INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

Special Report on Renewable Energy Sources and Climate Change Mitigation

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

Chapter 7

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

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	7	0	-	-	-	-	-	-	As we move to larger, GW and TW scale projects, the challenges with siting and public engagement strategies need to be upfront and central issues. New approaches need to be considered.	Agreed, but not just for larger projects, but also for greater deployments of smaller projects. We will try to better convey the importance of these issues as deployment and project scale increase.
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	7	0	-	-	-	-	-	-	At the end of Chapter 7 there is a reference to Chapter 10 concerning the potential contribution of wind energy to climate mitigation - here the consistency of assumptions should be checked again. A growth rate of 20% until 2050 seems to be a conservative assessment even if growth in the wind industry should slow and settle down to levels where other industrial products have been over a long time (e.g. gas turbines). As it is well known, Denmark has already reached 20%, Portugal and Spain (low interconnector capacity!) have already reached up to 15%. This has been achieved in less than 20 years. It is not understandable why this should not be possible on a gobal scale as well.	Though the authors agree that still-higher levels of penetration are technically possible, we have faithfully reported the literature here, including scenarios that reach as high as 50%. If further literature suggesting higher levels of penetration becomes available prior to the finalization of the chapter, that literature will also be reported here. In the meantime, we must remain consistent with the available modeling and scenarios literature, which already does span a large range in terms of wind deployment as repored in the chapter. Moreover, the range of citations included in chapter 7 and chapter 10 is very broad, including modeling and scenarios teams from all over the world and with very different world views, further bolstering the analysis as currently presented.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Australia (0)	7	0	-	-	-	-	-	-	Chapter 7: -appears to be US-centric; -overall a long and wordy chapter -firm capacity is generally much less than capacity factor; and -there is not enough discussion on the ramp rate of some RE and how this would be dealt with: e.g. wind power is low inertia whereas power stations are high inertia.	The available existing peer-reviewed literature is largely US and EU focused, as are the areas of existing deployment. We have and will continue to seek broader literatures, largely if peer-reviewed, but time limits and the scope of the existing literature will impose constraints on this. The reviewer does not identify any specific literature that should be added. The chapter will go through a final editorial review, though the reviewer does not offer specific areas of text that should be eliminated. Ramp rates, capacity value, and interial response are ALL already addressed in Chapter 7, and capacity values of 5-40%, based on peer reviewed literatