Could a more illustrative figure be used?	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	39	2	-	-	-	-	-	"Integration into electricity markets;" To what exactly are you referring here? Integration of new RE capacity into the existing electrical grid? Expanding and adding more transmission capacity? What exactly would the adequate payment system target?	resolved by rewrite
Peter Børre Eriksen (Energinet.dk)	8	39	17	39	19	-	-	-	"The Cell loads". Suggestion: "The cell consisted of existing distributed assets including wind turbines, local cogeneration units fired by biomass and natural gas and residential and commercial managed loads".	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	39	2	39	4	-	-	-	A reference to Ch. 11 section on FITs would be useful here. You could also reference Box 11.2, in which there is a discussion of the German FIT.	resolved by rewrite
Lennart Söder (KTH, Royal Institute of Technology)	8	39	1	-	12	-	-	-	Does this section also belong to the previous page?	resolved by rewrite
Michael Power (University College Dublin)	8	39	42	39	43	-	-	-	I would re-word the end of this line as follows: "developed to emphasise modularity and scalability..."	resolved by rewrite
Paul Smith (University College, Dublin)	8	39	14	40	13	-	-	-	In these paragraphs, the Danish TSO is referred to variously as Energinet, Energinet.dk and EnerginetDK. Energinet.dk is the correct version.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	39	1	39	2	-	-	-	Sentence "At higher penetrations; to balance production with demand." belongs with the paragraph above describing results of the model, not in this paragraph describing policy implications.	resolved by rewrite
Paul Smith (University College, Dublin)	8	39	14	-	-	-	-	-	the Danish TSO is Energinet.dk.	resolved by rewrite
Paul Smith (University College, Dublin)	8	39	17	39	21	-	-	-	This appears to be a description of a single "cell" and yet there is reference to "three areas of rural Denmark". Clarify.	resolved by rewrite
Paul Smith (University College, Dublin)	8	39	13	-	-	-	-	-	This heading is inadequate	resolved by rewrite
Paul Smith (University College, Dublin)	8	39	22	39	27	-	-	-	This introductory/background paragraph is misplaced	resolved by rewrite
Paul Smith (University College, Dublin)	8	39	14	40	13	-	-	-	This is an important description of a realisation of many aspects of what is generally understood as a Smart Distribution Network. It should be mentioned explicitly in a re-written 8.2.1.6.3	resolved by rewrite
Michael Power (University College Dublin)	8	39	18	-	-	-	-	-	Why is MWe used at this point? MW has been used throughout chapters 7&8.	resolved by rewrite

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Trevor Demayo (Chevron Energy Technology Cvo.)	8	39	4	-	-	8.2.1.6.4	-	-	What is 'EEG'?	resolved by rewrite
Peter Børre Eriksen (Energinet.dk)	8	40	9	-	-	-	-	-	"completion & redesigning" Suggestion: "completion of the project and thereby being able to further encourage the long-term process of redesigning"	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	40	37	40	38	-	-	-	Sentence "World annual data are uncertain" - data originates from 2004. Presumably district heat has grown considerably since 2004. Replace with more recent numbers.	Will look for newer data but can be hard. Will ask IEA
Michael Power (University College Dublin)	8	40	1	-	-	-	-	-	Should "attaining" be replaced by "implementing"?	resolved by rewrite
United States (U.S. Department of State)	8	40	13	-	-	-	-	-	The Danish Cell case study is a nice counter-weight to the centralized-control examples in the rest of this section. But the section would still benefit from a future directions discussion, which would specifically include the potential for more local autonomous grid operations at the distribution level.	Too detailed information for this report
Morgan Bazilian (UNIDO)	8	40	14	-	-	-	-	-	this section seems out of order.	Section restructured
Robert Pietzcker (PIK)	8	40	16	40	19	-	-	-	Try to express this more clearly e.g., A DHC network allows the transport of energy from one or several production centers to many demand centers. The energy carrier, usually, hot or cold water or steam, are pumped through insulated pipelines to supply space conditioners,	OK
Robert Pietzcker (PIK)	8	40	24	40	30	-	-	-	what is the point of this paragraph? Please clarify.	Moved to end of 8.2.2. and clarified
Trevor Demayo (Chevron Energy Technology Cvo.)	8	40	8	-	-	8.2.1.6.4	-	-	Energinet.dk?	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	40	-	-	-	8.2.2	-	-	Discussion of benefits is currently scattered throughout the section (e.g. p. 40 line 20, p. 41 line 10, p. 41 line 15, p. 42-43). It would be very helpful to reader if the entire discussion could be condensed and compiled in one specific subsection, presumably 8.2.2.5 under Benefits. See SRREN_SOD_TSU_Addendum_Ch08_Seyboth)	Benefits listed in final subsection

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Kristin Seyboth (IPCC WG III TSU)	8	40	16	47	-	8.2.2	-	-	The entire section could use a good, solid restructuring. (See details of recommended restructuring in SRREN_SOD_TSU_Addendum_Ch08_Seyboth) Heating/Cooling characteristics, challenges, options should be discussed throughout 8.2.2 in a consistent way. Recommend restructuring of sub-section headings as follows: 8.2.2.1 Characteristics 8.2.2.2 Features and structure 8.2.2.3 Challenges associated with integration into heating/cooling networks 8.2.2.3.1 Technological challenges 8.2.2.3.2 Institutional aspects 8.2.2.4 Options to facilitate integration into heating and cooling networks 8.2.2.4.1 Technological options for heating 8.2.2.4.2 Storage 8.2.2.4.3 Technological options for cooling 8.2.2.4.4 Institutional options 8.2.2.5 Benefits and costs 8.2.2.5.1 Benefits 8.2.2.5.2 Costs	Section restructured in line with proposal but with fewer sub-headings
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	40	14	49	21	8.2.2	-	-	The number of case study is too small. Add the explanation of DHC using underground water in Takasaki ( <a href="http://enec-n.energia.co.jp/enec_data/chikunetsu/heatpump/hp44/hp44-07.pdf">http://enec-n.energia.co.jp/enec_data/chikunetsu/heatpump/hp44/hp44-07.pdf</a> ), and DHC using steam generated from exhaust heat of incinerator in Tokyo. ( <a href="http://www.meti.go.jp/committee/materials2/downloadfiles/g90715b10j.pdf">http://www.meti.go.jp/committee/materials2/downloadfiles/g90715b10j.pdf</a> , Slide#13).	Space restrictions excludes more case studies
Kristin Seyboth (IPCC WG III TSU)	8	40	-	41	-	8.2.2.1	-	-	A section on the characteristics of heating/cooling generation should contain an explanation of the decentralized nature of heat/cool production - it is currently missing. Additional introductory text on the decentralized nature of heat generation is needed, ideally explaining the percent of global heat generation that is decentralized (e.g. in individual houses, buildings) and the percent that is centralized, in e.g. district heating and cooling networks. Unlike electricity, H/C has a very different nature of generation, this should be brought to the reader's attention	Reader is directed to 8.3.2 and heat density/urbanisation is mentioned here
Kristin Seyboth (IPCC WG III TSU)	8	40	-	-	-	8.2.2.1	-	-	Introduce current H/C technologies including electric boilers, ground-source heat pumps, district heating, natural gas boilers, oil boilers wood pellet boilers, etc, as reflected in Figure 8.16. here. Reader needs a general introduction to the H/C technologies available before they can consider how RE can be integrated into those systems. If you choose to focus the discussion of heat/cool on DHC, explain why here	heat sources per se is not integration issue but figure 8.15 has been moved up to be 8.14 and here heat sources are exemplified

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Kristin Seyboth (IPCC WG III TSU)	8	41	16	41	17	-	-	-	"This includes using electricity for heat pumps" should be deleted, as it contradicts the sentence prior that discusses DHC systems PROVIDING electricity. Heat pumps requiring electricity in order to provide heat, does not support that argument. Suggest rephrasing entire sentence to read "In cases where excess electricity is generated, electric boilers with thermal storage can be used for DH".	No, it can be geothermal heat pumps in DH systems
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	41	18	-	20	-	-	-	Create a new section on heat pump having high COP. Japanese heat pump for hot water "Eco-cute" has very high COP such as 3.0 (annually average).	Ch is about integration. No space to describe technologies
Kristin Seyboth (IPCC WG III TSU)	8	41	18	41	20	-	-	-	Sentence "Using electricity for producing, even more wasteful" could be deleted. Options to prevent spilling are discussed in 8.2.1, so it seems irrelevant to frame options for heat production around negative consequences of integrating RE into the electricity system.	Rephrased and moved: The option of spilling potential electricity from variable RE sources is economically wasteful
Kristin Seyboth (IPCC WG III TSU)	8	41	10	41	11	-	-	-	Suggest rephrasing sentence as follows: "A high overall system efficiency can be obtained by means of combined production of heat, cold and electricity, as well as the through diurnal and seasonal storage of heat and cold.	OK
Brazil (Ministry of Science and Technology)	8	41	14	-	-	-	-	-	The reference ""Euroheat & Power, 2006"" is missing in the reference list.	Werner 2006
Brazil (Ministry of Science and Technology)	8	41	9	-	-	-	-	-	The reference ""IEA, 2009b"" is missing in the reference list.	No, it is the IEA cities report
Brazil (Ministry of Science and Technology)	8	41	18	-	-	-	-	-	The reference ""Lund et al., 2010"" is missing in the reference list.	OK
Kristin Seyboth (IPCC WG III TSU)	8	41	-	42	-	8.2.2.2	-	-	This section should answer the question of what a typical or conventional DH system looks like. Here you only discuss where opportunities for RE exist, which should rather appear in 8.2.2.4. Would recommend cutting most of existing text to 8.2.2.4 and to focus here on features & structure of a typical DH system or DC system currently in place. A diagram to illustrate this would be useful. (See SRREN_SOD_TSU_Addendum_Ch08_Seyboth).	Figure 8.15 has been moved up and is good illustration of a DH system. Only difference is the heat sources. We also do not want to spend too much space describing basics.
Kristin Seyboth (IPCC WG III TSU)	8	41	-	-	-	-	8.14	-	Y-axis label needs to be changed to English decimal system (i.e. 4.00 not 4,00)	TSU will fix
Kristin Seyboth (IPCC WG III TSU)	8	42	10	-	-	-	-	-	"the potential is great" - please be more specific and use more scientific language. I.e. what exactly is 'great potential'?	OK

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Norway (Climate and Pollution Agency)	8	42	11	42	11	-	-	-	Chapter 5 should be changed to Chapter 4.	OK
Kristin Seyboth (IPCC WG III TSU)	8	42	11	-	-	-	-	-	geothermal is discussed in SRREN chapter 4, not chapter 5	OK
Kristin Seyboth (IPCC WG III TSU)	8	42	10	42	28	-	-	-	Please list technologies according to structure of the SRREN: i.e. 1st biomass, then solar, then geothermal unless there is some reason for listing otherwise (e.g. if geothermal is the preferred option). If there is another reason for the current listing structure, please state so.	OK
Ladislav Rybach (Geowatt AG Zurich (company))	8	42	11	-	-	-	-	-	The correct reference is [4], not Chapter 5.	OK
Robert Pietzcker (PIK)	8	42	22	42	24	-	-	-	what amount of energy is supplied by solar thermal? (either in absolute terms, or relative to the total heating energy used)	No data available. Important point here is the minimal current contribution
Richard Piwko (General Electric Company)	8	43	43	-	-	-	-	-	(usually an independent "operator", not regulator)	Don't understand, no line 43, can't find
Robert Pietzcker (PIK)	8	43	29	43	31	-	-	-	before, you used kWh, now you use J ; better stick to kWh all through this section	OK
Robert Pietzcker (PIK)	8	43	3	43	12	-	-	-	do you have any cost data for these storage methods? How much does heat storage for days cost compared to heat storage for months?	Looking for data, cost range will be provided
Robert Pietzcker (PIK)	8	43	24	43	27	-	-	-	how much cheaper will it become, in what time span?	Not possible to answer.
Robert Pietzcker (PIK)	8	43	14	43	19	-	-	-	is it kWh/m or kWh/m/year?	correct, per year
Kristin Seyboth (IPCC WG III TSU)	8	43	28	44	26	-	-	-	The way this section is currently written presents storage as an option, rather than a challenge. If it remains so, it should be moved to 8.2.2.4. Then, additional text should be written clarifying why storage for H/C can be problematic/challenging.	OK
Robert Pietzcker (PIK)	8	43	20	43	21	-	-	-	this line should belong to the last paragraph, and a line break should be inserted after ;systems;	Don't understand or agree with comment + the paragraph is split into different sections in restructured version
Robert Pietzcker (PIK)	8	43	4	43	7	-	-	-	what is the cost range for the distribution? ;large variations; has little informational value, better say something like xxx\$/km investment cost for piping or xxx\$/kWh distribution costs	No scientific literature on this point. Expert estimate for Swedish conditions is that distribution system alone may be about 10-20% of total cost to end-user
Kristin Seyboth (IPCC WG III TSU)	8	43	6	43	14	-	-	-	With this example you are only showing cases in which DH is competitive, but the other instances where it is not have been excluded - this could be considered as biased. Recommend presenting several e.g.'s of cost competitiveness of DH around the globe.	Not possible to do, but we will insert elsewhere data on DH expansion in China. This is real world data for Sweden and we don't build uncompetitive DH systems.

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Kristin Seyboth (IPCC WG III TSU)	8	43	-	-	-	8.2.2.3	-	-	Except for a very short discussion of heat distribution losses, this whole section is about costs. Recommend to cut most of the text to section 8.2.2.5 Benefits and costs.	OK
Kristin Seyboth (IPCC WG III TSU)	8	43	-	-	-	8.2.2.3	-	-	Technical challenges are clearly missing in text. Recommend completely rewriting 8.2.2.3. It should include a short discussion of CHALLENGES of storage, transmission of heating and cooling over distances, specific technical issues of incorporating RE into current system (e.g assuring a consistent biomass feedstock in terms of quality and production for co-firing)	OK, except for long distances. Issue of high density is mentioned
Kristin Seyboth (IPCC WG III TSU)	8	43	-	-	-	-	8.16	-	This is the first time that alternative heating options aside from DH have been presented. They should be presented in 8.2.2.1 or 8.2.2.2 as well, and ideally addressed throughout the section.	Don't see point of listing competition up-front (do other chapters?) The issue is mentioned at end of chapter
Trevor Demayo (Chevron Energy Technology Cvo.)	8	43	-	-	-	8.2.2.3	8.16	-	Do the heating costs include the up-front capital cost in piping networks for central DH options (as part of running costs)? If not, then the DH costs may be underestimating actual costs to end users.	Yes, up-front capital is included, has been clarified
Youba SOKONA (Sahara and Sahel Observatory)	8	45	32	45	34	-	-	-	Could you please give here some references?	IEA 2007 c but other references will be looked for
Robert Pietzcker (PIK)	8	45	20	45	30	-	-	-	interesting paragraph!	thanks
Kristin Seyboth (IPCC WG III TSU)	8	45	6	45	19	-	-	-	These lines discuss institutional options, rather than challenges. Suggest cutting to 8.2.2.4 under a new section for 'Institutional options'	8.2.2 restructured
Kristin Seyboth (IPCC WG III TSU)	8	45	32	45	38	-	-	-	This text should be cut to characteristics 8.2.2.1	No, not characteristics of DHC but of building energy use
Kristin Seyboth (IPCC WG III TSU)	8	45	42	45	43	-	-	-	Would recommend cutting this text describing location of DC systems to 8.2.2.2 just following the discussion of the location of DH systems.	Has new place in restructured version
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	45	1	-	1	8.2.2.3.2	-	-	8.2.2.3.1 -> 8.2.2.3.2	OK
Kristin Seyboth (IPCC WG III TSU)	8	46	35	-	-	-	-	-	Again, please list RE technologies in the same order as the SRREN chapters: biomass, solar, geothermal, etc.	OK
Australia (0)	8	46	35	46	44	-	-	-	All acronyms should be spelt out in their first occurrence, eg. DHC, CHP.	OK
Kristin Seyboth (IPCC WG III TSU)	8	46	26	46	33	-	-	-	Geothermal options weren't included in the list above (p. 46 lines 6-15). If it is a viable option, it should be included in the list.	Yes it is
Christoph von Stechow (IPCC WGIII TSU)	8	46	39	46	40	-	-	-	High penetration may become a problem, if the capacity factor decreases with increasing penetration levels.	Issue has been noted in relation to solar

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Ichiro Maeda (Federation of Electric Power Companies, Japan)	8	46	46	47	2	-	-	-	Suggest noting opposite case of Spain in which subsidies were necessary and further created an unsustainable bubble for solar production. Reference file: SRREN_Draft2_Review_Maeda_Ichiro_VanErp091006GabrielCalzadaReport_02.pdf	Spain example mainly for electricity, and in addition this is an issue for Ch 11
Kristin Seyboth (IPCC WG III TSU)	8	46	3	46	15	-	-	-	This list is very helpful to the reader - recommend presenting something similar for heat.	Included reference to heating
Trevor Demayo (Chevron Energy Technology Cvo.)	8	46	30	46	30	8.2.2.4	-	-	Delete the following sentence ""Vertical bores enable heat to be drawn out in the winter and concentrated within a building by a heat pump to reach the necessary temperature""	OK
Anca-Diana Barbu (European Environment Agency)	8	46	26	46	33	8.2.2.4	-	-	The paragraph implies that any heat pump can be considered renewable. In Europe, the renewables directive states that ""Only heat pumps with an output that significantly exceeds the primary energy needed to drive it should be taken into account [in calculating the renewable target]"". Work is on going in the Eurostat to better define how the contribution from heat pumps can be taken into account to meet the renewable target. For the text of the directive please see <a href="http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF">http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF</a> .	No space to elaborate details on HP RE
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	47	30	-	30	-	-	-	8.6.2.2.2 -> 8.2.2.6.2	OK
Robert Pietzcker (PIK)	8	47	41	48	11	-	-	-	interesting paragraph!	thanks
Kristin Seyboth (IPCC WG III TSU)	8	47	31	47	32	-	-	-	Sentence is confusing to reader. Suggest rephrasing as "District heating in Sweden expanded rapidly between 1960 and 1985. Prior to the 2nd oil crisis in 1979, Sweden was dependent on oil for the production of heat.	OK
Robert Pietzcker (PIK)	8	47	25	47	27	-	-	-	this number seems very high compared to normal heating costs (4-7cts/kWh for gas heating) ¿ is it correct? Are there subsidies?	Case study is presented as demonstration of advanced high share solar. Cost is correct
Kristin Seyboth (IPCC WG III TSU)	8	47	-	-	-	8.2.2.6.1	-	-	What is the time-line for this system? I.e. when will it be finished? Is there not a real-world, existing example that could be used in place of this case study?	Built in 2008, facts will be checked and confirmed
Robert Pietzcker (PIK)	8	48	13	48	20	-	-	-	please state some cost numbers for these DH networks	Not available
Robert Pietzcker (PIK)	8	48	21	48	26	-	-	-	this sounds like information from the company website, mixed with advertisement. Please reformulate.	Korea case will be replaced by a Chinese case study
Robert Pietzcker (PIK)	8	48	39	48	46	-	-	-	what is the load factor of this DH network? What is the resulting \$/kWh cost?	Information not available

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United States (U.S. Department of State)	8	49	22	63	30	-	-	-	Comment p. 49, line 22, p 63, line 30: Section 8.2.3 This section seems misplaced and more detail than useful. It may detour a reader from reading all of it. Consider moving discussions on the nature of these fuels to the Bioenergy chapter and limit discussion to basic integration aspects. No comments through Section 8.2.5. Not sure why so much discussion of these topic in this section.	It has been decided that system integration related technical issues are to be discussed in Chapter 8; hence, the level of detail.
Marc Darras (GDF SUEZ)	8	49	28	-	32	-	-	-	High pressure transmission pipelines (40-70 bar) go between the production plant and the distribution network, passing over public land and third party properties, while distribution pipelines, including main feeders, station connections and valves, are usually contained on the property (generally owned by the customer) at the end-use point (EIGA 2004) SHOULD READ High pressure transmission pipelines (40-70 bar) and distribution pipelines (10-0,25 bar) go from the Natural Gas field or storage, eventually the production plant and the distribution network, passing over public land and third party properties. Distribution pipelines, including main feeders, station connections and valves, may be contained on the property of the customer at the end-use point.	New text proposed will be added
Marc Darras (GDF SUEZ)	8	49	36	-	-	-	-	-	The pressure drop results from the gas friction in the pipe; it is indirectly connected to the flow through velocity at second order. However the right parameters are the size of the pipe and the pressure of the gas.	Existing text deals with pressure and size in pipeline. No need to go in details on pressure losses due to friction
Marc Darras (GDF SUEZ)	8	50	38	-	-	-	-	-	at the end of the line add: It is the traditional town gas in use since the beginning of the 19th century (Lebon process).	Proposed new text will be added
Marc Darras (GDF SUEZ)	8	50	19	-	-	-	-	-	Add after Naturalhy 2009). : Furthermore, EU Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources includes measures for access to Natural Gas grid for biogas.	Proposed new text will be added
Marc Darras (GDF SUEZ)	8	50	40	-	-	-	-	-	After transport fuel ADD: injection	Sentence clarified
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	50	38	-	-	-	-	-	Syngas can also be further upgraded to hydrogen. Indeed, according to 'GermanHy' (Dena et al 2009) and other studies gasification of biomass represents one of the most promising ways of hydrogen production from RE.	Hydrogen production is mentioned elsewhere

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Marc Darras (GDF SUEZ)	8	50	11	-	14	-	-	-	The first linkage is the injection of biogas in the NG system, before a more complex situation is develop as mention in this parameter. Therefore it SHOULD READ: Biogas production and natural gas system are linked firstly because injection in the natural gas pipeline is one way to develop usage of biogas when it is produce in large quantities by taking advantage of the infrastructure: then it rises the question of adequate specification of the biogas. Furthermore, linking biogas production, gas and electricity grids has been.....	This concern has been addressed by switching the order of text in 8.2.3.1 and 8.2.3.2
Marc Darras (GDF SUEZ)	8	50	41	-	42	-	-	-	There is no interaction between the gas processing and the electrical system to my knowledge. Withdraw this sentence, the topic of gas treatment being clarified somewhere else. The following two sentences are not in connection with the question of gas treatment.	the word "gas clean-up" is replaced by "gas processing" for clarity
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	51	6	51	16	-	-	-	GermanHy" (Dena et al 2009) and most other studies / concepts investigating hydrogen production and the built-up of hydrogen infrastructure (see, for instance: www.hyways.de), rather suggest that there will be a mix of decentral and central hydrogen production in the next few decades. Industrial by-product hydrogen will be important at first (see, for instance: Pastowski, Andreas ; Grube, Thomas: Scope and perspectives of industrial hydrogen production and infrastructure for fuel cell vehicles in North Rhine-Westphalia. In: Energy policy, 2009), next to hydrogen produced from natural gas. Hydrogen production from RE (mainly wind and biomass) is also increasingly important; in the German CEP, 20 % of hydrogen is to be produced from RE in 2010; and 50% from RE in 2015 (www.cleanenergy-partnership.de). Hydrogen production via large-scale electrolysis is a medium- to long-term, issue. There are several projects regarding wind-hydrogen systems running in Germany. Decentral hydrogen production (not requiring transport) will go along with central production (requiring transport). Initially, hydrogen is transported mainly by road trailer; only at around 2025 pipelines will become important for hydrogen transport. However, around 80% of all hydrogen centrally produced until 2050 will be transported by pipeline, according to GermanHy.	This information will incorporated in the section
Marc Darras (GDF SUEZ)	8	51	25	-	-	-	-	-	replace upgraded to by produce	Changes made
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	52	27	-	-	-	-	-	please add: ""Depending on the production pathway hydrogen needs¿""	Text will be revised

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Marc Darras (GDF SUEZ)	8	52	4	-	7	-	-	-	The standards for gas quality are generally not the responsibility of gas company at large but of transport and distribution company or authorities depending of local regulation. Furthermore the basis of this standards are plural. Therefore the first sentente of this paragraph should read: Transmission and distribution companies or authorities define the minimal composition of gas for injection on the basis of risks for the infrastructure, quality of combustion processes in industrial and domestic processes and appliances, and health for workers, population and environment in term of combustion emissions. For stand alone operation the standards are generally defined for risks associated with infrastructure and process. This can create a technical or economic barriers for biogas....	Information will be incorporated
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	52	5	-	6	-	-	-	You forget that composition quality of biogas integrated into gas grid is limited for users' safety. See Section 8.2.3.4.2.	See above
Marc Darras (GDF SUEZ)	8	52	-	-	-	-	-	8.2	The variation of composition of natural gas is not well reflected in the table given. It is important since the gas transported is a mixture of gases from various origins. Therefore the important reference is the grid requirement as mentionned later in table 8.3. See for instance IEA Bioenergy Task 37 Energy from biogas and landfill gas, 2009 for more.	Table 8.2 only shows examples
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	53	14	53	16	-	-	-	A problem with injecting H2 in natural gas pipelines is that it is difficult to get it out of the pipeline / gasmix again. If pure H2 - as needed for fuel cells - is required, it is not sensible to inject and transport H2 in gas pipelines.	We are not talking about NG/H2 mixtures in this case. Text clarified.
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	53	41	53	42	-	-	-	As noted above, there is clearly no consensus that H2 will be mainly produced in smaller distributed systems in the next few decades. Most studies suggest that there will be a mix of decentral and central hydrogen production. Also the industries involved in hydrogen production and infastructure initiatives take the latter position (see, for example, www.linde.com). Production and infrastructure requirements differ widely depending on the region concerned. In many densely populated regions centrally produced H2 is far more important than decentral H2.	Text will be revised
Marc Darras (GDF SUEZ)	8	53	31	-	40	-	-	-	For large scale storage, underground gas storage is generally the solution. LNG is only interesting if the gas is distributed over large distances (over a few thousand km) when it become competitive with pipe transportation, since the process requires a large amount of energy. There is no small scale facilities for LNG.	Sentence added about LNG.

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Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	53	46	54	2	-	-	-	In some filling stations components (pipelines) can withstand pressures of up to 1000 bar today ( <a href="http://www.zeroregio.com">www.zeroregio.com</a> ). Composite cylinders can accommodate similar pressures. Several of the latest HFCVs incorporate 700 bar tanks ( <a href="http://www.cleanenergy-partnership.de">www.cleanenergy-partnership.de</a> ).	Text will be revised. Reference need to be added on 1000 bar composite cylinders
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	54	6	54	8	-	-	-	As correctly noted on page 54 lines 36-38, H2 has been handled safely by the industry in large volumes and for decades. There are also various H2-pipelines around the world; two of them in Germany alone (Pastowski et al. 2009; <a href="http://www.linde.com">www.linde.com</a> ). It is true that H2 has to be handled with care (such as many other gases that are explosive under certain conditions; or indeed petrol). However, the industrial H2 infrastructure is normally located rather close to 'densely polutated areas' in regular industrial parks and no 'longer' pipelines are required for safety reasons. The present wording of the draft should be changed so to neither deny, nor overstate, safety concerns.	Sentence rephrased
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	54	13	54	15	-	-	-	As noted above, hydrogen caverns and related infrastructure are operated in the USA and the UK. It is true that safety and viability of underground storage must always be evaluated on a case-by-case basis; but in principle H2 cavern storage is a proven technology.	phrase "proven technology" is added
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	55	23	55	24	-	-	-	Leading vehicle manufacturers anticipate worldwide HFCV introduction starting around 2015. Also, demonstration projects such as the California Fuel Cell Partnership ( <a href="http://ww.fuelcellpartnership.org">ww.fuelcellpartnership.org</a> ) and CEP are substantial and growing.	Sentence added about HFCV to market in 2015
Marc Darras (GDF SUEZ)	8	55	22	-	24	-	-	-	The comment on CNG vehicles concern Natural Gas quality biogas; for direct use of biogas, this has been exploited notably for fleets of vehicles attached to water treatment plants, which represents only a few hundreds of vehicles, and some agricultural usage. (for a review see also IGU: Report on Study Group 5.3 ¿Natural Gas for Vehicles (NGV)¿ Global Opportunities for Natural Gas as a Transportation Fuel for Today and Tomorrow FINAL REPORT December 2005 . World Gas Congress Amsterdam 2006	Sentence on biogas vehicles added
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	56	-	-	-	-	8.18	-	Add the explanation of Fig. 8.18.	Some more explanation will be added in figure caption.

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Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	56	-	-	-	-	8.18	-	Close bracket	done
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	57	12	57	13	-	-	-	GermanHy anticipates that the accumulated costs for the built-up of H2 production and distribution infrastructure sufficient to supply some 7 million fuel cell cars and light duty vehicles in Germany will amount to billion 21 € in 2030. This equates to an investment of about billion 1 € per year.	Additional text will be incorporated. Paragraph will be edited.
Sweden (Swedish Environmental Protection Agency)	8	58	12	-	-	-	-	-	"Biogas methane" ? Use "biomethane" or "upgraded biogas". Define ¿biodiesel¿ ? Suggestion: ¿long chained non-petroleum oil for a diesel engine, e.g., dimethylester.¿ Add: ¿Modified diesel engines may run on neat alcohol, E95, with ignition improver. ¿ (Potential references: Stockholm has 424 ethanol-run buses (2009, SLfakta 2009, (in Swedish)) Scania Delivering 85 New Ethanol Buses for Stockholm Fleet, New Brief, 21 June 2010 <a href="http://www.greencarcongress.com/2010/06/scaniabus-20100621.html">http://www.greencarcongress.com/2010/06/scaniabus-20100621.html</a> ). Suggested shorter sentence: ¿ Biogas methane, if it meets appropriate specifications, can also be used combusted directly in spark-ignition internal combustion engines similar to those suitedable for running on compressed fossil natural gas (CNG).¿	Information will be incorporated
Sweden (Swedish Environmental Protection Agency)	8	58	18	-	-	-	-	-	A new paragraph may be added to reflect the importance of quality issues, e.g.,: ¿Fuel and drive train have to be seen as a system. Any alternative fuel or alternate fuel system have to preserve quality and the performance of the emission control system. Poor quality biofuels, and/or contaminated, may cause engine and control system break-down, damaging the environment	Biofuels quality issues are important. A sentence about this will be added in 8.3.1.2.1 (transport)
Sweden (Swedish Environmental Protection Agency)	8	58	15	-	16	-	-	-	Acid hydrolysis can also be used (expensive but used in the US today I think)	all conversion technologies will be referred to Chap 2
Gustavo Nadal (Fundacion Bariloche)	8	58	10	58	12	-	-	-	Agricultural machinery certified for B20 is available	Information will be incorporated
Sweden (Swedish Environmental Protection Agency)	8	58	29	59	6	-	-	-	Comment: Many words on problems, which are not very large, and has been overcome at many places already. Equipment requirements and cost are in the range of normal reinvestment and maintenance of installations etc., which is also stated on row 12/page 59. And it is repeated at p. 60, from row 20...	Revised according to response to comment 502/63

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Sweden (Swedish Environmental Protection Agency)	8	58	7	-	-	-	-	-	Delete ζfoodζ.	done
Sweden (Swedish Environmental Protection Agency)	8	58	17	-	18	-	-	-	Fisher-Tropsch not the only promising method for producing "2nd gen." fuels from syngas. For methanol (liquid fuel), DME, biomethane and hydrogen other methods exist	all conversion technologies will be referred to Chap 2
Christoph von Stechow (IPCC WGIII TSU)	8	58	6	58	18	-	-	-	Please add a cross-reference to the respective sections in chapter 2.	The text will incorporate the references to chap 2.
Sweden (Swedish Environmental Protection Agency)	8	58	28	-	-	-	-	-	remove: ζ, and can take advantage of existing infrastructure components already usedζ. Rationale: it has been mentioned in sentence before, but it is also unclear what ζcomponentsζ mean, perhaps gears mentioned next.	Revised according to response to comment 502/63
Robert Pietzcker (PIK)	8	58	16	58	18	-	-	-	the listing of aviation, marine and other applicationsζ sounds as if these fischer-tropsch-liquids could or would not be used for road transport ζ is that the case? If yes, why?	Text will be revised
Sweden (Swedish Environmental Protection Agency)	8	58	25	59	32	-	-	-	This chapter seems contradictory (perhaps only my understanding of the wording). At first, transition barriers are low, later integration issues are particularly challenging for biofuels. Also some repetition with later chapter 8.2.4.3. Suggest to make clearer that the overall transition barriers are relatively small (compared to hydrogen e.t.c) but that technical hurdles (corrosion e.t.c) still exist in the distribution system. 1:s sentence may be shortened to read: ζLiquid biofuels integrated into existing transport fuel systems can make use of existing infrastructure made to transport and distribute oil products.	Text will be revised from p. 58 line 25 to p.59 line 11
Australia (0)	8	58	19	58	22	-	-	-	This comment about fuel replacement in developing countries does not seem relevant. Also, there are significant cost barriers to adopting the 'more convenient' fuels.	Sufficient peer-reviewed literature reporting on programmes and technology options to provide info biofuels for cooking
Sweden (Swedish Environmental Protection Agency)	8	58	-	63	-	8.2.4	-	-	General comment. What is "liquid fuels". Seems here also to include DME and biomethane. However, a good and interesting chapter but with limited number of references (mainly IEA and Reynolds (2000)).	DME (boiling point at -25 C) can be liquid, depending on end-use
Sweden (Swedish Environmental Protection Agency)	8	59	18	-	-	-	-	-	Delete ζonlyζ in the middle of the line. Comment: Energy content in E85 is 71 per cent compared to market petrol (95 per cent with 5 % ethanol), but practical experience is cited to on average increase fuel consumption with 14%.	Partially accepted. "only" deleted. Correct comment, but no need to define this here

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Sweden (Swedish Environmental Protection Agency)	8	59	31	-	32	-	-	-	Good point about biogas but check wording. Now it is not clear what the author actually means. Biogas can either be used directly to produce electricity or upgraded and fed into the gas grid. Upgraded biogas (biomethane) can be used for vehicles and so can electricity (EVs, PHEVs)	Sentence clarified
United States (U.S. Department of State)	8	59	14	-	-	-	-	-	The two sentences seem somewhat in conflict: 1. "ethanol and gasoline blends cannot be easily stored, transported, and delivered in the existing petroleum infrastructure..." and 2. "in Brazil alcohol produced from sugar cane has been successfully transported in the same pipelines used for oil products over the last 20 years."  Some clarification on this issue would help. What has Brazil done to ensure success if this is a difficult problem?	Revised according to response to comment 502/63
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	59	31	-	32	-	-	-	This sentence is confusing because vehicle fuel is not used as the fuel of electricity generation.	Sentence clarified
Robert Pietzcker (PIK)	8	59	14	59	18	-	-	-	why does it work in Brazil when you say before it cannot easily use the existing infrastructure? - do they use different technologies, different ethanol, ...? can their experience be used for systems in other countries? Please quote some sources that do research about the Brazilian (and other) ethanol transport systems or say see 8.2.3.6 for more info on the Brazilian case study	Revised according to response to comment 502/63
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	60	16	-	17	-	-	-	Eliminate "tend to".	text deleted
Sweden (Swedish Environmental Protection Agency)	8	60	14	-	16	-	-	-	This is already stated in the Figure text to figure 8.21. Also, the author could mention the crucial role of international trade of both feedstocks and biofuels for easing seasonal variations.	Text below Figure 8.21 deals with biomass. Reference will be found on international trade of feedstock for liquid biofuels
Sweden (Swedish Environmental Protection Agency)	8	60	19	61	9	8.2.4.3	-	-	Coordinate this chapter better with chapter 8.2.4.1, page 58, line 25 to page 59, line 32	Coordination will be done
Sweden (Swedish Environmental Protection Agency)	8	60	-	-	-	-	8.21	-	I'm not convinced that this figure actually contributes with anything.	Improved figure (iconic figure) will be made

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Sweden (Swedish Environmental Protection Agency)	8	61	43	-	44	-	-	-	Costs are stated to vary between 60 to 170 USD/m3 here but in table 8.4 next page the variation is 143 to 170 if I have calculated correctly	Figures will be checked
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	61	24	-	24	-	-	-	Eliminate "?".	?
Sweden (Swedish Environmental Protection Agency)	8	61	24	-	28	-	-	-	Where do the authors want to take this argument? Fuel specifications differ in several aspects between the EU, US and Brazil due to differing tail-pipe emission regulations, safety concerns e.t.c. I'm not convinced that to much standardisation would ease the transition, some differences will continue to exist for legitimate reasons	A sentence added on to explain the purpose of standardization, namely to ease trade
Sweden (Swedish Environmental Protection Agency)	8	61	13	61	15	8.2.4.4.1	-	-	Is standardisation the main reason for not having more biofuels out today? The price would seem to be a more obvious answer.	Sentence revised
Sweden (Swedish Environmental Protection Agency)	8	61	-	61	-	8.2.4.4.2	-	-	This chapter does not really contribute - strike out or extend the text	Another paragraph will be added in 8.2.4.4.2
Sweden (Swedish Environmental Protection Agency)	8	61	-	62	-	8.2.4.5	-	-	A lot of numbers on costs from old and few and geographically limited (US) references. What can be understood from table 8.4 with no comparison to gasoline or diesel fuel ?	Change title to table to "Example of Equipment Capacity and Cost for ethanol ..."
Juan Llanes (Centre for Environmental Studies)	8	61	35	-	-	8.2.4.5	-	-	Benefits & costs of large scale penetration, 8.2.3.6 Case study: Brazil ethanol, page 63 Suggest to include information on life cycle/energy payback/ energy balance, Also page 69 row 32	A sentence will be added on life cycle/energy payback/ energy balance, with pointers to Chapter 2 (bioenergy) and 8.3.1.4 (transport)
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	62	4	-	4	-	-	-	8.2.3.6 -> 8.2.4.6	No section 8.2.4.6 exists
Sweden (Swedish Environmental Protection Agency)	8	62	24	-	-	-	-	-	Do we have data for transport costs?	Numbers provided are transport costs

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Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	62	7	-	7	-	-	-	Explain the definition of "E10"	Done
Kristin Seyboth (IPCC WG III TSU)	8	63	35	63	36	-	-	-	A clear, concise definition of autonomous systems would be useful. If this is a definition it will need to be rewritten. Recommend first defining clear attributes of an autonomous system, THEN making a note that the demand-supply balance problem becomes even more prevalent with small, autonomous systems.	definition will be provided
Kristin Seyboth (IPCC WG III TSU)	8	63	35	63	36	-	-	-	A clear, concise definition of autonomous systems would be useful. If this is a definition it will need to be rewritten. Recommend first defining clear attributes of an autonomous system, THEN making a note that the demand-supply balance problem becomes even more prevalent with small, autonomous systems.	relevant, considered in rewrite process of 8.2.1
Brazil (Ministry of Science and Technology)	8	63	14	63	15	-	-	-	Check the range of anhydrous ethanol into petrol in Brazil - here says between 20 and 23% in volume. The correct range is between 20 and 25 % in volume.	Information will be incorporated
Sweden (Swedish Environmental Protection Agency)	8	63	19	-	-	-	-	-	Production cost is 0.20-0.30 US\$/litre (SEPA 2010). Production cost overview has reference to E4tech (2008).	Purpose of statement is to show that ethanol is competitive, without subsidies, to gasoline
Kristin Seyboth (IPCC WG III TSU)	8	63	40	64	10	-	-	-	This bullet list needs to be restructured, as it does not focus on TYPES of autonomous systems. Recommend categorizing types according to A) electricity/heat/other end use B) single or multiple technologies C) back up technologies (i.e. the difference between developed countries that tend to use fossil fuel generator back up vs. developing countries that tend to use no back up or storage technologies if possible. Ideally this structure could then be mirrored throughout the section.	the suggested recommendation is not typology. However, we will make appropriate modification to the bullets headings
Brazil (Ministry of Science and Technology)	8	63	-	-	-	8.2.3.6	-	-	It would be interesting to add that, currently, in Brazil consumes more ethanol than petrol in volume	Will be done and reference will be given
Sweden (Swedish Environmental Protection Agency)	8	63	10	-	-	8.2.3.6	-	-	Production of ethanol soared in ten years from 1996; the feedstock land increased by 27 per cent. Reference: Is it possible to avoid bad impacts by using good fuel ethanol? (authors: Berndes, Bryngelsson and Sparovek), SEPA report No 6331, 2010.	Information will be incorporated

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Kristin Seyboth (IPCC WG III TSU)	8	63	-	68	-	8.2.5	-	-	In general the section could use a good, solid rewrite. There is no flow or coherency to the text, and often the text does not match the headings. It could be cleaned-up significantly based on what is there with some additional text and references added in. Case studies were ok and an added-value to the section.	some modification will be made
Jorge Bonnet Fernández-Trujillo (Agencia Canaria de Desarrollo Sostenible y Cambio Climático)	8	63	31	68	2	8.2.5	-	-	In this subchapter the social aspects of the autonomous systems and the energy savings aspects are missing because it is too focused in the power supply aspect. The Canary Islands project of pumped hydro systems plus wind energy integration which is placed under 8.2.5.2.1 (pg 64) is more than what is said there, and also covers the social and energy savings aspects in El Hierro island (Biosphere reserve). It is an integrated project supported by UNESCO that involves a portfolio of renewable technologies (solar thermal collectors, PV, biomass and the cited in 8.2.5.2.1) together with an energy saving programme, a transport programme and social aspects programme (public information, education and training) that is focused to involve the population in the project with the main objective of getting a 100 % renewable energy supply. One of the objectives of this project is also the replication to other islands. For all these reasons and the importance of this project, it should be included in the 8.2.5.5 "Case studies" or explained better in other places of chapter 8. More info about this project in: <a href="http://www.insula-elhierro.com/english.htm">http://www.insula-elhierro.com/english.htm</a>	Additional phrases have been added in the sentence referring to Canary case. The social aspect has been dealt in Chapter 9. Sentences will be added in section 8.2.5.2.1. No case study on Canary islands will be added due to text limitation
Jorge Bonnet Fernández-Trujillo (Agencia Canaria de Desarrollo Sostenible y Cambio Climático)	8	63	31	68	2	8.2.5	-	-	In this subchapter the social aspects of the autonomous systems and the energy savings aspects are missing because it is too focused in the power supply aspect. The Canary Islands project of pumped hydro systems plus wind energy integration which is placed under 8.2.5.2.1 (pg 64) is more than what is said there, and also covers the social and energy savings aspects in El Hierro island (Biosphere reserve). It is an integrated project supported by UNESCO that involves a portfolio of renewable technologies (solar thermal collectors, PV, biomass and the cited in 8.2.5.2.1) together with an energy saving programme, a transport programme and social aspects programme (public information, education and training) that is focused to involve the population in the project with the main objective of getting a 100 % renewable energy supply. One of the objectives of this project is also the replication to other islands. For all these reasons and the importance of this project, it should be included in the 8.2.5.5 "Case studies" or explained better in other places of chapter 8. More info about this project in: <a href="http://www.insula-elhierro.com/english.htm">http://www.insula-elhierro.com/english.htm</a>	relevant, considered in rewrite process of 8.2.1

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Canada (Environment Canada)	8	63	-	-	-	8.2.5	-	-	Suggest that section on autonomous systems be expanded to include remote and village or island power concepts. Could also be a separate section since it would deal with systems at a smaller scale (technologies and economics are different).	Already included in the text such as, in second bulleted paragraph in 8.2.5.1
Kristin Seyboth (IPCC WG III TSU)	8	63	-	64	-	8.2.5.1	-	-	Information on where autonomous systems are most common is missing and would be useful to include.	Accepted
Kristin Seyboth (IPCC WG III TSU)	8	64	3	64	7	-	-	-	A building is not a type of autonomous system. Cut this text (which focuses on benefits) to e.g. options in 8.2.5.2 and focus here instead on TYPES of autonomous systems, which would appropriately be single technology systems that can be applied in buildings. See comment above on restructuring bullet list.	taken care of
Kristin Seyboth (IPCC WG III TSU)	8	64	19	64	25	-	-	-	Cut basic technology description to introduction of system types in 8.2.5.1. and examples of how to increase reliability of the system following the introduction of all these options.	reformatted the text
Kristin Seyboth (IPCC WG III TSU)	8	64	12	64	13	-	-	-	Cut sentence "An autonomous RE power system in rural areas" to 8.2.5.1	we did not find the sentence with "rural areas", however the sentence has been deleted
Kristin Seyboth (IPCC WG III TSU)	8	64	29	64	32	-	-	-	Discussion of heat should be cut to 8.2.5.1	modified
Kristin Seyboth (IPCC WG III TSU)	8	64	13	64	15	-	-	-	Suggest rephrasing sentence as follows: "Adding other types of RE generation technologies can enhance operational flexibility" (cutting most of sentence), and compiling all discussion of increasing the number of technologies in an autonomous system in one place.	modified
Kristin Seyboth (IPCC WG III TSU)	8	64	11	-	-	8.2.5.2	-	-	There is no clear structure to this section and discussion of different options is scattered throughout text. Ideally it would begin by pointing out that integration issues for autonomous systems do not exist per se as for other RE technologies. Then more into discussing the features of autonomous systems that make them more reliable - keeping discussion of different options compiled in a way that is clear for the reader: 1) Increased integration of different RE types 2) Fossil fuel generator back-up 3) Batteries/storage 4) Special energy use technologies 5) Energy efficiency.	made some modification to the text
Kristin Seyboth (IPCC WG III TSU)	8	64	-	-	-	8.2.5.2.1	-	-	Delete header and combine text with 8.2.5.2	modified
Kristin Seyboth (IPCC WG III TSU)	8	65	26	65	27	-	-	-	Cut sentence or combine with 8.2.5.2. Inappropriate here.	modified

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Kristin Seyboth (IPCC WG III TSU)	8	65	24	65	25	-	-	-	Cut sentence. The inevitability of the use of biomass is not a benefit.	but sentence amended
Kristin Seyboth (IPCC WG III TSU)	8	65	5	65	6	-	-	-	Cut text that reads "The Net-Zero by 2025". No added value to reader.	this is a name of a project as an example illustrating in the previous sentence
Kristin Seyboth (IPCC WG III TSU)	8	65	33	65	36	-	-	-	Cut text to 8.2.5.1 introduction and characteristics of technologies/autonomous systems	Accepted
Kristin Seyboth (IPCC WG III TSU)	8	65	4	65	11	-	-	-	Paragraph seems to focus on energy efficiency as an option to facilitate reliability of autonomous systems, though message is hidden in text.	modified
Christoph von Stechow (IPCC WGIII TSU)	8	65	46	-	-	-	-	-	Please insert a cross-reference to the relevant section in chapter 2 (e.g. 2.4.4.2 and 2.5.5.1) and 9.	Accepted
Kristin Seyboth (IPCC WG III TSU)	8	65	29	65	32	-	-	-	Recommend cutting text from "In Japan, house suppliers..." to "...power service". Text is not useful to reader.	Accepted
Kristin Seyboth (IPCC WG III TSU)	8	65	45	65	46	-	-	-	Reference to sustainability section of Chapter 2 SRREN would be useful here.	Accepted
Kristin Seyboth (IPCC WG III TSU)	8	65	14	65	15	-	-	-	Sentence "Integration of and Papadopoulos 2007) should be cut to 8.2.5.2 under discussion of increasing integration of different RE types.	improve reliability is a benefit
Kristin Seyboth (IPCC WG III TSU)	8	65	16	65	18	-	-	-	Sentence misses 'based on the added-value or benefit of autonomous systems' ideally placed between 'should be evaluated' and 'including'. It currently lists benefits without introducing readers to them.	cost avoidance is a benefit
Luiz A. Horta Nogueira (Instituto de Recursos Naturais)	8	65	15	-	-	-	-	-	the maximum content of ethanol in the Brazilian gasoline is 25%.	Information will be incorporated
Arieta Gonelevu (International Union for Conservation of Nature (Oceania Office))	8	65	12	65	36	-	-	-	Will this section also cover the concept of smart grids?	it is not the purpose of this section, smart grid is covered in 8.2.1
Kristin Seyboth (IPCC WG III TSU)	8	65	-	-	-	8.2.5.3	-	-	Reference to environmental and social benefits in Chapter 9 would be useful here.	made reference in the text to Ch 9
Kristin Seyboth (IPCC WG III TSU)	8	65	-	-	-	8.2.5.3	-	-	Reference to environmental and social benefits in Chapter 9 would be useful here.	relevant, considered in rewrite process of 8.2.1
Kristin Seyboth (IPCC WG III TSU)	8	65	-	-	-	8.2.5.4	-	-	If sub-section is going to include options (i.e. not only constraints) as it currently does, recommend changing title accordingly to something e.g. "Constraints on the rate and extent of deployment and options"	Accepted
Kristin Seyboth (IPCC WG III TSU)	8	65	-	-	-	8.2.5.4	-	-	Often headers in italics do not match the contents of following paragraphs, and do not clearly delineate the specific constraint and option that is being discussed. E.g. 'implementation and operation' on p. 66 would be more appropriately titled "Up-front capital costs and financial support schemes'.	Accepted

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Kristin Seyboth (IPCC WG III TSU)	8	66	8	66	11	-	-	-	Recommend cutting paragraph. I is unnecessary and inappropriate here unless it can be made specific to autonomous systems based on the literature.	it is useful paragraph and short and make cross referenc eto Chap 11
Kristin Seyboth (IPCC WG III TSU)	8	66	13	66	17	-	-	-	Reference is missing for entire paragraph.	reference is added
Kristin Seyboth (IPCC WG III TSU)	8	68	23	-	-	-	-	-	"transition issues' - why have you used this terminology? Are you not refering to challenges to integrate RE into specific sectors? For consistency, recommend amending accordingly.	Reworded
Kristin Seyboth (IPCC WG III TSU)	8	68	7	68	8	-	-	-	Delete sentence "Multi-benefits; ultimate aim" It's up to policy makers to determine what the aim should be. This sounds policy-prescriptive.	Reworded
Manfred Treber (Germanwatch e.V.)	8	68	28	68	29	-	-	-	It is written: ""The direct combustion of fossil fuels for transport consumes 19% of global primary energy use, produces approximately 23%10 of GHG emissions and ..."" Please insert in a footnote: 'The effects of contrails and cirrus clouds from aviation emissions on global warming are not included in the 23% of GHG emissions.'"	Report is designed to give overview, and cannot provide this level of detail. This point is covered in the reference provided
Kristin Seyboth (IPCC WG III TSU)	8	68	28	68	30	-	-	-	Please clarify the year to which these figures relate. Are they all 2005?	Claried that it is 2005
Kristin Seyboth (IPCC WG III TSU)	8	68	28	68	30	-	-	-	Please note that the SRREN uses the direct equivalent method to present primary energy. These figures, originating from the IEA which uses the IEA method for calculating primary energy, may need to be amended accordingly.	Will change according to IPPC method
Kristin Seyboth (IPCC WG III TSU)	8	68	4	68	5	-	-	-	Replace 'in order to gain greater RE deployment' with 'in order to increase the contribution of RE to total primary energy with the ultimate aim of climate change mitigation'	Reworded
Kristin Seyboth (IPCC WG III TSU)	8	68	9	-	-	-	-	-	The AR4 assessed the economic MITIGATION potentials - please don't forget the word mitigation in this sentence.	OK
Kristin Seyboth (IPCC WG III TSU)	8	68	9	68	25	-	-	-	These two paragraphs miss a critical link to oneanother: one explaining the percent contribution of RE to the overall mitigation potential of each of the sectors. It currently jumps from a discussion of mitigation potential of different sectors to directly discussing RE deployment.	Not reported although analysis was done
Kristin Seyboth (IPCC WG III TSU)	8	68	12	68	13	-	-	-	Was the potential contribution of RE also considered for the other sectors in the AR4? Please include this information here.	Reworded

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Kristin Seyboth (IPCC WG III TSU)	8	68	-	-	-	8.3	-	-	Each sub-section in 8.3 discusses the percent of primary energy accounted for by that sector. A summary figure would be useful in the introduction to 8.3 (one similar to e.g. Fig 8.2 if not shifting that figure itself) as well as a general summary of conclusions applicable to all sectors (e.g. reduction in energy demand, energy efficiency). It may be useful to cut the text in 8.1 that relates to the sectors to the introduction of 8.3 to give the reader more context directly before the discussion of the sectors. This introduction should logically also include a discussion of energy density (which Ch. 1 claims to be in Ch. 8) and synergistic effects with energy efficiency.	Energy intensity now to Chapter 1. will refer to Fig 8.2
Sweden (Swedish Environmental Protection Agency)	8	68	21	24	-	8.3	-	-	Good chapter with limited scope on references. Strange that there is not one reference from Asia, perhaps the world leader in EV and HEV technology. Higher fossil energy prices could also be mentioned as a driver for Res	Trying to get references
Kristin Seyboth (IPCC WG III TSU)	8	68	-	-	-	-	8.23	-	One of the most important messages from this figure: that the greatest mitigation potential is in the buildings, agriculture and industry sectors, is missing from the surrounding text. Please incorporate!	Not RE mostly
Sweden (Swedish Environmental Protection Agency)	8	69	1	61	3	-	-	-	"Recent studies suggest $\zeta$ ." This is also stated in line 8 to 13 where it fits better. Strike this sentence here	Sentence re-written
Kristin Seyboth (IPCC WG III TSU)	8	69	6	-	-	-	-	-	a large fraction' - what exactly is a large fraction? Please be more specific.	70% fraction
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	69	30	-	31	-	-	-	Clarify the reference.	Cross-reference to 8.3.1.6.1
Sweden (Swedish Environmental Protection Agency)	8	69	21	-	-	-	-	-	For $\zeta$ mass transit $\zeta$ may be used: $\zeta$ public transport $\zeta$ .	Both is acceptable
Sweden (Swedish Environmental Protection Agency)	8	69	14	-	-	-	-	-	For $\zeta$ vehicle kms travelled $\zeta$ it may be used: $\zeta$ travelling distance $\zeta$ . Rationale: Besides, this text seems to suggest travelling = driving (your own?) passenger cars. Besides energy conservation, modal split has been cited as inevitable mean to come to grip with transports impact on climate change.	Partially accepted. The term "vehicle km travelled" will be kept, as this is the common term used. Mode shifts will be discussed in separate bullet.
Sweden (Swedish Environmental Protection Agency)	8	69	40	-	-	-	-	-	Possible addition: (...Sweden ... encouraged ...) ... through taxation policy..., or exemption, and imported may be removed, because all are taxed equally.	information will be incorporated

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Sweden (Swedish Environmental Protection Agency)	8	69	3	-	-	-	-	-	Possible addition: ζNon-road mobile machinery consumes a significant portion of the fossil fuel. These, ranging from lawnmower to excavator, may emit 5 per cent of total greenhouse gases . Ref: This is for Sweden: Non-road Mobile Machinery, SEPA, report no. 5728, 2007 [in Swedish, with a note in English].	Too detailed information for this report
Kristin Seyboth (IPCC WG III TSU)	8	69	8	69	13	-	-	-	Scenarios are also presented/evaluated in the SRREN Ch. 10. It would be useful to present the scenarios evaluated in Ch. 10 here first, and then supplement the information with additional scenarios, e.g. Yang and McKinsey.	Cross-reference to Chapter 10 will be included
Sweden (Swedish Environmental Protection Agency)	8	69	14	61	19	-	-	-	Shouldn't it be reduction of "transport demand" also including freight transport. Also, I'm not convinced by the references given that claim that GHG emission can be reduced by 25% by building denser cities. This is a very difficult field of research where, in my opinion, no conclusions have yet emerged. However, I certainly agree that transport planning is crucial for dampening transport growth.	More references will be added to give a range of GHG-reductions (%)
Sweden (Swedish Environmental Protection Agency)	8	69	4	-	-	-	-	-	Strange perspective, especially if taken from an environment adaptation stand-point. First sentence may be redrafted as: ζEnergy demand pushes up from being a supply security is also a serious concern for the transport sector. ζ.	Suggested wording does not make sense
Sweden (Swedish Environmental Protection Agency)	8	69	27	-	-	-	-	-	Suggested additional sentence: ζOptimizing engine size for transport purpose could potentially save 16 % of CO2 emissions from a light commercial truck. ζ Rationale: See the EU-Parliament discussion on controlling power/driving speed performance as a mean to control light commercial trucks greenhouse gas emission performance. [Suggested link: PE 441.0142 ]. The EP-report gives the rationale: ζThese vehicles are almost exclusively used for commercial purposes and do not need to exceed 120km/hour.ζ (page 9, amendment 6, doc. 2009/0173, 22.4.2010)	Reference will be included
United States (U.S. Department of State)	8	69	38	-	-	-	-	-	This is the first of a number of cases where Brazil is mentioned as an example of a highly renewable transport system. It should also be mentioned that Brazil is a highly unusual case: a relatively small population and economy for its land area, generous water endowment, tropical location conducive to production of sugar crops. Such success with current biofuels is unlikely to be replicated in most parts of the world.	Brazil has 200 million and covers about 50% of the land area of South America (about same size as USA, minus Alaska)
Sweden (Swedish Environmental Protection Agency)	8	69	38	70	3	-	-	-	This sentence does not make sense..Rewrite	Sentence makes sense to authors

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United States (U.S. Department of State)	8	69	14	-	-	-	-	-	-	<p>This way of looking at the problem is more usefully outlined using the transportation emissions identity (similar to Kaya identity):  <math>g\ CO_2 = \text{passenger km} * \text{vehicle km/passenger km} * \text{MJ/vehicle km} * \text{gCO}_2/\text{MJ}</math></p> <p>Thus, looking at each term, emissions can be reduced by:</p> <ol style="list-style-type: none"> <li>1. Reducing passenger travel</li> <li>2. Increasing vehicle occupancy</li> <li>3. Increasing vehicle efficiency</li> <li>4. Reducing carbon intensity of fuels.</li> </ol> <p>This framework would make the discussion on pg. 69 make more sense.</p>	Partially accepted. Mode shifts will be discussed in separate bullet.
Sweden (Swedish Environmental Protection Agency)	8	69	-	-	-	8.3.1.6	-	-	-	See for example suggested modal transfer of long-haul transport from diesel-fuelled to electric via installations of power lines along major roads.	Unclear comment
Sweden (Swedish Environmental Protection Agency)	8	70	5	-	-	-	-	-	-	Replace "biogas" with "biomethane" or "upgraded biogas". Is note number 14 relevant? Sweden also uses ethanol and biodiesel and together approximately uses 5% biofuels in the transport sector today. Biomethane is just a small part	Change made
Manfred Treber (Germanwatch e.V.)	8	70	6	70	7	-	-	-	-	<p>We read 'electricity also makes a material contribution to the transport sector in many countries, mostly limited to rail.' Please give more intelligence on this fact for different countries. E.g. for Germany in the year 2008 surface passenger transport amounted to 1042 billion Pkm and 80 billion Pkm (i.e. roughly 8 %) was electricity driven (mainly rail transport). See <a href="http://www.dpg-physik.de/veroeffentlichung/broschueren/studien/energie_2010.pdf">http://www.dpg-physik.de/veroeffentlichung/broschueren/studien/energie_2010.pdf</a>, table 1 on page 36 and footnote 2 in <a href="http://www.germanwatch.org/klima/mt09emob.pdf">http://www.germanwatch.org/klima/mt09emob.pdf</a>. There exist already regional rail networks which have decided to use only renewable electricity. E.g. The electricity for S-Bahn Hamburg (600000 daily passengers) has been 100% from hydro energy since 1. January 2010 and - according to their own calculations - by this 60.000 t of CO2 per year are avoided (see <a href="http://www.s-bahn-hamburg.de/s_hamburg/view/aktuell/presse/2009_12_04.shtml">http://www.s-bahn-hamburg.de/s_hamburg/view/aktuell/presse/2009_12_04.shtml</a>).</p>	Information will be incorporated
Sweden (Swedish Environmental Protection Agency)	8	70	14	-	-	-	-	-	-	You may prefer plug-in electric cars, w/o combustion engine. There is of course a mayor challenge to switch to RE in heavy duty road transport. See e.g., the concept to electrifying roads.	Discussed in 8.3.1.6.1

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Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	71	33	-	34	-	-	-	inefficiency $\zeta$ ->"process"	Unclear comment
Felix Creutzig (TU Berlin)	8	71	15	-	19	-	-	-	For comprehensiveness: "A variety of alternative vehicle drive trains could use RE based fuels including advanced ICE vehicles using spark-ignition or compression-ignition engines (ICEVs), HEVs, PHEVs, EVs, HFCVs, and CACs. Several recent studies have assessed the performance, technical status, and cost of different 19 vehicle types (CONCAWE 2007; Kromer and Heywood 2007; Bandivadekar, Bodek et al. 2008; 19 IEA 2009; Plotkin and Singh 2009; Creutzig et al. 2009). F. Creutzig, A. Papsen, L. Schipper, D. Kammen (2009) Economic and environmental evaluation of compressed-air cars Environ. Res. Lett. 4:044011	A foot note will be included
Robert Pietzcker (PIK)	8	71	9	71	11	-	-	-	how large are the quantities of neodymium and lanthanum needed? Is this a real concern that could stop or slow the development of electric vehicles?	New data and reference will be included
Felix Creutzig (TU Berlin)	8	71	37	-	40	-	-	-	RE have lower associated WTT efficiency loss than other power sources. Relevant in this context.	Too strong statement. Cannot generalize on this point
Sweden (Swedish Environmental Protection Agency)	8	71	43	-	-	-	-	-	Suggested revision (replace last bullet): $\zeta$ Smaller and slimmer cars may be produced to easier perform more fuel efficient, but larger cars may too, and relatively easier swallow possible increased cost due to a technically refined product. $\zeta$	See comment response to 502/93
Sweden (Swedish Environmental Protection Agency)	8	71	27	-	-	8.3.1.2.	-	-	Some examples have been discussed here in previous comment. Not the least the easy ones: less weight, slimmer and balanced engine performance. On regulatory side: limiting technical permissible top speed, power resources, etc. There are loads more, of course. And updates may be required related to possible technical improvements, e.g., batteries and recharging. A general comment: In Europe (and UN) and perhaps increasingly in the US, $\zeta$ fuel consumption $\zeta$ is used, thus the reverse of $\zeta$ fuel economy $\zeta$ . See also page 80. This may be confusing.	Information will be incorporated
Anca-Diana Barbu (European Environment Agency)	8	71	37	71	40	8.3.1.2.	-	-	The language is quite loose and I am not sure the percentages stated in the text 40-80% refer to losses in the electricity system or to losses in efficiency gains of electric vehicles compared to ICEs. If it is the former, than the percentages seem rather large. If it is the later, again the percentages seem rather large. My suggestion is to clarify the text and than include references where these percenatges come from.	Reference will be included

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Sweden (Swedish Environmental Protection Agency)	8	72	15	-	-	-	-	-	Life-span and durability for the batteries could be high-lighted as key-factor?!	Lifetime has already been mentioned
Sweden (Swedish Environmental Protection Agency)	8	73	11	-	-	-	-	-	15 years is fairly OK for most places.	See comment to response 475/184
Robert Pietzcker (PIK)	8	73	36	73	42	-	-	-	are flexible fuel vehicles much more expensive than normal ICEVs?	Sentence will be added p.73, line 37
Robert Pietzcker (PIK)	8	73	11	-	-	-	-	-	for european standards, 15 years lifetime seems rather long ¿ could you quote a source?	Lifetime for different countries will be looked into
Sweden (Swedish Environmental Protection Agency)	8	73	15	73	18	-	-	-	Good point! Add references	Reference will be included
Japan (the Japanese Ministry of Foreign Affairs)	8	73	17	-	19	-	-	-	It should be specified what year the data provided represents. The authors are requested to recheck the data for HEV sales. In Japan, HEV's represented approximately 7.5% of new car sales in 2009	Data will be updated
Sweden (Swedish Environmental Protection Agency)	8	73	35	74	19	-	-	-	No mentioning of DME, methanol or synthetic diesel, only ethanol ¿. maybe a sentence on possible future fuels?	These fuel are shown in Fig 8.24 and discussed in 8.2.3 (liquid fuels)
Christoph von Stechow (IPCC WGIII TSU)	8	73	43	-	-	-	-	-	Please specify this cross-reference, since chapter 2 is voer 100 pages long.	Cross reference to 2.3.3
Sweden (Swedish Environmental Protection Agency)	8	74	14	-	-	-	-	-	"National potential" ¿. which nation?	Sentence revised
Sweden (Swedish Environmental Protection Agency)	8	74	20	74	25	-	-	-	Biomethane pathways also includes biomethane from gasification of woody biomass. This is a crucial argument for biomethane in the longer run as an option beyond tha small scale. Reference (Ahman 2010) used in this report gives a good overview of biomethane pathways	Already discussed and referenced in 8.2.3.5
Manfred Treber (Germanwatch e.V.)	8	74	23	74	25	-	-	-	Is it really the CO2 that is being stripped in "" Biogas would first need the CO2 to be stripped to give greater range per storage cylinder refill"" ?	Sentence clarified
Robert Pietzcker (PIK)	8	74	15	74	16	-	-	-	please add the information what total amount (in EJ) these 20-25% would be	information will be incoporated
Christoph von Stechow (IPCC WGIII TSU)	8	74	21	-	-	-	-	-	Please specify this cross-reference, since chapter 2 is voer 100 pages long.	Reference to 2.3.3
Robert Pietzcker (PIK)	8	74	41	74	42	-	-	-	sadly, I can find little information about the cost of building up a new h2 infrastructure in 8.2.3, so please provide the numbers here or forward the reference to the authors of 8.2.3	This is discussed in some detail in 8.2.3.5 (GermanHy)

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United States (U.S. Department of State)	8	74	26	-	-	-	-	-	The discussion of hydrogen here seems imbalanced and does not cite the many hydrogen skeptics. One such article is Keith and Farrell (2003), Rethinking hydrogen cars, Science.	This reference is out of date, and cannot be used.
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	74	27	74	29	-	-	-	The emission reductions of HFCVs - as compared to conventional vehicles - established by studies are usually very substantial. Assuming a market share of hydrogen powered vehicles by 2050 GermanHy concludes that CO2 fleet emissions of cars and light duty vehicles can be reduced to 40g CO2/km (well to wheel) and 20g CO2/km (tank to wheel).	This has been discussed in 8.3.1.4
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	74	44	75	-	-	-	-	The information needs updating: Iceland announced ambitious plans and received much media attention some ten years ago. Other projects such as the California Fuel Cell Partnership (www.fuelcellpartnership.org), the Japan Hydrogen & Fuel Cell Demonstration Project (www.nedo.go.jp), and the CEP (www.cleanenergy-partnership.de) have developed into far more comprehensive projects than the earlier Icelandic activities. Hyways is merely a study; with the establishment of the the EU Fuel Cells and Hydrogen - Joint Undertaking (ec.europa.eu/research/fch) a powerful new player emerged with the potential to realize some of the suggestions of the earlier study. Similarly, in Scandinavia several large-scale demonstration projects have materialized (such as: www.hynor.no), superceeding the earlier plans referred to in the draft report.	information will be incorporated
Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	74	38	-	-	-	-	-	The latest Toyota HFCV (called FCHV-adv) achieves a range of 790 km (www.cleanenergy-partnership.de)	Footnote on FCHV from Toyota
Robert Pietzcker (PIK)	8	74	3	74	12	-	-	-	this paragraph seems mixed, the information and structure is not clear, I do not understand what information the author tries to convey ¿ please rewrite.	Paragraph edited. Cross-reference to 8.2.4.1
Robert Pietzcker (PIK)	8	74	23	74	25	-	-	-	would these processes (reducing co2 content, stripping H2S) be costly or complicated and thus make this pathway unfeasible, or are they just minor difficulties which can easily be overcome? Please quote some research in this area ¿ maybe Sterner 2009 (¿bioenergy and renewable power methane...¿) writes something about this topic?	This is discussed in some detail in 8.2.3.3
Robert Pietzcker (PIK)	8	75	14	75	20	-	-	-	good paragraph! What is the energy content of hydrogen (in GJ/kg)?	Conversion factor added in foot note
United States (U.S. Department of State)	8	75	34	-	-	-	-	-	Please cite sources for these EV efficiencies. I have seen lots of figures for these numbers, some higher.	See response to comment 475/192
Robert Pietzcker (PIK)	8	75	30	75	34	-	-	-	please give a source for these efficiencies	Ref will be added

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United States (U.S. Department of State)	8	75	16	-	-	-	-	-	Should be presented in \$/l of gasoline equivalent. Conversion is given in footnote, but would be more useful in main text. kg of hydrogen is not a common metric.	\$/kg is the most common way to report these figures. kgH2 is industrial standard
United States (U.S. Department of State)	8	75	0	-	-	-	-	-	This discussion leaves out the truly interesting (and difficult) part of the transition to a hydrogen-based transportation system. This is the often cited "chicken or egg" problem: It is not clear at all that we will rebuild an (essentially) entirely new delivery infrastructure for hydrogen when we have petroleum and electricity delivery systems that will work with modification to deliver biofuels or electricity. And who will buy the cars without the system?	The aspect of a coordinated infrastructure and FCV build-up will be discussed. Cross ref to 8.2.3.5 added
Robert Pietzcker (PIK)	8	75	28	75	20	-	-	-	what is the normal cost/km you assume for an ICEV? Or, directly ¿ what is the current and the expected future fuel price for Fuel cell car?.\$NC??	Cost data for ICEVs will be added in a note for Figs 8.26 and 8.28.
Robert Pietzcker (PIK)	8	76	14	76	16	-	-	-	please always use relative AND absolute values: ¿today's lithium batteries cost xxx\$/kWh, which is 3-5 times the the target needed to compete with gasoline ...¿	Will be done
Japan (the Japanese Ministry of Foreign Affairs)	8	76	9	-	12	-	-	-	The sentence is rather misleading because some manufacturers will launch EVs before the publication of this report. The report should include the most recent information available. For example, in Japan, Mitsubishi Motors and Fuji Heavy Industry launched EVs in 2009 and Nissan will launch a model in 2010.	Latest data on EV models will be included
Sweden (Swedish Environmental Protection Agency)	8	77	6	77	14	-	-	-	This is a good argument. A suggestion: This line of argument from an industrial point of view is well explained and references in "Avadikyan and Llerenaa (2010) A real options reasoning approach to hybrid vehicle investments in Technological Forecasting and Social ChangeVolume 77, Issue 4, May 2010, Pages 649-661"	Reference will be included
Sweden (Swedish Environmental Protection Agency)	8	77	17	-	-	-	-	-	Unclear sentence "Different entire fuel/vehicle¿¿"	Sentence to be re-written
Sweden (Swedish Environmental Protection Agency)	8	78	8	-	-	8.3.1.5	-	-	¿Transition¿ may be explained	Sentence will be added p.73, line 37
Manfred Treber (Germanwatch e.V.)	8	78	-	-	-	-	8.28	-	the description of the y-axis 'g CO2/km' is confusing as a fast reader thinks that a gasoline ICE vehicle emits 1 g CO2/km. Please write 'normalised g CO2/km' or another explanation which shows directly that these are no absolute numbers for the y-axis.	Axis will be changed
Sweden (Swedish Environmental Protection Agency)	8	79	-	-	-	T.8.5	-	-	There is a noise pollution issue here ¿ and possible gain by electric vehicles. Radiation from electric motors may still need further investigations.	These are secondary issues

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Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	79	-	-	-	-	-	8.5	See the cell "Fuel Cost" of "Electricity" - the number in the cell must be wrong. Please make sure.	The figure has been double-checked, and is correct
Manfred Treber (Germanwatch e.V.)	8	79	-	-	-	-	-	8.5	There is one important information relevant for the description of the 'system' electric vehicles and hydrogen vehicles missing. Please insert one 'line' 'storage reservoir'. For Biofuels this is the tank with negligible cost (50 liters or 500 kWh can be stored with low investment cost for the tank [less than 100 \$]. For the electric vehicle the investment cost for the chargeable battery amounts to 1000 \$ /kWh [present value] with a goal for the industrial producers to decrease this to 350 \$/kWh. Of course with these cost the electric energy that can be stored is far below 100 kWh (equivalent to 10 l fuel). For Hydrogen I don't have the numbers at hand.	Too much detail, and requires detailed description on the assumptions in the calculations
Germany ( Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	8	79	-	79	-	8.3.1.5	-	8.5	row 8 (GHG emissions) column 2 (biofuels): GHG emissions resulting from sugar cane not always the lowest, depending on emissions from LUC	Note added to Table 8.5
Sweden (Swedish Environmental Protection Agency)	8	80	21	-	-	-	-	-	"Compressed biogas" should be "Compressed biomethane". Biogas contains only 45 to 60% methane before upgrading and biogas is not used for vehicles use without upgrading it to CNG specification (roughly >97% methane)	Text revised
Robert Pietzcker (PIK)	8	80	7	80	16	-	-	-	a further important option is to switch to rail $\zeta$ much of freight transport is long-distance over very limited routes (across the US, or transit through a smaller country) and could easily be replaced by rail if the interconnection points between short-distance truck transport and long-distance rail would be improved to allow faster and cheaper loading/unloading. Please add a few lines about this option to reduce GHG emissions and fuel consumption	As above
Australia (0)	8	80	37	80	37	-	-	-	After 'Rapid growth of aviation' insert 'emissions'	Text revised
Norway (Climate and Pollution Agency)	8	80	40	-	-	-	-	-	Energy efficiency gains of 30-50% in future aircraft (reference IEA 2009). Please add base year or basis for comparison: is this compared to the efficiency of the current fleet (year), or is this in comparison to the worst-performing aircraft currently in use? Are higher occupancy rates (load factors) included in this estimate? At the higher end, this would seem to approach physical limits.	Data need to be checked and ref. provided

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Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	80	45	81	1	-	-	-	I cannot follow the meaning of this sentence.	Sentence need to be clearer
Sweden (Swedish Environmental Protection Agency)	8	80	38	-	-	-	-	-	I doubt that the aviation industry goes around and "boasts" with this fact. Furthermore, I'm not certain that this is always correct. Long distance flights might to my knowledge have relatively low energy intensity (not the same as GHG intensity for aviation due to water vapour). Add references	Sentence reworded. Data need to be checked and ref. provided
Sweden (Swedish Environmental Protection Agency)	8	80	23	-	-	-	-	-	In Stockholm and other Swedish municipalities buses are run on ethanol, biogas and/or hydraulic system since long. Hundreds of short distance driving HDV:s are run on biogas, e.g., all 75 garbage trucks in Stockholm.	Too much detail
Canada (Environment Canada)	8	80	13	80	14	-	-	-	Instead of "improved truck-trailer integration for better aerodynamics", suggest "increased use of aerodynamic technologies on the tractor and trailer". The original implies only closing the gap between the tractor-trailer.	Text revised
Manfred Treber (Germanwatch e.V.)	8	80	7	-	-	-	-	-	Please also mention (like in the LDV case) the possibility of a modal shift to more efficient modes (rail, inland water ways) to reduce fuel consumption.	Information will be incorporated
Canada (Environment Canada)	8	80	10	80	16	-	-	-	Suggest adding long combination vehicles as another tool for increasing the energy efficiency of freight transport for trucks.	information will be incorporated
Canada (Environment Canada)	8	80	24	80	25	-	-	-	Suggest adding truck stop electrification, since it eliminates the need for APUs by allowing the driver to plug into an electrical energy source to run their accessories. However, benefit would depend on the carbon footprint of the local electricity source.	No reference material provided
Robert Pietzcker (PIK)	8	80	22	80	25	-	-	-	you mention LNG, but do not continue to write about it. Is a large-scale use of LNG feasible for freight transport? How much would it reduce GHG emissions/tkm? What are the main difficulties?	Not renewables so discussion excluded
Norway (Climate and Pollution Agency)	8	80	-	-	-	8.3.1.6.	-	-	Given that aviation accounts for 11% of transport energy use and is projected to grow 2-3 fold in its energy requirements to 2050, is a more detailed discussion of options to use biofuels warranted?	This topic will be discussed a bit more in this section
Sweden (Swedish Environmental Protection Agency)	8	81	9	-	-	-	-	-	Comment: But not as much research and demonstration projects have been performed, so the aviation industry doesn't know as well what may be done.	R&D status will be investigated
Robert Pietzcker (PIK)	8	81	28	-	-	-	-	-	do you have a reference for the replacement rate of ships?	Reference will be added
Mark Fulton (Deutsche Asset Management, Deutsche Bank)	8	81	40	81	40	-	-	-	For marine transport, what about nuclear energy? This is of course a renewables study, but most of the innovation happening on efficiency is from the nuclear programs used in military ships.	Note this in text and add reference if possible

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Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	81	1	-	1	-	-	-	Is "9%" correct? You mentioned "10%" at line 1 in page 69. Which is correct?	Cannot find what it is referred to here
Manfred Treber (Germanwatch e.V.)	8	81	17	-	-	-	-	-	It should be mentioned that the warming effects of contrails and cirrus clouds from aviation emissions won't be mitigated in changing the jet fuel to synthetic fuels.	Too much detail for this report
Australia (0)	8	81	21	81	23	-	-	-	No reference for this statement	Reference will be added
Christoph von Stechow (IPCC WGIII TSU)	8	81	42	-	-	-	-	-	Please add a cross-reference to the respective sections in chapter 2.	Cross reference to 2.3.3
Sweden (Swedish Environmental Protection Agency)	8	81	2	-	-	-	-	-	Possible addition at the end: ...and fuel switch.	This paragraph deals with efficiency and not fuels
Sweden (Swedish Environmental Protection Agency)	8	81	15	-	-	-	-	-	Possible addition: ...alternatives .../in the shorter time-frame/..., but¿	See above
Australia (0)	8	81	4	81	7	-	-	-	The punctuation in this sentence is confusing and inconsistent. Replace the word 'particularly' with 'including' and follow with a colon.	Change made
Australia (0)	8	81	15	81	17	-	-	-	This sentence is unclear - why would alternative fuels be used if they were not low carbon? Is this correct to say that synthetic jet fuels refined from biomass, natural gas or coal fuels are not low carbon? Should this term be in the glossary?	Sentence clarified
Robert Pietzcker (PIK)	8	81	40	81	40	-	-	-	would ¿biocrudes¿ be cheaper than normal biofuels? Why not power ship engines with the normal biofuels discussed above?	Note this in text and add reference if possible
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	82	18	-	20	-	-	-	How different are biodiesel and renewable "Green" diesel?	Changed to biodiesel
Robert Pietzcker (PIK)	8	82	5	82	7	-	-	-	mention that in the EU, more than 50% of rail is powered by electricity (¿Eurostat 2009: Panorama of Transport¿)	Information will be incorporated
Robert Pietzcker (PIK)	8	82	5	82	7	-	-	-	please check your reference for the numbers. In IEA(2009): ¿Transport, energy and CO2¿ it says on p 231 about the energy use for rail: ¿worldwide, electricity is gaining share, rising (¿) to 31% in 2006¿	Reference will be checked
Australia (0)	8	82	4	82	5	-	-	-	This sentence is vague regarding the benefits of rail - are qualitative figures available?	We are not talking about benefits of rail

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Manfred Treber (Germanwatch e.V.)	8	82	5	82	6	-	-	-	We read 'Rail transport is primarily powered by diesel fuel (almost 90% of rail energy use in 2005)'. Is this for freight transport on a global level or for the whole rail transport with freight and passengers trains? And what are the 100% for the 90 % - are these the train-kilometers [this would be the best reference]. If we look at passenger and freight volumes in Pkm and tkm it is difficult to compare both unless train kilometers are the reference.Or the 90 % are the energy content of the diesel consumed and 10 % are the electric kWh? But this is a bad mapping of the situation as the electricity has a much higher primary energy consumption associated than the heat value of the electricity.	Information will be incorporated
Robert Pietzcker (PIK)	8	83	7	83	8	-	-	-	Please also mention „modal shift“ from a more carbon intensive mode to a less carbon intensive mode!	Text on modal shift added
Kristin Seyboth (IPCC WG III TSU)	8	83	21	83	32	-	-	-	This bullet list should be completely redone to focus strictly on the building sector and exclude aspects that are clearly covered in other subsections of 8.3 e.g. transport or agriculture. Suggest focusing simply on three bullets: 1) electricity for lighting and appliances 2) heating 3) cooling.	Accepted
Kristin Seyboth (IPCC WG III TSU)	8	83	-	-	-	8.3.2	-	-	The introduction to 8.3.2 could use a good solid rewrite. (See 8.3.1 as a positive example) Suggested paragraph flow would include: 1st: Different characteristics of buildings covered within the buildings sector, e.g. high-rises to single dwellings 2nd: primary energy demand and GHG emissions accounted for by the buildings sector 3rd: Options for reducing GHG in the buildings sector including a) energy conservation b) energy efficiency c) RE... 4th: Options for integrating RE in the buildings sector, specifically within electricity (for lighting and appliances), heating and cooling.	Done
Kristin Seyboth (IPCC WG III TSU)	8	83	-	-	-	8.3.2	-	-	This section doesn't follow the structure of the other sector sub-sections as promised in the introduction of 8.3, and as a result the entire section is much weaker than the others. A good solid re-write would be necessary, restructuring the subsections to flow logically with the other sections, and assuring that the content is also consistent and complementary.	Restructures
Kristin Seyboth (IPCC WG III TSU)	8	84	16	-	-	-	-	-	"RE integration differs" - it is not RE integration that differs bu the characteristics of the building sector itself - suggest rewording accordingly.	Amended
Trevor Demayo (Chevron Energy Technology Cvo.)	8	84	5	84	5	-	-	-	change ""many millions"" to billions (per Table 8.7)	Rejected- not correct

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Kristin Seyboth (IPCC WG III TSU)	8	84	20	-	-	-	-	-	covers these regional differences' The following subsections don't (or shouldn't) focus on regional differences, but the options available to integrate RE into the buildings sector while taking regional differences into account. Suggest rewording accordingly.	accepted
Kristin Seyboth (IPCC WG III TSU)	8	84	25	84	26	-	-	-	Cut energy density discussion to introduction of 8.3	Amended
Kristin Seyboth (IPCC WG III TSU)	8	84	26	84	28	-	-	-	Delete sentence "Nevertheless, secure energy supplies (IEA 2009)" Provides reader no new information, and is misplaced here.	Wording amended
Kristin Seyboth (IPCC WG III TSU)	8	84	13	84	15	-	-	-	Delete sentence "Policies place (IEA, 2007)". The focus here should be on options to reduce GHG emissions and on options for integrating RE into the buildings sector NOT on policies for H/C, which are covered extensively in Ch. 11	Amended
Emmanuel Branche (Electricité de France)	8	84	23	84	23	-	-	-	Electricity is also used for heating and cooking and for those countries (France, Norway, etc.) with an electricity carbon factor lower than natural gas, greenhouse gas emissions will be decreased. Proposition: "Many have natural gas these services, except for those using electricity"	Agree
Emmanuel Branche (Electricité de France)	8	84	-	-	-	-	-	8.6	A line for "heating" should be added	Accepted
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	84	-	-	-	-	-	8.6	Absorption refrigerators driven by gas/ liquid fuel often are utilized for space cooling.	Agree
Kristin Seyboth (IPCC WG III TSU)	8	84	-	-	-	-	-	8.6	What are the criteria for judging suitability? Cost? Social/environmental impacts? What reference is this information based upon? Would recommend deleting this table and the preceding paragraph unless clear criteria can be developed and substance can be based upon literature.	Reference added
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	85	29	-	35	-	-	-	Include "Mind the Gap" published by IEA in 2007. Refer this book. ISBN: 978-92-64-03884-4-september 2007	Too specific to EE

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Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	85	19	-	21	-	-	-	Include literature on possible integration of demand side resources in electricity markets as a demand response program and also economic feasibility of reserve provision by a distributed energy system or a microgrid. For example "Demand participation in the power market by load curtailment of building energy use and distributed generation of commercial customers in Japan", International Conference on Clean Electrical Power (ICCEP), Capri, Italy, (2009.6), attached as SRREN_Draft2_Review_Sugiyama-Taishi_Material_6	References expanded
Australia (0)	8	85	27	85	28	-	-	-	Perhaps brief reference to some policy examples here	Space restricted
Trevor Demayo (Chevron Energy Technology Cvo.)	8	85	28	85	28	-	-	-	Reference examples of successful gov't policies and entrepreneurial activities	Space restricted
Australia (0)	8	85	5	85	5	-	-	-	Replace 'drastic' with 'comprehensive'. Conveys the degree of the task but with a more measured tone, stressing the integration needed in planning RE and energy supply systems required	Accept
Trevor Demayo (Chevron Energy Technology Cvo.)	8	85	41	85	41	-	-	-	Suggest showing a figure to compare energy use in buildings in key countries (e.g. US, China, EU, Japan) to show variability. Another figure can show energy use in buildings over time in these regions, showing how much progress has been made and what it will take to get to zero net energy buildings by 2050	Too detailed
Trevor Demayo (Chevron Energy Technology Cvo.)	8	85	12	85	15	-	-	-	surface ground water"" doesn't make sense. Should it be surface water and/or groundwater? Also, BIPV market is not 20 GW by 2009 (that's closer to total global grid-connected PV installed capacity)	Groundwater
United States (U.S. Department of State)	8	85	13	-	-	-	-	-	The concept of buildings becoming energy suppliers is a valuable approach and could be addressed in more detail in earlier sections on integrating RE into the electric grid. Similarly, the technological advances that will help integrate RE into the built environment include significant advancement in management and interconnection for the electric distribution system.	In section 8.1.5
Anca-Diana Barbu (European Environment Agency)	8	85	4	85	8	8.3.2.1.	-	-	The message of this paragraph is less clear. Given that cities are generally consuming more natural resources than they have available, we need to shift from current practices of putting in place energy systems as the city evolves to a situation where we build the cities (or reshape them) according to what resources are available. For developing countries this would also mean to find a solution for the informal settlements.	accepted
Australia (0)	8	86	30	86	30	-	-	-	Reference for this statement	Accept

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Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	86	30	-	33	-	-	-	What is "solar chimney" for residential ventilation?	Common terminology
Australia (0)	8	87	18	87	18	-	-	-	Unclear how building codes and minimum air emission standards on their own will address barriers such as education and training. These measures address barriers such as principal/agent benefit splitting	Not clear - no reference
Kristin Seyboth (IPCC WG III TSU)	8	87	-	-	-	8.3.2.1.5	-	-	Delete this sub-section and text. There is no policy section under the other sectors in Ch. 8. Planning is covered extensively in Ch. 11, so for reasons of consistency in Ch. 8 and to reduce overlap with Ch. 11 - this section should be deleted. At the most a sentence on influence of planning policies and a reference to Ch. 11 would be needed in the Future Trends section of 8.3.2 (which doesn't currently exist)	Policy included
Trevor Demayo (Chevron Energy Technology Cvo.)	8	87	-	-	-	-	8.29	-	This is a confusing figure and its significant features should be explained, at least with definition of acronyms. It could be removed.	Amended
Kristin Seyboth (IPCC WG III TSU)	8	88	-	-	-	8.3.2.1.6	-	-	These case studies (especially the France example) are based on one literature source that is a scenario for what COULD happen. Delete figures 8.30 and 8.31 and focus instead on describing the current and past situations in France and Japan and how those countries have succeeded in increasing the shares of RE in the buildings sector (indeed, if they even have). This section could use a good solid rewrite.	Amended
Australia (0)	8	89	14	89	14	-	-	-	Commercial example for balance?	Space restricted
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	89	14	-	17	-	-	-	I cannot follow the meaning of this sentence.	Amended
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	89	14	-	17	-	-	-	Is China a developed country?	No
Naoto Tagashira (Central Research Institute of Electric Power Industry)	8	89	40	-	-	-	-	-	Some vehicles in Japan, such as i-MiEV by MITSUBISHI MOTORS, can be charged from an ordinary grounded outlet via the household charger plug.	Need a reference

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Naoto Tagashira (Central Research Institute of Electric Power Industry)	8	89	46	-	-	-	-	-	The i-MiEV was sold by MITSUBISHI MOTORS in 2009 and others such as the Leaf by NISSAN are planned to be marketed in 2010 (before this report is published). I recommend adding these new vehicles and trends regarding EVs since 2009.	Not possible to keep up to date
Australia (0)	8	89	16	89	16	-	-	-	The importance of 'metering of energy use is based on actual data' - does this mean actual data has demonstrated the importance of these retrofitting and metering measures?	No reference material provided
Australia (0)	8	89	12	89	14	-	-	-	This sentence is confusing. Is the 100% supply from RE? Reword to 'Many retrofitting projects are underway to enable 100% supply for heating, cooling and electricity needs from RE, for example the Renewable Energy House in Bruxelles.'	Amended
Christoph von Stechow (IPCC WGIII TSU)	8	90	32	-	-	-	-	-	Please insert a cross-reference to the relevant section in chapter 2 (e.g. 2.4.4.2 and 2.5.5.1) and 9.	Accept
Naoto Tagashira (Central Research Institute of Electric Power Industry)	8	90	4	-	-	-	-	-	Reuse of batteries used for EVs for 3-5 years, for example, as storage for variable RE, has been studied. If the reuse works well, the cost of EVs would be reduced. I recommend adding the latest results from related studies.	Needs a reference
Emmanuel Branche (Electricité de France)	8	91	-	-	-	-	8.32	-	Problem to read all elements written on that figure.	Amended
Hiromi Takeuchi (Advanced Industrial Science and Technology)	8	92	25	93	4	-	8.34	-	The description on multi-family housing in China is different standpoint of view from that in Brazil. And, also, the description about China can be seen in P.89, line 28. It is better to eliminate this part, including Fig.8.34.	Considered but left in
Trevor Demayo (Chevron Energy Technology Cvo.)	8	93	-	94	-	8.3.2.3.	-	-	Would be helpful to discuss economic and scale aspects of the project (how much RE was installed, how much was energy efficiency increased?)	Too detailed
Kristin Seyboth (IPCC WG III TSU)	8	93	-	-	-	-	8.34	-	This China case study has the same fatal flaw as those on p. 88 - they focus on hypothetical future situations without giving concrete examples of what HAS happened in China. Recommend deleting figure and refocusing case study.	Is a useful reference
Laura Verduzco (Chevron Corporation)	8	94	29	-	-	-	-	-	Crosscheck number with chapter 2, page 7, line 9 for consistency: "... biomass provides fuel for the cooking needs of 2.4 billion people"	Amended
Trevor Demayo (Chevron Energy Technology Cvo.)	8	94	23	94	27	-	-	-	Lighting in developing countries is a major opportunity. Use of LEDs or CFLs can cut energy requirements significantly and reduce GHG emissions and improve health and safety.	Accept

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Kristin Seyboth (IPCC WG III TSU)	8	95	12	95	18	-	-	-	This paragraph tells the reader very little and contains not a single reference.. It would be good to expand the discussion on what is needed 1st: increased access to energy, listing options for doing this, and then options for integrating RE slowly. Simply stating that only the rich can afford RE is unacceptable. Rewrite section/paragraph accordingly.	Accept - to be reqorded
Kristin Seyboth (IPCC WG III TSU)	8	96	-	-	-	-	-	8.8	Delete table. All the relevant information for helping a reader understand the options for increasing RE in rural areas of the Congo are presented in one sentence describing deforestation rates earlier in the section, making this table unnecessary.	Accepted
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	97	2	-	5	-	-	-	add explanation of the first option and second option. It's difficult to understand.	Reworded to clarify
Australia (0)	8	97	34	97	35	-	-	-	Not clear that these percentages relate to percentage of industry emissions rather than all emissions	OK
Christoph von Stechow (IPCC WGIII TSU)	8	97	29	-	-	-	-	-	Please add a cross-reference to the respective sections in chapter 2.	OK
Australia (0)	8	97	26	97	27	-	-	-	Reference for this statement	OK
Trevor Demayo (Chevron Energy Technology Cvo.)	8	98	17	98	22	-	-	-	May condense discussion of cement production to just talk about potential for RE and not focus on GHG emissions reductions.	Whole point of RE in this context is GHG emissions
Christoph von Stechow (IPCC WGIII TSU)	8	98	37	98	41	-	-	-	Please add a cross-reference to the respective sections in chapter 2.	OK
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	98	6	-	10	-	-	-	Review COURSE50 which is Japanese Project named "CO2 Ultimate Reduction in Steelmaking Process by Innovative Technology for Cool Earth 50 (COURSE50)". Main theme of this project is; 1. Iron ore reduction by hydrogen enriched gases in blast furnace, 2. Development of new novel chemical absorbents for the capture of CO2, 3. Development of technologies for utilizing medium and low temperature exhausts heat 4. Total evaluation of reduction technology of carbon dioxide form BFG Ref: Takashi Miwa, Haruji Okuda: "CO2 Ultimate Reduction in Steelmaking Process by Innovative Technology for Cool Earth 50 (COURSE50)", Journal of the Japan Institute of Energy, Vol.89, 28-35 (2010) Attached as SRREN_Draft2_Review_Sugiyama_Taishi_Material_7	Reference added as well as mention of ULCOS

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Trevor Demayo (Chevron Energy Technology Cvo.)	8	99	38	100	2	-	-	-	Need to be mindful that using electricity for heat is generally discouraged until we have a very decarbonized electricity system. Carbon pricing will not likely encourage use of electro-technologies for process heat because of large demand for using electricity directly. Also, generating process heat directly can be several times more efficient than first making electricity and then converting this into heat, thus increasing use of primary energy, contrary to the statement on p. 99, line 45. In addition to biomass combustion/gasification and solar thermal, other direct heat carbon heat options include geothermal (conventional, not heat pumps), nuclear, and simple natural gas cogen systems. We should not lose track of overall energy usage because without accompanying reductions in end-use energy, as the world electrifies it will also become less efficient.	Good point, language revised accordingly
Australia (0)	8	100	47	101	1	-	-	-	Finland seems an odd example in this context	Example motivated
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	100	35	-	47	-	-	-	Review the paper by LBNL, "Pacific Gas & Electric Company 2007 Auto-DR Program: Task 13 Deliverable: Auto-DR Assessment Study" <a href="http://drrc.lbl.gov/drrc-pubsall.html">http://drrc.lbl.gov/drrc-pubsall.html</a>	Paper checked, deals mainly with tertiary sector and has only one (non-representative) example of industry
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	102	46	-	-	-	-	-	Check the unit of energy.	OK
Norway (Climate and Pollution Agency)	8	102	21	102	27	-	-	-	Numbers must be updated according to Lund (2010); see Chapter 4, Section 4.4.	OK
Trevor Demayo (Chevron Energy Technology Cvo.)	8	103	26	104	3	-	-	-	This case study is too detailed. Suggest simplifying Fig. 8.37 and perhaps listing other examples of solar thermal systems for process heat (e.g., Frito Lay chip factory in Modesto California) and even the original ARCO solar power tower that was used for enhanced oil recovery in California in the 1980s. A reference for this application can be provided upon request.	References requested from commentator to be considered for inclusion

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Arthur Lee (Chevron Corporation)	8	105	19	-	30	-	-	-	Rich multi-national corporate organisations and food importing countries such as Saudi Arabia, South Korea, Kuwait and Qatar have negotiated investments with governments of poor countries for between 15 to 20 M ha of land from 2006 to 2009. Their aim is to grow, manage and export food such as wheat, rice and maize, but also to produce crops for biofuel exports (Von Braun and Meizen-Dick 2009). Deals being quoted include China securing the right to grow palm oil for biofuel on 2.8M ha in the Democratic Republic of the Congo and also negotiating 2M ha in Zambia, South Korea investing in Madagascar, and Sun Biofuels UK, a private company, growing jatropha plantations for biodiesel oil in Ethiopia and Mozambique. Investments can either cause exploitation of the existing rural communities (WWICS 2010) or provide benefits when the advantages are equally shared, such as Brazilian sugar ethanol companies investing in Ghana (REW 2008). A code of good conduct to share benefits, abide by national trade policies and respect customary rights of the family farm unit is being considered." A scientific assessment such as this should not have value-laden phrasing that runs through this entire statement: "Rich multinational corporate organisations..." and "...poor countries." Some might say that China is still a poor country by some criteria of its rural population. This statement is simply too inaccurate and value laden. Further, the reference used is WWICS 2010, a Woodrow Wilson International Center's panel discussion summary. It is not clear whether the panelist's own evidence or words used in their presentations are accurately reflected or whether sufficient evidence were presented to warrant these very incendiary descriptions of commercial deals and events. The authors of Chapter 8 need to check these facts that are being assessed carefully to avoid any embarrassment for the IPCC process.	Reworded
Kristin Seyboth (IPCC WG III TSU)	8	105	19	105	30	-	-	-	Would recommend cutting this text. It does not fit well into section and leaves reader lost.	Reworded
China (China Meteorological Administration)	8	105	23	105	24	8.3.4	-	-	"Deals being quoted include China securing the right to grow palm oil for biofuel on 2.8M ha in the Democratic Republic of the Congo and also negotiating 2M ha in Zambia". This is not true, please delete the sentence.	Reworded
Kristin Seyboth (IPCC WG III TSU)	8	106	-	107	-	-	-	8.9	Cut table to Chapter Annex and include a brief summary in the text.	Table a useful overview

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United States (U.S. Department of State)	8	108	22	-	-	-	-	-	Anaerobic digestion is a less efficient mechanism than gasification when convert organic waste material into combustible gas (methane or syngas). The same amount of feedstock will give you a higher energy output with gasification than AD. In addition, the chemical processes for gasification are more compatible with liquid fuel production (pyrolysis), which can be particularly valuable in an agricultural context.	AD for wet biomass . Gasification for dry biomass
Christoph von Stechow (IPCC WGIII TSU)	8	108	23	-	-	-	-	-	Please specify this cross-reference, since chapter 2 is voer 100 pages long.	Done
Trevor Demayo (Chevron Energy Technology Cvo.)	8	109	30	-	-	-	-	-	the net energy and nutrient balance associated with biochar utilization are key issues.	Agree
Trevor Demayo (Chevron Energy Technology Cvo.)	8	109	-	-	-	-	8.39	-	Specify the regions that this covers...is it a global average? Label y-axis.	Amended
Australia (0)	8	110	7	110	31	-	-	-	The tenses are confusing in this case study. Are there any reportable results on the trial?	Amended
Trevor Demayo (Chevron Energy Technology Cvo.)	8	111	-	-	-	-	-	-	There should be a summary section w/ key conclusions. The ending is too abrupt. Suggest trying to rank priorities in terms of cost-effectiveness of integration of RE into residential, commercial and industrial sectors.	Exec summary. No analysis for ranking in literature
Trevor Demayo (Chevron Energy Technology Cvo.)	8	111	-	-	-	-	-	8.41	This figure is not very informative, suggest removing.	Done
HONGGUANG JIN (Thermophysics engineering ,Chinese Academy of Scinces)	8	112	-	133	-	-	-	-	There are many references more than 20 pages. I suggest some should be cancelled.	References encouraged
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	125	16	-	20	-	-	-	These two references have same title, same journal title, and same page. It's mistake.	Rectified
United Kingdom (Department of Energy and Climate Change)	8	769	-	-	-	WRONG PAGE NUMBERS	-	-	It may not be obvious to the reader that national energy systems vary widely, even between countries in the same geographic region or with similar states of development. This means that there are universal issues to consider in integrating RE but no universality of optimal system design. While this is implied in the transition to the next page, it would be better to make it explicit.	Accept - but Not clear

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United Kingdom (Department of Energy and Climate Change)	8	770	45	-	-	WRONG PAGE NUMBERS	-	-	Does the author mean will be required rather than is conceivable?	Accept
United Kingdom (Department of Energy and Climate Change)	8	770	25	-	-	WRONG PAGE NUMBERS	-	-	It is worth mentioning that building stock dynamics vary widely and that there is a major difference between retrofit and new build in terms of what is economically feasible.	Too detailed here
United Kingdom (Department of Energy and Climate Change)	8	773	11	-	-	WRONG PAGE NUMBERS	-	-	Roof mounted wind turbines are an unfortunate example given the poor results that have been experienced from operating them. Simple physics explains why a building roof in a city is a poor location for a turbine. See for example the report from the UK Energy Savings Trust. Small turbines located at a distance to buildings in windy rural areas are more promising.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	775	34	-	-	WRONG PAGE NUMBERS	-	-	While it is true that transmission sometimes operates over 100s of km, the typical distances is 100s.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	776	7	-	-	WRONG PAGE NUMBERS	-	-	A similar point; while it is true that networks span continents, the main use is still national. Transmission is expensive and so it is only used to the extent required.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	781	25	-	-	WRONG PAGE NUMBERS	-	-	This statement is potentially misleading. The recent Poyry study on wind intermittency at moderately high penetration in the UK shows that high pressure events remove much of the capacity. The capacity credit for wind at this level in the UK is around 5%. Given that the average capacity factor for the UK mix is over 30%, this means that a large part of the wind requires to be backed up by other generation. There are also frequent high wind events, when much of the baseload generation is suppressed by negative margin (due to ROCs) wind. The apparent modest impact of low wind penetration is due to sharing the backup with a 1.3GW nuclear plant.	resolved by rewrite

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United Kingdom (Department of Energy and Climate Change)	8	782	26	-	-	WRONG PAGE NUMBERS	-	-	Depending on the connection/conversion type, there can also be problems with increased fault current when RE is connected into the distribution system.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	782	42	782	43	WRONG PAGE NUMBERS	-	-	The scale of wind systems is such that transmission can only distribute some of the variation over a larger area in situations where large areas have wind farms.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	783	6	-	-	WRONG PAGE NUMBERS	-	-	It should be mentioned that the case for replacing conventional assets in areas with high RE density is less and this needs to be part of the strategic planning; market structures can complicate this, especially if the system is vertically integrated or the conventional generator has long lived transmission rights attached to their site.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	783	38	-	-	WRONG PAGE NUMBERS	-	-	This paragraph implies that each country can increase the level of RE, while relying on transmission to connect to the conventional generation of surrounding countries for security. A more thoughtful discussion of the issues or a useful reference to studies on a 100% RE continent would be helpful.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	785	13	785	15	WRONG PAGE NUMBERS	-	-	Or it could make matters worse. Vague comments without a reference or analysis are unhelpful. In this example it would be helpful in an area with airconditioning where wind is negatively correlated with sunlight. This is another point where a comparison of different mix and load scenarios for different locations would be instructive.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	786	5	792	23	WRONG PAGE NUMBERS	-	-	this is a really useful section, but it would be easier to understand if the demand side was also described and the target supply mix and management systems aligned with demand.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	788	8	-	-	WRONG PAGE NUMBERS	-	-	From reading the text it is not obvious that Denmark has a potentially serious waste electricity problem from the combination of high penetration of wind and CHP district heating schemes. It would be useful if the implications in terms of re-engineering the district heating systems were discussed with more factual analysis.	resolved by rewrite

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United Kingdom (Department of Energy and Climate Change)	8	788	2	-	-	WRONG PAGE NUMBERS	-	-	This is a frequently repeated statement, which does not make it true. Either cut the statement or provide a reference showing that people adjust their vehicle charging behaviour to match electricity supply.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	792	38	-	-	WRONG PAGE NUMBERS	-	-	This would be a good point to discuss the implications of making nuclear and thermal plants more load following.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	794	-	-	-	WRONG PAGE NUMBERS	-	8.1	It would be useful to have non electricity stores such as underground heat, building integrated heat, LNG, geological gas and hydrogen etc storage.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	795	16	-	-	WRONG PAGE NUMBERS	-	-	It would be worth discussing the difference between dynamic load management such as the water heater example and the suppression of demand peaks through pricing and focussing users on the efficiency and timeliness of power usage for peak loads.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	795	36	-	-	WRONG PAGE NUMBERS	-	-	The whole of this and the following section seem repetitive of earlier material and internally repetitive.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	795	11	-	-	WRONG PAGE NUMBERS	-	-	This statement is unclear; all energy systems have storage and many have system level storage; for example the US has strategic oil and gas stores. Does this statement mean energy that can easily be converted to electricity? In which case gas should certainly be mentioned.	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	798	20	-	-	WRONG PAGE NUMBERS	-	-	It is entirely possible that users can game the market system, driven by the unintended consequences of incentives for RE; there is an instability caused by interaction between heat pumps and gas micro-CHP systems, where adding a resistance heater to the micro-CHP that saves gas when power is cheap causes a poor return on the heat pump. The instabilities caused by consumer reaction to varying prices might be very interesting!	resolved by rewrite

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United Kingdom (Department of Energy and Climate Change)	8	799	37	-	-	WRONG PAGE NUMBERS	-	-	See Oswald for a paper that suggest the conclusion reported here is based on misleading statistics.	resolved by rewrite
Michael Power (University College Dublin)	8	-	-	-	-	-	-	-	General Comment: I think it would be beneficial to the overall document if all the issues related to wind power, ancillary services, flexibility, interconnection, loads and storage and their impact on electricity networks (both transmission and distribution) were kept together in chapter 7 rather than splitting them over chapters 7 and 8. This would allow chapter 8 to concentrate on future systems without having to discuss issues such as electrical power plant and electrical network characteristics.	it is not possible to change that anymore. References to ch7 will be given in order to minimize overlappings
Osamu Kimura (Central Research Institute of Electric Power Industry)	8	-	-	-	-	-	-	-	Heatpumps are recognized as renewable energy these days. Technology and policy has to be reviewed by SRREN. To name a few, followings are the literature: i) EU Directive on the promotion of the use of energy from renewable sources <a href="http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:01:EN:HTML">http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:01:EN:HTML</a> ii) German Renewable heat Law <a href="http://www.bmu.de/files/pdfs/allgemein/application/pdf/ee_waermeg_en.pdf">http://www.bmu.de/files/pdfs/allgemein/application/pdf/ee_waermeg_en.pdf</a> iii) UK's Renewable Heat Incentive <a href="http://www.rhincentive.co.uk/eligible/energies/">http://www.rhincentive.co.uk/eligible/energies/</a> iv) UK's Renewable strategy  <a href="http://filesdown.esecure.co.uk/Gartree/TheUKRenewableEnergyStrategy2009_1_.pdf_17072009-1624-43.pdf">http://filesdown.esecure.co.uk/Gartree/TheUKRenewableEnergyStrategy2009_1_.pdf_17072009-1624-43.pdf</a>	Heat pumps are treated as renewable in Ch 8 while recognising the importance of decarbonisation of electricity
Peter de Haan (Ernst Basler + Partner AG)	8	-	-	-	-	-	-	-	no comments from Reviewer P de Haan	??
Morgan Bazilian (UNIDO)	8	-	-	-	-	-	-	-	Overall some interesting information, but needs to be refined for a more coherent narrative	Been revised
Morgan Bazilian (UNIDO)	8	-	-	-	-	-	-	-	Overall some interesting information, but needs to be refined for a more coherent narrative	resolved by rewrite
Steffen Schlömer (IPCC WGIII)	8	-	-	-	-	-	-	-	Please check statement on intermittency of RES and corresponding role of geothermal: Ch4, p.5, l.16-18	the comment is specifically directed to e.g. a specific phrasing of the (old) section. Hence it is not relevant anymore due to the rewrite of the section.

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Gonzalo Piernavieja (Instituto Tecnológico de Canarias (ITC))	8	-	-	-	-	-	-	-	See general comments above	??
Seppo Hänninen (VTT)	8	-	-	-	-	-	-	-	Smart metering is recognized as a key enabling technology for the implementation of demand response products	relevant, considered in rewrite process of 8.2.1
Robert Pietzcker (PIK)	8	-	-	-	-	-	-	-	something seems wrong with the references ¿ there are 7 different references all referred by IEA2009 ¿ you need to add further differentiation, e.g., IEA2009a, IEA2009b, ¿ Else the referencing is just a bad joke!	Rectified
Robert Pietzcker (PIK)	8	-	-	-	-	-	-	-	something seems wrong with the references ¿ there are 7 different references all referred by IEA2009 ¿ you need to add further differentiation, e.g., IEA2009a, IEA2009b, ¿ Else the referencing is just a bad joke!	resolved
Paul Smith (University College, Dublin)	8	-	-	-	-	-	-	-	There are 7 IEA 2009 citations. Which one is referred to here?	resolved by rewrite
Hannele Holttinen (VTT)	8	-	-	-	-	-	-	-	We should decide the focus for this chapter - how much deployment issues, barriers to building more RES should be written here. I would leave them all away or then make very sure that the texts on these issues are very concise.	resolved by rewrite
Hannele Holttinen (VTT)	8	-	-	-	-	8.1	-	-	The introduction should be shortened and just clearly point out the issues that will be further described	Attempted to shorten but has to set the scene
Hannele Holttinen (VTT)	8	-	-	-	-	8.1	-	-	The introduction should be shortened and just clearly point out the issues that will be further described	the comment is specifically directed to e.g. a specific phrasing of the (old) section. Hence it is not relevant anymore due to the rewrite of the section.
Hannele Holttinen (VTT)	8	-	-	-	-	8.1.2	-	-	last paragraph rows 18-25 is better written than the first part of the section (repetition that could be shortened)	Attempted to shorten
Hannele Holttinen (VTT)	8	-	-	-	-	8.1.2	-	-	last paragraph rows 18-25 is better written than the first part of the section (repetition that could be shortened)	the comment is specifically directed to e.g. a specific phrasing of the (old) section. Hence it is not relevant anymore due to the rewrite of the section.
Hannele Holttinen (VTT)	8	-	5	-	17	8.1.2	-	-	why is this issue taken up here? Could be mentioned somewhere deeper in the section	resolved by rewrite
Robert Pietzcker (PIK)	8	-	-	-	-	8.1.3.	-	-	The separation between 8.2 and 8.3 is not so strong: for transport, you definitely also need to talk about vehicles, thus technical aspects.	Vehicles included

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Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	8	-	-	-	-	8.2	-	-	You must address the troubles caused by the integration of intermittent RE into electricity grid. For example, large scale blackout happened in Europe in November 2006. Generally, the uncontrolled operation of dispersed generation (mainly wind and combined-heat-and-power) during the disturbance complicated the process of re-establishing normal system conditions. Review, at least, the following: Union for the co-ordination of transmission of electricity: "Final Report on System Disturbance on 4 November 2006", SRREN_Draft2_Review_Sugiyama_Taishi_Material_08	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	It gives no sense of scale of the practical resources and the reader is not left with any impression about how the future system may look like.	resolved by rewrite
Richard Piwko (General Electric Company)	8	-	-	-	-	8.2.1	-	-	Chapter 8 contains numerous serious technical errors. Furthermore, the entire approach to the Chapter seems to have a fatal flaw in that it considers anything that was published in a technical journal as being technically correct, while it ignores many of the best sources of valid technical information, including the reports from the technical studies themselves. In addition, several concepts are described as sound and "accepted" technical science when in fact they have no sound basis to support their value. For example, the "renewable virtual power plant" is not sound science. While it may be possible to group one set of selected resources to achieve a desired result, this concept cannot be duplicated on a large scale to provide renewable for the bulk power grid. It is pure fantasy and only serves to reduce the value of this entire report If the authors truly want to issue a report of the stature and accuracy warranted by the Intergovernmental Panel and Climate Change, then I suggest that Chapter 8 be totally rewritten to focus on proven facts that are known in the industry.	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1	-	-	Country case studies and examples, if included, must clearly relate to the points made in the text, illustrating how the integration road map has been or can be applied.	resolved by rewrite
Hannele Holttinen (VTT)	8	-	-	-	-	8.2.1	-	-	I propose to think about the focus more, and shift it more to the (engineering) integration part, not so much institutional, and as much concrete practical information as possible. Also the examples chosen in 8.2 should reflect experience on variable RE integration so I would change these.	resolved by rewrite

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Peter Børrre Eriksen (Energinet.dk)	8	-	-	-	-	8.2.1	-	-	I suggest that one author rewrites the section with the aim of harmonizing the text. It would be a good idea to include an introduction for explaining which subjects that will be described in the succeeding subsections. The messages and points should be more crisp and direct. More focus on the needs of the busy reader is important.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	In many places statements are made that indicate that something is not happening or the power system does not account for it. Many of these statements simply boil down to the fact that these things do not make technical or economic sense. Whoever wrote much of this material shows very little knowledge of real power systems.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	In many places the content of a section is inconsistent with the section heading.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	It is dominated by wind.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	Many concepts are introduced as if they have merit and are 'true' yet no concrete evidence is given to support them. Therefore it reads like someone has an agenda. It does not read like an objective assessment.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	Many sentences simply do not make any sense 'I mean this in an English language sense in the first instance. Then many are clearly factually incorrect and misleading. Also there are a share of them that are simply left hanging i.e. unfinished business.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	Many things are not defined and sometimes the definitions that are given are wrong.	resolved by rewrite

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Charlie Smith (Utility Wind Interest Group)	8	-	-	-	-	8.2.1	-	-	<p>Section 8.2.1, Electric Power Systems, is written from a much different viewpoint and in a much different style from the corresponding section of Chapter 7. The authors assume much less knowledge about the basics of power systems from the reader, and much less knowledge about integration issues. My own impression is that the authors should assume they are writing for an audience with some familiarity with the subject matter, and get away from the presentation of very basic material. I find the constant explanations in parenthesis near the beginning of the section particularly distracting. The further impression given is that the authors are not experts in the subject matter and are learning and presenting some of the information for the first time. They oftentimes belabor the obvious, and present materials that are the findings of others, and not something with which they have much familiarity. This impression is reinforced with the excessive and inconsistent use of references.</p> <p>This section is also less technical than I would have expected, with presentation of what I consider political and socio-economic policy issues. I am sure there is a place for such considerations, but I would question whether they belong here. You could simply drop the case studies on New Zealand, Chile, and Indonesia, and save 3 pages. At the same time, the treatment of the material is uneven. Some of the material is repetitive, and some of it is too detailed, for example on transmission design, and distributed generation and smart grids. In particular, the last set of case studies on future power system concepts could be summarized in a paragraph with references to the papers and reports, saving 5 pages.</p> <p>My recommendation is that you get a panel of subject matter experts to re-write this chapter, starting from scratch. I think this section needs to be on a par with the corresponding section of Chapter 7, and better coordinated with it. It is too scattered and diffuse as it stands, and needs to be sharpened and strengthened.</p>	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	The Case studies have no uniform in style or content and many are not based on any rigorous analysis that would result in a large scale roll out i.e. nice ideas but that is it.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	The Electricity part of Chapter 8 takes up approximately 1/3 of total chapter (probably a little less) & however it is clear that most renewable will be integrated through electricity hence an imbalance.	resolved by rewrite

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Kristin Seyboth (IPCC WG III TSU)	8	-	-	-	-	8.2.1	-	-	The entire section is difficult for a reader to follow, and contains serious overlap between sections 8.2.1.3 and 8.2.1.6, most of which can be easily separated into a clear distinction of 'challenges' and 'options'. Logistically, I would suggest restructuring the end of the section to read as follows: 8.2.1.3 Challenges for integrating RE 8.2.1.3.1 Power system design, stability and operation 8.2.1.3.2 Network reinforcement, extension and inter-connection 8.2.1.3.3 Network connection requirements 8.2.1.3.4 System adequacy 8.2.1.3.5 Electricity market design and corresponding market rules 8.2.1.3.6 Costs 8.2.1.4 Options to facilitate integration of RE 8.2.1.4.1 Engineering Options 8.2.1.4.2 Institutional Options 8.2.1.4.3 Country Case Studies 8.2.1.5 Visions for possible future power supply systems 8.2.1.5.1 Large-scale RE generation 8.2.1.5.2 Distributed generation 8.2.1.5.3 Case study concepts for future power supply systems	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	The material is overly influenced by policy issues $\zeta$ while I am a big fan of multidisciplinary work etc. I found the emphasis excessive, in particular when you consider many of the critical technical issues are simply missing. For example, dynamics, operational issues, real time control, system reliability, challenges to be overcome with HVDC technology etc. It is particularly concerning as there is a sense that there are no technical barriers $\zeta$ there are and properly addressed we can integrate large amounts of renewable $\zeta$ if not systems will be either very expensive and/or unreliable $\zeta$ this is a major weakness and a dangerous message.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	The references are very poor: Some are used so often that I lost count, many are not peer reviewed, I did not recognise many of the authors and I did check the reference list and discovered that the ones that are peer reviewed are not from mainstream electrical engineering Journals e.g. IEEE Transactions on Power Systems features only once despite being the leading journal in the area.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	The text in itself is inconsistent within itself in many places.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	There are large overlaps with Chapter 7.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	There are some silly errors relating to units etc.	resolved by rewrite

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Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	There is an underlying tendency to indicate that we are looking at 100 % penetrations - surely not ¿ surely we are looking for a portfolio ¿ renewable, CCS, Nuclear and fossil etc.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	There is no detail of research questions that need to be answered (see above comment on policy). This is an important issue considering future systems which is completely missing.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	There is no punch line ending it just dribbles out ¿ this off course is due to its lack of focus and structure.	resolved by rewrite
Mark O'Malley (UCD)	8	-	-	-	-	8.2.1	-	-	There is no real strong structure or coherence within the material ¿ it looks and feels like a jumble of points almost randomly put together.	resolved by rewrite
Peter B¿rre Eriksen (Energinet.dk)	8	-	-	-	-	8.2.1	-	-	This section must be improved. It is very difficult to follow the red thread. Also the language tends to be of varying quality.	resolved by rewrite

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Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.1	-	-	<p>Suggested revised text: There are many textbooks and papers that discuss electric power systems at various levels of specialization (Freris and Infield 2008; El-Sharkawi 2009; Ummels 2009). This section therefore will provide only a brief summary of the issues relevant to RE integration. The overall aim of any electric power supply system, small or large, autonomous or inter-connected, is to balance supply with continually varying demand in a cost-effective manner at all times in order to maintain continuity and quality of supply to end users. (Box 8.1).</p> <p>The components of a power system include generation (converting primary energy into electrical energy in power stations), transmission (transferring electrical energy at high voltage over large distances up to 1000s of km), distribution (transferring electrical energy at low voltage over local networks), and delivery to end-users, appliances that provide valued energy services. Most modern power supply systems have a portfolio of grid-connected generation technologies, which may include large hydro and a relatively small share of other RE technologies, mainly wind, geothermal, bioenergy CHP and solar. The most common conventional thermal generation technology is based on steam turbines using coal, natural gas or a nuclear reactor to heat water and produce steam that spins the turbine connected to a generator and gas turbines, where compressed air is passed into a combustion chamber fired by natural gas or oil and the hot compressed gas spins the turbine. Steam and gas turbine technologies can be linked in a combined-cycle plant passing the exhaust gas from the gas turbine into a heat-recovery boiler to produce steam.</p> <p>Transmission networks or grids were developed to serve large geographic regions or entire countries from larger power stations including remote hydro power stations, later becoming inter-connected to reach continental scale. Transmission networks comprise High Voltage (HV) and Extra-High Voltage (EHV) overhead lines, underground cables and substations for transformation between different voltage levels and switching. They transfer electric power between generators and grid connection points to local distribution networks. Transmission networks enable the most cost-effective generation sources to be used to meet demand, and enable pooling of generation resources over a wide area to ensure reliability of supply. Distribution networks convey electric power from the grid connection points to the premises of consumers. Embedded generation that is connected directly to the local distribution network is becoming more significant, especially smaller scale RE generation.</p>	resolved by rewrite
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HONGGUANG JIN (Thermophysics engineering ,Chinese Academy of Scinces)	8	-	-	-	-	8.2.1.1	-	-	The description is too long and should be shorted. And the three-level subtitle are over classified.	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.1	-	-	this comment relates to 8.2.1.1 including all its subsections. The description of electric power systems is too long, includes excessive detail and therefore masks the key points. The entire section should be re-written and shortened to emphasise a few key points relevant to the integration of renewables. These are (1) electricity cannot be stored economically and so supply and demand must be balanced at all times, (2) electricity power systems have been designed, developed and operated to deliver reliable supplies to end users in a safe and cost-effective manner (3) power generation has in many cases been centralised in large plants because of resource location, fuel supply, economy of scale and other considerations (4) transmission networks have evolved to enable power to be delivered from the most competitive resources and to enable pooling of resources to enhance reliability. Since resources are normally greater than required to meet demand at any given time (since provision must be made for peak demand and for plant failures) optimal scheduling of resources is a key issue. Traditionally handled by integrated monopolies, resource scheduling is now determined through competitive market arrangements in many countries. (5) Prices to most end users are normally prespecified and constant with adjustments from time to time.	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.1.1	-	-	Some mention of the role of markets in the operation of many power systems is required. Scheduling of generators may be determined by market processes, with the market-based schedules being varied if necessary by the system operator to balance supply and demand and ensure reliability.	resolved by rewrite

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Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.1.1	-	-	<p>Suggested revised text: 8.2.1.1.1 Design and operation of power systems Electricity supply involves a complex technological system made up of a vast number of individual components which may have many different owners and operators. Electric power systems are designed and operated to ensure delivery of electric power to meet demand in a cost-effective manner. In general terms, reliable delivery means that demand is met even following more likely unplanned events such as generator or network faults. For less likely events, such as multiple faults, supply to some users may be interrupted but the integrity of the main power system is maintained so that the interrupted supplies can be restored rapidly.</p> <p>Electrical energy is not storable in a cost-effective manner so supply and demand must be balanced at all times (Box 8.1). Planning and operation of power systems ranges from managing second-to-second short-term fluctuations through to long-term planning of future investments in new generation and network assets to meet predicted demand.</p> <p>Forecasts of future demand and supply out to days ahead can be used to support security management and other operational decisions such as unit commitment and dispatch, and out to a year ahead for fuel purchasing, reservoir-hydro scheduling and planned maintenance of generation and network assets. Longer-term forecasts are used for planning system expansion.</p>	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.1.1	-	-	This section is really just about operation, so design should be deleted from the title.	resolved by rewrite
Hannele Holttinen (VTT)	8	-	-	-	-	8.2.1.1.2	-	-	Point out that the load is easier to forecast to larger quantities of loads and usually follows daily patterns	resolved by rewrite

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Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.1.2	-	-	<p>Suggested new text: 8.2.1.1.2 Electricity demand characteristics</p> <p>Electricity demand reflects user requirements for energy services and the characteristics of the appliances installed to deliver those services, such as heating, cooking, motor drives, lighting etc. In analyzing and predicting demand behaviour, it is useful to group end-users into residential, commercial, industrial and miscellaneous categories. Residential and commercial consumers tend to have strong diurnal, weekly and seasonal patterns, but are sensitive to weather conditions, whereas industrial consumption is usually steadier over time. Residential electricity tariffs normally have few time-dependent characteristics and supply is regarded as an ‘essential service’. Therefore to date little attempt has been made to actively influence the consumption of residential or small commercial end-users through price variation or by direct control of end-users’ appliances. For large commercial and industrial end-users, more attention has been paid to pricing mechanisms or other financial incentives to encourage demand reduction (possibly by operating on-site generation) at times of peak demand or high wholesale electricity prices.</p> <p>With the advent of electronic electricity meters and advanced communication and control equipment, more attention is now being paid to active end-user and embedded generator engagement. This is reflected in the growing international attention being given to the concept of the ‘smart grid’ (Schweppe, Tabors et al. 1980; Cheung 2010) that envisages coordinated, decentralized decision making involving all electricity industry participants. The concept could assist with wide scale RE integration but is only at an early stage of development (8.2.1.6). Critical evaluations are in progress as it may have unintended consequences as yet undefined.</p>	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.1.2	-	-	<p>This section needs to say that in advanced societies, consumers expect a continuous, reliable, high-quality electricity service. Loss of electricity supply results in great inconvenience and cost.</p>	resolved by rewrite
United States (U.S. Department of State)	8	-	-	-	-	8.2.1.1.3	-	-	<p>In some regulated energy structures, revenues are based on energy usage; however, new incentives should be created to promote conservation and efficiency.</p>	Accept but not easy. No reference
Hannele Holttinen (VTT)	8	-	-	-	-	8.2.1.2	-	-	<p>Chop long sentences to two: ‘generation plants. RE generation cannot always be dispatched’. Understanding RE characteristics and ‘by variable RE sources. These can be largely accommodated’.</p>	resolved by rewrite
HONGGUANG JIN (Thermophysics engineering ,Chinese Academy of Sciences)	8	-	-	-	-	8.2.1.2	-	-	<p>The listed case studies are based on real experience of RE integration for different countries. But they cover 7 pages of this section. I believe these cases are not necessary for this part and suggest that it should be removed or shorten.</p>	resolved by rewrite

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Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.2	-	-	this comment relates to 8.2.1.2 including all its subsections. This material appears to duplicate material in other chapters, e.g. Chapter 7 for wind. Therefore the treatment in 8.2.1.2.1, 8.2.1.2.2 and 8.2.1.2.3 could be very much shorter and better focussed on the characteristics that are relevant to integration.	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.2	-	-	This introductory section is too complex. The last sentence should come first, then a sentence to say that many forms of RE are nondispatchable, then the sentence from line 10 to line 12 ("Understanding these characteristics...")	resolved by rewrite
United States (U.S. Department of State)	8	-	-	-	-	8.2.1.2.1	-	-	A reference could be added to cite variability of biomass in terms of BTU content per ton.	relevant, considered in rewrite process of 8.2.1
United States (U.S. Department of State)	8	-	-	-	-	8.2.1.2.1	-	-	This section discusses variability and predictability, but only lists one solution (forecasts). Other solutions to variability should be provided for context to the reader. These solutions compete with, as well as supplement forecasting: 1. Storage - flywheel, pumped hydro, batteries (many kinds), etc 2. operational methods - shorter scheduling periods - cooperative resource sharing programs - consolidating balancing areas or dynamically scheduling resources into other areas 3. Demand response (different types and time scales) 4. Better use of existing generation fleet (e.g. utilize ramping capabilities of individual generators) etc...	relevant, considered in rewrite process of 8.2.1
Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.2.2	-	-	There are two aspects of resource location that need to be addressed. (1) RE plants may be relatively small, widely dispersed and embedded in distribution networks, posing challenges in the fields of operation and control, and to the design and operation of the distribution networks and (2) Large scale exploitation of renewable resources may require substantial new transmission infrastructure. The section should be re-written to make this clearer.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	-	-	-	-	8.2.1.3	-	-	In general there is a lot of overlap in this section with section 8.2.1.6. A clear effort should be made to focus this section on challenges, and to cut all discussion of solutions/options to 8.2.1.6. For the reader it is confusing to have bits of 'solutions' or 'options' throughout this section. It may also be useful for the reader to structure 8.2.1.6 in accordance to the challenges outlined in 8.2.1.3, clearly explaining the solutions to the challenges outlined.	resolved by rewrite

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Kristin Seyboth (IPCC WG III TSU)	8	-	-	-	-	8.2.1.3	-	-	Short paragraph giving an introduction to the different sub-sections would be useful. The current division between impacts, issues and challenges doesn't seem to make sense. It needs clear differentiation, otherwise the entire text should be combined under 'challenges' and the two headings 8.2.1.3.1 and 8.2.1.3.2 should be deleted.	resolved by rewrite
United States (U.S. Department of State)	8	-	-	-	-	8.2.1.3	-	-	The beginning of this section needs to present the integration problem as three legged stool of: planning, operations, and incenting behavior (markets/policy). Additionally, for high renewable penetrations, planning and operations are not the same as they have historically have been, thus operations must be focused for a system that has been planned a certain way. And likewise, planning must plan a system that is going to be operated a certain way. These cannot be decoupled, unlike historic practices.	relevant, considered in rewrite process of 8.2.1
Markus Haller (Potsdam Institute for Climate Impact Research)	8	-	-	-	-	8.2.1.3	-	-	the Challenges section is subdivided in 'Impacts' (8.2.1.3.1) and 'Issues and Challenges' (8.2.1.3.2), with the 'Impacts' subsection being almost empty; and without explaining the differences between both sections. I suggest to merge impacts and issues subsections. This has already been suggested for the FOD.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	-	-	-	-	8.2.1.3	-	-	There is a serious overlap between sections 8.2.1.3 (Challenges) and 8.2.1.6 (Solutions), with lots of the solutions being covered in both sections. As far as I understand, 8.2.1.3 should only state the problems that arise due to RE integration.	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.3	-	-	this comment relates to 8.2.1.3 including all its subsections. The fundamental objective in integrating renewable sources in electric power systems is not stated clearly. This should be to deliver electricity from sustainable sources to end users in a cost-effective manner, while continuing to meet end-users' electricity needs reliably and safely. More important and less important issues, near term and long term issues, established concepts and more speculative ideas, facts and opinions are mixed throughout these sections. It needs to be completely re-drafted to show a clear integration "road map" that can be adapted for the wide range of circumstances in different parts of the world. It should make clear in which areas research and development is needed to achieve integration, as against areas where investment and time are needed to deploy well known and understood solutions. There is an excessive focus on issues in continental Europe and the whole section appears to have been written from a purely continental European perspective.	resolved by rewrite
Dara O'Sullivan (University College Cork)	8	-	-	-	-	8.2.1.3.1	-	-	This section adds very little, and its information is mostly conveyed elsewhere. Removing it could be considered for chapter length reduction.	resolved by rewrite

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Dara O'Sullivan (University College Cork)	8	-	-	-	-	8.2.1.3. 2	-	-	An additional paragraph/section should be included on the fundamental change in network protection system design required to facilitate high levels of RE penetration. Existing fault protection systems are based on large numbers of large synchronous generators feeding faults at current levels several multiples of their rated current output. However, the majority of RE generators utilise power electronic converters and consequently fault current levels are limited to levels not significantly greater than rated current. This has a significant impact on protection design, and this technological shift needs to be addressed in system designs into the future.	relevant, considered in rewrite process of 8.2.1
Hannele Holttinen (VTT)	8	-	-	-	-	8.2.1.3. 2	-	-	rewrite the beginning - before it is mentioned that for wave and tidal also exist integration studies	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	-	-	-	-	8.2.1.4	-	-	Discussion of benefits seems misplaced here. Drivers/benefits for RE are covered extensively in Ch.1. Recommend deleting the entire 'benefits' discussion and merging cost discussions with 8.2.1.3 challenges. It could be a subheading of challenges, e.g. 8.2.1.3.3. There it would make sense, here it seems to float without any connection.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	-	-	-	-	8.2.1.4	-	-	I suggest to rename this section to 'Costs of RE integration' (i.e. not to mention benefits in the heading). It is obvious that RE expansion has beneficial effects, that is precisely why integrating them into power systems is being discussed. For this section, you should focus on analyzing the costs of this integration process.	resolved by rewrite
United States (U.S. Department of State)	8	-	-	-	-	8.2.1.5	-	-	"Other countries" mentioned in this passage should include the U.S.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	-	-	-	-	8.2.1.5	-	-	Both Ireland and Denmark case studies present information on options for facilitating RE integration that hasn't yet been presented in chapter (e.g. links to electric vehicles/transport). Suggest moving the entire case study section until after options have been presented. I.e. make 8.2.1.5 into 8.2.1.6, switching the location of case studies and options so that readers can learn about options first, and then see how specific countries have dealt with these options.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	-	-	-	-	8.2.1.5	-	-	Case study titles should also be consistent in terms of either a) describing the circumstance (e.g. 'with limited interconnection') or b) describing what steps were taken to integrate RE (e.g. by market reform). There is currently no consistency across them.	resolved by rewrite
Michael Power (University College Dublin)	8	-	-	-	-	8.2.1.5	-	-	Could a summary of the case studies be included at the start of this section? This summary would include a piece on lessons learnt or significant experiences gained.	resolved by rewrite

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United States (U.S. Department of State)	8	-	-	-	-	8.2.1.5	-	-	Most of the country case studies focus on future RE plans. It would also be of interest to discuss experience to date, especially in countries which already have a high share of RE (e.g. Denmark)	resolved by rewrite
Hannele Holttinen (VTT)	8	-	-	-	-	8.2.1.5	-	-	not clear why the low penetration cases Australia and Indonesia are chosen. Also Chile and New Zealand have no variable RE integration experience listed that should be the focus of this chapter and section. I would leave these out. The valuable Australian experience with the market integration could be mentioned somewhere else in the text.	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.5	-	-	The case studies should be at the end of the chapter.	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.6	-	-	The structure of this section and the subsection headings gives the impression that there is a choice between engineering solutions and institutional solutions. It must be made clear that technical, institutional, regulatory and market measures will all be required to achieve successful, effective integration of high levels of RE. Surely the structure of this section should reflect the points on lines 10-15 on page 17.	relevant, considered in rewrite process of 8.2.1
Dara O'Sullivan (University College Cork)	8	-	-	-	-	8.2.1.6.1	-	-	An additional paragraph should be included to recommend more detailed feasibility studies into the inclusion of the offshore zone as a feasible region for expansion of the transmission grid, where appropriate. Mitigation of the public acceptance and planning issues could provide a significant impetus to this approach.	relevant, considered in rewrite process of 8.2.1
United States (U.S. Department of State)	8	-	-	-	-	8.2.1.6.1	-	-	You entirely miss an important technology option in this summary: either enhancement of existing generation to achieve better ramping, turn-down, and cycling capability, and/or gradual retirement of constrained units and replacement with generation that can more easily and economically provide these 3 types of flexibility.	relevant, considered in rewrite process of 8.2.1
Markus Haller (Potsdam Institute for Climate Impact Research)	8	-	-	-	-	8.2.1.6.3	-	-	The introduction to this section is very vague and only repeats topics that have been mentioned in various sections before. I strongly suggest to improve coordination between the authors of different subsections to avoid this. Please, instead of repeating in five different subsections that extended transmission infrastructure is important, just mention it once, dedicate a whole subsection to it, and discuss the topic there in detail!	resolved by rewrite

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Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.6.3	-	-	This section is headed "visions for possible future power supply systems", but it is a very poor vision. EPRI Intelligrid and ETP SmartGrids documents set out visions for future electricity networks. These should be used as a basis for a "visionary" section. the ETP documents include concepts like Flexible, Accessible, Reliable and Economic. The Intelligrid vision includes words like automated, responsive, resilient, and customer services. These concepts are not communicated in section 8.2.1.6.3	relevant, considered in rewrite process of 8.2.1
Emmanuel Branche (Electricité de France)	8	-	-	-	-	8.2.1.6.4	-	-	Another initiative Transgreen should be added in this report ( <a href="http://www.transgreen.eu/">http://www.transgreen.eu/</a> ). This initiative states for transmission system for green electricity in the framework of the Mediterranean Solar Plan	relevant, considered in rewrite process of 8.2.1
Paul Smith (University College, Dublin)	8	-	-	-	-	8.2.1.6.4	-	-	More case studies. Why aren't all the case studies together? TradeWind is a study promoted by a vested interest (European Wind Energy Association) This should at least be made very clear.	resolved by rewrite
Robert Pietzcker (PIK)	8	-	-	-	-	8.2.2	-	-	Change the title so that it communicates more clearly that you are talking about district heating or cooling (¿networks¿ could be much smaller, maybe in one large building)	Clarifying intro added
Robert Pietzcker (PIK)	8	-	-	-	-	8.2.2	-	-	I do not fully understand the difference between 8.2.2.1 and 8.2.2.2, neither from the title nor from the content. Maybe you could improve the structure and either join the two sections or differentiate more clearly	Revised also according to input from Kristin Seyboth of TSU
Robert Pietzcker (PIK)	8	-	-	-	-	8.2.2.	-	-	I am missing good information about the possibility of integrating several production centers, e.g., what about many local small solar thermal roofs connected to a DH grid which actually inject their heat into the system? How could this be managed, metered and made economically feasible?	There is not much information in the literature on this specific solution (although cases exist in f.x. Austria) and we don't have the space to elaborate on this particular option.
Robert Pietzcker (PIK)	8	-	-	-	-	8.2.2.	-	-	Too many commonplaces ¿ please improve/rewrite large parts of this section! Try to make sure that you really convey information, and not just say obvious things like ¿DH is cheaper when building density is high and less pipelines have to be built¿ - how much cheaper at what densities? Or ¿further research will decrease cost¿ - by how much, over what time span, through what development?	This comment is difficult to accomodate without considerable expansion on the economics of DH systems. This is beyond the scope of RE integration but some steps have been taken in the direction of responding to this comment
Robert Pietzcker (PIK)	8	-	-	-	-	8.2.2.4	-	-	a bit too general ¿ what are the costs, what are the efficiencies?	Costs and efficiencies are very site specific. Not enough space to elaborate in detail
Robert Pietzcker (PIK)	8	-	-	-	-	8.2.2.6.1	-	-	the rest of the section uses kWh, so it would be helpful if you could give this information as well.	Use of J and Wh will be harmonised across whole SRREN
Marc Darras (GDF SUEZ)	8	-	-	-	-	8.2.3	-	-	Some part of 8231 relate to 8232 and vice versa: exemple description of the gas grid relates to 8232 while last 3 paragraphs of 8232 relates to 8231	Good point. All text in 8.2.3.2.moved to 8.2.3.1, and vice versa.

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Marc Darras (GDF SUEZ)	8	-	-	-	-	8.2.3	-	-	This chapter has been written on the basis: 1 of the perspective of industrial gases infrastructure while the question is for a larger part to be treated in the perspective of public distribution of gas (see for instance IEA, Bioenergy Task 37, Energy from biogas and landfill, Pettersson A, Wellinger A, october 2009); 2 in the scenario of development of biogas from energy crops mainly, while the first entry point point in the short term is valorisation of Biogas from landfill, urban and industrial waste and manure. This does not prevent consideration of energy crops in the short term and in the longer one, but change the perspective. EIGA is concerned only by industrial gases. See IGU or Eurogas for more information on gas systems.	Clarification on sources for biogas added on line p.50, line 26. No need to specify that it is an industrial or public gas grid.
Robert Pietzcker (PIK)	8	-	-	-	-	8.2.3	-	-	This section is ok in general, but I am missing cost numbers for gas grids (averaged numbers, or, even better, the pipelines themselves, compressors, $\zeta$ ) and especially for the new buildup of a hydrogen grid. Please provide some of this information	Costs are discussed in 8.2.3.5, p.56, lines 7-16. More detailed cost numbers are in the references supplied.
HONGGUANG JIN (Thermophysics engineering ,Chinese Academy of Scinces)	8	-	-	-	-	8.2.3.4	-	-	For the options to facilitate the integration of RE into gas grids, we may see many engineering problems. I think IPCC report is to predict the challenge of the future, and to give the direction of the development of novel RE energy system. But the engineering problems in the section makes the IPCC report to be like the engineering handbook. I suggest this section should be removed , or else it will impair the important role of IPCC report.	The detailed information provided (e.g. Table 8.2 and 8.3) is there to underline the challenges with upgrading biogas. Level of detail is comparable to the rest of the chapter. Level of detail is far away from an engineering handbook.
Robert Pietzcker (PIK)	8	-	-	-	-	8.2.4.5	-	-	it seems that only ethanol systems are discussed $\zeta$ what about costs, difficulties and experiences for other liquid biofuels?	Will add a short paragraph on biodiesel in 8.2.4.5
United States (U.S. Department of State)	8	-	-	-	-	8.2.5.5.2	-	-	One reviewer noted that the building in this case study is still fully integrated into the local electric power grid and additionally has a natural gas supply. If this is verified, it should be noted in the text.	the Renewable Energy House case ( 8.2.5.5.2) has been moved to the building section (8.3.2)

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Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	-	-	-	-	8.2.5.5.3	-	-	Compared to other literature and the estimates of experts involved in German wind-hydrogen projects, the quoted overall efficiency achieved - and the efficiency held feasible for the future - seem very low. David Colomar, Ulrich Bunger, Christoph Stiller, and Hubert Landinger assume that an overall efficiency of re-electrification (electrolyser-storage-fuel cell) of wind-hydrogen systems of 32 % can be achieved (Paper: COGENERATION OF HYDROGEN FUEL AND DISPATCHABLE: ELECTRICITY FROM OFFSHORE WIND POWER IN GERMANY; Proceedings of 17 th World Hydrogen Energy Conference, Brisbane, Australia; 15  19 June 2008). Based on most recent wind-hydrogen projects ('ENERTRAG- Hybrid-Power Plant' (www.enertrag.com) and 'Renewable Hydrogen RH2' (www.wind-projekt.de)) efficiencies of up to 40% seem to be feasible in the future based upon efficiency gains mainly arising from more efficient pressurized electrolyzers and advanced fuel cells for re-electrification.	The authors are aware of the fact that the round-trip efficiency of a hydrogen efficiency can be up to 40% (theoretically) and that other wind/H2 installations have achieved higher round trip efficiencies than the case study selected. However, the purpose of the Utsira case study was to report on actual data from a real-world stand-alone wind/H2 system. Such systems typically operate at part-load for long periods at the time;hence, the relatively low overall efficiencies. Larger offshore wind/electrolyzer based systems will have a very different operation scheme. In this case the wind/electrolyzer systems will be grid-connected and the electrolyzer will be designed to operate at part-load; hence, higher efficiencies can be achieved.
Markus Haller (Potsdam Institute for Climate Impact Research)	8	-	-	-	-	8.2.6.1	-	-	The introduction to this section should be rewritten entirely. It should give a short overview of technological and institutional integration options and explain how the section is structured. Currently, it fails to do this.	not clear , to what section this comment refers to, as there is no 8.2.6 section
Markus Haller (Potsdam Institute for Climate Impact Research)	8	-	-	-	-	8.2.6.1.2	-	-	This section should address, as its title suggests, institutional options to incentivise and facilitate the integration of RE. Instead, it mostly repeats technological options (especially in the bullet list) that have already been mentioned in the previous section. The information given on policies and institutional aspects is very weak.	not clear , to what section this comment refers to, as there is no 8.2.6 section
Doug Arent (Joint Institute for Strategic Energy Analysis)	8	-	-	-	-	8.3	-	-	might this section be shortened as it seems to deal with many other issues that while important to overall GHG reduction and are complementary to RET integration, could be capture more succinctly with a strong reference section??	Endeavouring to strngthen 8.3
Kristin Seyboth (IPCC WG III TSU)	8	-	-	-	-	8.3	-	-	The introduction to every sub-section (or sector) reports the percentage of that sectors contribution to primary energy demand, but are not consistent or comparable with one another. One section bases numbers on 2005, another on 2007, others have no base year quoted. One consistent source should be used across all subsection for comparability.	Will do

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Robert Pietzcker (PIK)	8	-	-	-	-	8.3.1.	-	-	This section has some good information, but it is missing a) better cost data in \$/km for different vehicles and transport modes b) a longer discussion of different transport modes besides light duty vehicles. When thinking about RE integration, the easiest pathway for all RE besides biomass is electricity, and most passenger trains and many freight trains in OECD countries are electrified. Thus inducing a shift towards more rail use could be a key element towards a larger RE share in the transport sector. Please discuss this topic in more depth	The information on cost could not be included due to space limitation but some information is included in table 8.5. Will include mode shift discussion on page 69 and the role of rail transport in increasing the RE participation on page 82.
Robert Pietzcker (PIK)	8	-	-	-	-	8.3.1.1	-	-	good section $\zeta$ with the clear distinction between three emission reduction strategies travel demand reduction, efficiency, and use of low-carbon fuels. However, I think a more complete grasp of the situation could be achieved with a four-fold distinction: a) reducing travel demand (in passenger-km and ton-km), b) shifting transport from less efficient to more efficient modes (from light/heavy-duty vehicles to bus and rail), c) improving vehicle efficiency within one transport mode d) using low-carbon fuels for a given vehicle	same as above
Robert Pietzcker (PIK)	8	-	-	-	-	8.3.1.2.1	-	-	What are the cost and efficiency data for CNG vehicles? How do they fare compared to gasoline/diesel engines?	Information will be incorporated into figure 8.25, 26 and 28
Laura Verduzco (Chevron Corporation)	8	-	-	-	-	8.3.1.4	-	-	Carbon absorbed by agricultural plants is released every year when the plants decay anyway. In principle, it does not matter much that they are harvested for food and energy "on the way". Given that the land already is designated for single-year plants, only the choice between food and energy counts. Forests, on the other hand, continue to store carbon from year to year, and in fact for hundreds of years if left undisturbed. When trees are cut down, it can take for example a hundred years before the lost carbon is recovered. This makes up a carbon debt, and new debt is added when new acreage is harvested each year. Hence, when we move from agriculture to forestry, which is much the same as moving from "first" to "second generation", we have to include a temporal dimension that may be powerful enough to distort the neutrality principle just as much as the spatial dimension distorted it for first generation biofuels.	Reference will be made to chapter 2, where this topic is dealt with in more details. This will be done in line 2 page 74-
Robert Pietzcker (PIK)	8	-	-	-	-	8.3.1.4	-	-	the same way that you compare WtW-Emissions for different vehicles, it would be great if you could compare \$/km travelled for the different vehicles.	same as line 123
Robert Pietzcker (PIK)	8	-	-	-	-	8.3.1.6.4	-	-	given the higher efficiency of electric railway, why is the majority of rail transport powered by diesel? Do you have numbers on the costs of electrifying rail tracks (\$/km)?	a sentence will be added on page 82 line 9

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Klaus Bonhoff (NOW GmbH National Organization Hydrogen and Fuel Cell Technology)	8	-	-	-	-	8.3.2	-	-	Fuel cells are barely mentioned in the section. However, especially MCFs offer substantial sustainability benefits. Fuel cell CHP systems supplying power and heat are highly efficient and may run on biogas and other widely available energy carriers. Such MCFs are being employed, for example, in NIP projects in Germany ( <a href="http://www.now-gmbh.de">www.now-gmbh.de</a> ) and in Japan ( <a href="http://www.nedo.go.jp">www.nedo.go.jp</a> ).	Balance sought
Supachai Panitchpakdi (United Nations Conference on Trade and Development)	8	-	-	-	-	8.3.2	-	-	This section aims to discuss the RE in households, but case studies in this subsection do not include the access to energy for domestic use. The following source provides such information. UNCTAD, Renewable Energy Technologies for Rural Development, UNCTAD current studies on science, technology and innovation (2010), page 9 et seq. (available at <a href="http://www.unctad.org/en/docs/dtstict20094_en.pdf">http://www.unctad.org/en/docs/dtstict20094_en.pdf</a> ).	Reference relevant for BUILDINGS section
Kristin Seyboth (IPCC WG III TSU)	8	-	-	-	-	8.3.2	-	-	Why is there no sub-section on future trends in this section as there is for all the other sectors?	Not appropriate
Trevor Demayo (Chevron Energy Technology Cvo.)	8	-	-	-	-	8.3.2.1.6	-	-	Fonts are very small on Figures 8.30 & 8.31. The key messages from these two figures and opportunities for technology transfer from one country to another should be described. How can we promote best practices building energy efficiency (technologies and policies) in developed countries?	Revised
Gerrit Hansen (TSU)	8	-	-	-	-	8.3.4	-	-	concerning "complimenting other low carbon technologies" (OOA 3.6) you might consider to touch upon the conflict between using agricultural and forest residues for biomass based energy, and enhancing the soil carbon sink (e.g. via zero tillage farming).	But also covered in Chapter 2
Trevor Demayo (Chevron Energy Technology Cvo.)	8	-	-	-	-	8.3.4	-	-	The whole section can be condensed to concisely show that we need to focus on high yields and sustainable agriculture (tillage practices, water consumption, fertilizer runoff, land degradation) and the corresponding impact on energy consumption. Land use change and net energy and carbon balances are key issues	Agree in principle, but this is a section on RE integration
Trevor Demayo (Chevron Energy Technology Cvo.)	8	-	-	-	-	8.3.4.5	-	-	It's not clear that this is an efficient scheme. The cost and conversion efficiency losses associated with the electricity to H2 to electricity are concerns. Conversion losses due to electrolysis (70%) and the fuel cell (50%) lead to an overall electricity-to-H2-to-electricity loss of ~ 35% vs. storing the wind energy in a battery bank or even compressed air system with only a total 25-30% loss. Not only does the H2 option appear to have a lower efficiency it is not clear that the economics will be better than the wind-to-battery/CAES option.	Agree in principle, but the Cu cable was costly - hence this option beingevauated

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Netherlands (KNMI (Royal Dutch Meteorological Institute))	8	-	-	-	-	9.4.4	-	-	This section overlaps and repeats a lot of what has already been written in section 9.4.2. These two sections could be merged into one to save space and unnecessary repetitions.	Not Chapter 8
China (China Meteorological Administration)	8	-	-	-	-	all	-	-	Overall comments: In general Chapter 8 is well structured, the RE integration technologies are introduced systematically and the viewpoints are described objectively.	OK
Paul Smith (University College, Dublin)	8	-	-	-	-	Box 8.1	-	-	The treatment of reserves in this box is not correct. The characterisation of reserves will vary from system to system, depending on system characteristics, and on which reserve constraints are found to be binding. Systems require regulating reserves to cater for normal demand fluctuations and increasingly with RE supply fluctuations. Operating reserves are required to deal with contingencies such as loss of generation or transmission infeeds. There may be different categories of operating reserves as plants which can deliver increased output for a short period may have to be replaced with plants which are slower to respond but have longer term capabilities.	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	Box 8.1 para 3	-	-	Last sentence needs to be re-written. There are many day-ahead markets; 5 to 60 minutes is not correct.	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	Box 8.1, para 2	-	-	It is not generally correct to say that coal plants run as base load and plants with more rapid response times are used for meeting peak demands. The running of plants is likely to be determined by a combination of technical capabilities and costs. The cost characteristics of some plants such as combined cycles may cause them to operate at base load even though they may have considerable flexibility, and older less efficient coal plants often operate at low load factors.	resolved by rewrite
Doug Arent (Joint Institute for Strategic Energy Analysis)	8	-	-	-	-	exec summ	-	-	Executive summary could be shortened and revised to reflect more scientific language of the assessment. Some of the major electricity integration studies might be cited here. The implication of "high" being >20% sets a benchmark that RETs may not be able to contribute--or it would be an exception if they did--more than 20%, and there are systems and communities, and countries today with more than that % from RETs. In the language on transportation, the summary does not capture any potential synergies (see Parks, Denholm, PNNL/EPRI studies, or Kempton) of RET electricity and electrified transportation. The use of the term "desireable" for "more RE integration" is not scientific reporting, but a statement of position. One might rephrase that "Increased amounts of RET has been shown to provide significant GHG emissions mitigation potential"	Exec summary been rewritten

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Doug Arent (Joint Institute for Strategic Energy Analysis)	8	-	-	-	-	exec summ	-	-	Executive summary could be shortened and revised to reflect more scientific language of the assessment. Some of the major electricity integration studies might be sited here. The implication of ""high"" being >20% sets a benchmark that RETs may not be able to contribute--or it would be an exception if they did--more than 20%, and there are systems and communities, and countries today with more than that % from RETs. In the language on transportation, the summary does not capture any potential synergies (see Parks, Denholm, PNNL/EPRI studies, or Kempton) of RET electricity and electrified transportation. The use of the term ""desireable"" for ""more RE integration"" is not scientific reporting, but a statement of position. One might rephrase that ""Increased amounts of RET has been shown to provide significant GHG emissions mitigation potential""	relevant, considered in rewrite process of 8.2.1
United States (U.S. Department of State)	8	-	-	-	-	Executive Summary	-	-	Even in the executive summary, reports referred to specifically need full citations. The editors of this chapter should decide whether to include additional citations to support major assertions and conclusions. The editors should also decide whether to provide RE and power amounts in both EJ and GWh so readers can read this and quickly be able to read and digest what the numbers mean. Or, use percentages for comparisons to make it easier to understand.	relevant, considered in rewrite process of 8.2.1
United States (U.S. Department of State)	8	-	-	-	-	Executive Summary	-	-	Even in the executive summary, reports referred to specifically need full citations. The editors of this chapter should decide whether to include additional citations to support major assertions and conclusions. The editors should also decide whether to provide RE and power amounts in both EJ and GWh so readers can read this and quickly be able to read and digest what the numbers mean. Or, use percentages for comparisons to make it easier to understand.	Units consistent with whole report. No refs in Exec summary
United States (U.S. Department of State)	8	-	-	-	-	Executive Summary	-	-	Executive Summary ¿ The document often uses 20% penetration as a threshold above which significant market design and operational changes are required to reliably integrate RE into the grid. This may be a useful value that should be referenced in the Executive Summary, but should also be softened to perhaps 15-20%. However, this threshold range may be more applicable to the U.S. than other countries.	Exec summary been rewritten

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United States (U.S. Department of State)	8	-	-	-	-	Executi ve Summ ary	-	-	Executive Summary ¿ The document often uses 20% penetration as a threshold above which significant market design and operational changes are required to reliably integrate RE into the grid. This may be a useful value that should be referenced in the Executive Summary, but should also be softened to perhaps 15-20%. However, this threshold range may be more applicable to the U.S. than other countries.	Too detailed for Exec summary
United States (U.S. Department of State)	8	-	-	-	-	Executi ve Summ ary	-	-	When discussing integration of RE into the electricity and possibly other sectors, a high-level concept deserving mention in the executive summary and introduction sections is the major differences between utility-scale generation which will generally be near-distant to far-distances from load centers and distributed RE (e.g. rooftop PV), which presents much different integration issues. In addition, TYPES of RE -- this is a key concept missing from the initial sections -- have much different integration challenges. Two key technologies that must be drawn out include: dispatchable RE v. variable RE (meaning, biomass and geothermal v. wind and solar); and in the solar arena: PV v. CSP (with built in thermal capacity and much less dramatic ramp rates than PV).	Exec summary been rewritten
United States (U.S. Department of State)	8	-	-	-	-	Executi ve Summ ary	-	-	When discussing integration of RE into the electricity and possibly other sectors, a high-level concept deserving mention in the executive summary and introduction sections is the major differences between utility-scale generation which will generally be near-distant to far-distances from load centers and distributed RE (e.g. rooftop PV), which presents much different integration issues. In addition, TYPES of RE -- this is a key concept missing from the initial sections -- have much different integration challenges. Two key technologies that must be drawn out include: dispatchable RE v. variable RE (meaning, biomass and geothermal v. wind and solar); and in the solar arena: PV v. CSP (with built in thermal capacity and much less dramatic ramp rates than PV).	resolved by rewrite
Arieta Gonelevu (International Union for Conservation of Nature (Oceania Office))	8	-	-	-	-	Genera l comme nt	-	-	the pacific is vastly covered with ocean (Pacific Ocean), can there be some sections that look at integrating ocean related energy technologies in future? What options is available to the Pacific? Etc	Chapter 6

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Doug Arent (Joint Institute for Strategic Energy Analysis)	8	-	-	-	-	objectiv e	-	-	the stated objective "Determine how problems of intergration might affect future RE integration" does not reflect the intent of the assessment report; that is" to assess the literature on the state of science regarding the integration of RET into current and possible future energy systems" might be more appropriate, no??	resolved by rewrite
Doug Arent (Joint Institute for Strategic Energy Analysis)	8	-	-	-	-	objectiv e	-	-	the stated objective "Determine how problems of intergration might affect future RE integration" does not reflect the intent of the assessment report; that is" to assess the literature on the state of science regarding the integration of RET into current and possible future energy systems" might be more appropriate, no??	Reworded
Brazil (Ministry of Science and Technology)	8	-	-	-	-	Refere nces	-	-	There are seven ""IEA (2008)"" itens. They must be adequately identified, by sequential letters, and the references to these itens in the text must address the correct one.	Accepted
Brazil (Ministry of Science and Technology)	8	-	-	-	-	Refere nces	-	-	There are seven ""IEA (2008)"" itens. They must be adequately identified, by sequential letters, and the references to these itens in the text must address the correct one.	resolved (editing error)
Brazil (Ministry of Science and Technology)	8	-	-	-	-	Refere nces	-	-	There are seven ""IEA (2009)"" itens. They must be adequately identified, by sequential letters, and the references to these itens in the text must address the correct one.	Accepted
Brazil (Ministry of Science and Technology)	8	-	-	-	-	Refere nces	-	-	There are seven ""IEA (2009)"" itens. They must be adequately identified, by sequential letters, and the references to these itens in the text must address the correct one.	resolved (editing error)
Brazil (Ministry of Science and Technology)	8	-	-	-	-	Refere nces	-	-	There are two ""EnerginetDK (2009)"" itens. They must be adequately identified, by sequential letters, and the references to these itens in the text must address the correct one.	Accepted
Brazil (Ministry of Science and Technology)	8	-	-	-	-	Refere nces	-	-	There are two ""EnerginetDK (2009)"" itens. They must be adequately identified, by sequential letters, and the references to these itens in the text must address the correct one.	resolved (editing error)
Brazil (Ministry of Science and Technology)	8	-	-	-	-	Refere nces	-	-	There are two ""Holtinen, H., P. Meibom, et al. (2009)"" itens. They must be adequately identified, by sequential letters, and the references to these itens in the text must address the correct one.	Accepted
Brazil (Ministry of Science and Technology)	8	-	-	-	-	Refere nces	-	-	There are two ""Holtinen, H., P. Meibom, et al. (2009)"" itens. They must be adequately identified, by sequential letters, and the references to these itens in the text must address the correct one.	resolved (editing error)
Brazil (Ministry of Science and Technology)	8	-	-	-	-	Refere nces	-	-	There are two ""IEA (2010)"" itens. They must be adequately identified, by sequential letters, and the references to these itens in the text must address the correct one.	Accepted

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Brazil (Ministry of Science and Technology)	8	-	-	-	-	References	-	-	There are two ""IEA (2010)"" itens. They must be adequately identified, by sequential letters, and the references to these itens in the text must address the correct one.	resolved (editing error)
Brazil (Ministry of Science and Technology)	8	-	-	-	-	References	-	-	There are two ""UNDP (2009)"" itens, with the same title, but both are incomplete.	Accepted
Brazil (Ministry of Science and Technology)	8	-	-	-	-	References	-	-	There are two ""UNDP (2009)"" itens, with the same title, but both are incomplete.	resolved (editing error)
Brazil (Ministry of Science and Technology)	8	-	-	-	-	References	-	-	There are two ""USDOE, 2008"" itens. They must be adequately identified, by sequential letters, and the references to these itens in the text must address the correct one.	Accepted
Brazil (Ministry of Science and Technology)	8	-	-	-	-	References	-	-	There are two ""USDOE, 2008"" itens. They must be adequately identified, by sequential letters, and the references to these itens in the text must address the correct one.	resolved (editing error)
Paul Smith (University College, Dublin)	8	-	-	-	-	-	8-10	-	This is a very poor representation of a power system	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	-	8-11	-	Electrons don't flow in an AC system! The flow from fuel supplier to large generation plant is not electrical. All money does not pass through an operations centre.	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	-	8-11	-	This diagram is an even worse representation!	resolved by rewrite
United States (U.S. Department of State)	8	-	-	-	-	-	8.1	-	Fig 8.1 seems to mislead the reader by implying that items listed in the boxes (electricity generation and distribution, heating and cooling networks, natural gas grids, etc) are all equally ranked, when in fact they are not even close. I suggest a revision to this graph to better represent the ranking of benefits or use associated with these systems.	Rankings not relevant here - and how measured anyway?
Robert Pietzcker (PIK)	8	-	-	-	-	-	8.16	-	what kind of boiler is used for the district heating? What percentage of the costs are necessary for the distribution system, what percentage is the heat production?	More detail on DH economics has been added
Hannele Holttinen (VTT)	8	-	-	-	-	-	8.2	-	interesting would be see the electricity part of the energy	resolved by rewrite
Hannele Holttinen (VTT)	8	-	-	-	-	-	8.2	-	interesting would be see the electricity part of the energy	Too detailed
Robert Pietzcker (PIK)	8	-	-	-	-	-	8.25	-	what about biofuels and natural gas? Using ethanol, other biofuels or CNG in a ICEV changes the fuel efficiency, no? Please add this to the figure (if the numbers are different)	Changes will be incorporated; ICEV with CNG will be added

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Robert Pietzcker (PIK)	8	-	-	-	-	-	8.26	-	what is the basic cost assumed for a standard gasoline ICEV in the different studies? This information is very important to judge the different additional costs in different studies.	Note about standard ICEV will be added
Robert Pietzcker (PIK)	8	-	-	-	-	-	8.27	-	caption is misleading : if you only show the emissions $\zeta$ when running on electricity only $\zeta$ , why are there yellow bars for petroleum? If possible, show also the emissions for a purely electric vehicle. Please also say what the emissions in $G\_CO2/kWh\_el$ are for a $\zeta$ partially decarbonized grid similar to that in California $\zeta$ .	Figure will be improved with new captions: (1) CA-grid, (2) U.S. grid, (3) NG-grid, and (4) Coal-grid.
United States (U.S. Department of State)	8	-	-	-	-	-	8.27	-	Consider citing the work of Samaras and Meisterling on life cycle GHGs from PHEVs (environmental science & technology). I think their main results figure is a more useful representation of the life cycle carbon intensity compared to that of conventional vehicles.	Ref. will be checked, and figure re-drawn if appropriate
Robert Pietzcker (PIK)	8	-	-	-	-	-	8.28	-	something seems wrong with the y axis $\zeta$ $g\_CO2/km$ values around 1 cannot be right. please do not normalize the numbers, but give the real values.	Label of Y-axis will be corrected. Data needs to be normalized, due to different assumptions and scatter on data points
Robert Pietzcker (PIK)	8	-	-	-	-	-	8.28	-	what fuel was assumed for the PHEVs? They can be used with either gasoline or biofuels, so they should have different WtW emissions depending on the different fuels	A sentence about gasoline vs. Biofuel will be added in Figure caption
United States (U.S. Department of State)	8	-	-	-	-	-	8.28	-	Why does this figure not address the enormous issue of indirect emissions from land use change? A key citation is Searchinger et al (2008) in Science. It is imperative that this issue be included in the discussion of biofuels emissions. Ignoring it entirely provides a skewed assessment of the GHG benefits of biofuels.	A disclaimer will be added on indirect land-use effects on p.77, line 21
Hannele Holttinen (VTT)	8	-	-	-	-	-	8.3	-	in fig and text above it, very odd that wave is not having sub-hourly variations?	Agree
Australia (0)	8	-	-	-	-	-	8.3	-	Text in green boxes is very hard to read even with magnification	Revised
Australia (0)	8	-	-	-	-	-	8.31	-	Graphic is split over two pages - hard to follow	Revised
Trevor Demayo (Chevron Energy Technology Cvo.)	8	-	-	-	-	-	8.33	-	The figure is not explained. Since financing is a critical issue, these schemes should be explained further to show how they have been effective.	Now explained
Trevor Demayo (Chevron Energy Technology Cvo.)	8	-	-	-	-	-	8.34	-	What is different about China than France and Japan? Try to draw conclusions by comparing the countries in Fig. 30, 31 and 24	Amended

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Naoto Tagashira (Central Research Institute of Electric Power Industry)	8	-	-	-	-	8.3.1.3	8.35	-	Because EVs will be used for shorter distance trips compared to gasoline ICEVs even in the future, the direct comparison with gasoline ICEVs may lead readers' misunderstandings. I recommend referring to Werber et al. (2009), which analyzes EV costs according to battery capacity. Mathew Werber, Michael Fisher, Peter V. Schwarts (2009) ¿Batteries: Lower cost than gasoline?¿, Energy Policy, 37, 2465-2468.	It is assumed that this comment is on Figs 8.25 and Fig 8.26 Discussion of EV driving range will be included in text on p.73, line 2 and in note under Fig 8.26. References will be checked
United States (U.S. Department of State)	8	-	-	-	-	-	8.4	-	Add the word "bulk" in front of the words "power systems" in the caption for figure 8.4.	resolved by rewrite
Hannele Holttinen (VTT)	8	-	-	-	-	-	8.4	-	the caption and the text above the fig could point out more clearly that these are impacts that could be looked at for any addition of new generation to the power system, and then mention that they come from a wind integration study	resolved by rewrite
United Kingdom (Department of Energy and Climate Change)	8	-	-	-	-	-	8.5	-	This figure is not consistent with some of the earlier text, see earlier comments.	resolved by rewrite
Markus Haller (Potsdam Institute for Climate Impact Research)	8	-	-	-	-	-	8.5	-	Why is the gradient of the cost curves decreasing with higher wind share? That is an interesting find and should be discussed!	resolved by rewrite
Hannele Holttinen (VTT)	8	-	-	-	-	-	8.6	-	clarify that penetration level is electrical energy	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	-	8.6	-	What are the units in this figure? It should be drawn in a two-dimensional format - the three-dimensional format does not facilitate reading values. Furthermore, this figure should be up-dated from 2007.	resolved by rewrite
Kristin Seyboth (IPCC WG III TSU)	8	-	-	-	-	-	8.7	-	Figure misses an explanation of the differences between dotted and solid lines.	resolved by rewrite
Emmanuel Branche (Electricité de France)	8	-	-	-	-	-	8.7	-	Figure not easy to read and some captions are missing	resolved by rewrite
Paul Smith (University College, Dublin)	8	-	-	-	-	-	8.1	-	Isentropic pumped heat electricity storage is now being proposed as an storage technology. See <a href="http://kn.theiet.org/magazine/issues/1009/windless-day-1009.cfm">http://kn.theiet.org/magazine/issues/1009/windless-day-1009.cfm</a>	relevant, considered in rewrite process of 8.2.1
United States (U.S. Department of State)	8	-	-	-	-	-	8.1	-	Missing thermal storage for CSP, to permit leveling and time-shifting of generation Also missing storage of syngas from biomass gasification	relevant, considered in rewrite process of 8.2.1
United States (U.S. Department of State)	8	-	-	-	-	-	8.1	-	Table 8.1 includes Vanadium and ZN-BR which are barely commercial with mostly demonstration projects, but doesn't include NaS which is a commercially available product with over 270 MW of installations. Also ¿ there is cost per kW with vague indication of how much energy (i.e. how many hours does this buy you?)	relevant, considered in rewrite process of 8.2.1

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Markus Haller (Potsdam Institute for Climate Impact Research)	8	-	-	-	-	-	-	8.1	The table itself is OK, but it lacks referencing or explanation in the text. If you show a table that states power ratings and energy densities, you should at least explain the different application areas of storage technologies, and the different resulting requirements for charging / discharging power and energy storage capacity.	relevant, considered in rewrite process of 8.2.1
United States (U.S. Department of State)	8	-	-	-	-	-	-	8.2	Lower heating value for Dutch Natural gas. The range appears very wide. Should it be 31.6?	No
United States (U.S. Department of State)	8	-	-	-	-	-	-	8.2	The Table does not reflect the previous and subsequent discussion, which included syngas from biomass gasification. The differences between natural gas and syngas parameters (though highly variable depending on the organic materials used as feedstock) may constitute a significant barrier to gas pipeline integration, and should be included in the Table.	Syngas data from biomass gasification plant(s) will be included.
Brazil (Ministry of Science and Technology)	8	-	-	-	-	-	-	8.5	Avoid the term of first and second generation biofuels. Prefer the specification eg. Ligno-cellulosic ethanol, or made from waste and residues. As interpretations differs to qualify 1st, 2nd or even 3rd generation biofuels.	1st and 2nd generation is defined in Glossary under Biofuel
Brazil (Ministry of Science and Technology)	8	-	-	-	-	-	-	8.5	conventional vehicles are limited to low concentration blends of ethanol (< 10%)". This is not true. Conventional vehicles in Brazil use high concentration blends (from 20 to 25% of ethanol in gasoline). We suggest that this sentence should be reformulated.	Changes will be incorporated and new text will be added
United States (U.S. Department of State)	8	-	-	-	-	-	-	8.5	Table 8.5 ζSafety of on board gaseous hydrogen storageζ ζ Recommend adding "perceived safety" as well as "safety." Also in the ζConsumer acceptanceζ row under ζElectricityζ ζ ζLack of charging stations away from homeζ needs to be added. Under ζGHGζ row in hydrogen column ζ Add the word ζnuclearζ as shown in the statement WTW HGH emissions can approach zero for RE/ζNuclearζ pathways. Under ζEnvironmentalζ row in electricity column ζ Lithium battery disposal and recycling is not addressed.	Partially accepted: (1) "Safety" deleted; safety is not going to be an issue because once the automakers have certified the technology it will be perceived as safe, (2) "Lack of charging stations" added, (3) "Nuclear" added, and (4) "Material recycling" added
United States (U.S. Department of State)	8	-	-	-	-	-	-	8.5	The row called "compatibility with existing infrastructure" needs more coverage in the text and discussion, considering this is a chapter on integration. Here the table says that hydrogen needs a new infrastructure, while biofuels and EVs can utilize existing infrastructures. This is a key point, and is the essence of why integrating these new fuels will be completely different for hydrogen than for EVs or biofuels. Please make this point more forcefully in the article text.	Gas integration issues are discussed in 8.2.3 (gas grids). No need to elaborate further here.

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Trevor Demayo (Chevron Energy Technology Cvo.)	8	-	-	-	-	-	-	8.9	Table 8.9 could be simplified somewhat, e.g., removing ""export"" column since most entries are ""low"". Also, energy use intensity (generally used to represent energy input per production unit (e.g., kJ/gal biofuel)) should be renamed to land footprint or similar.	Amended
Hiromi Takeuchi (Advanced Industrial Science and Technology)	8	-	-	-	-	-	-	8.9	This table can be eliminated, because there is not so much argument using this table in the text.	The Table replaces text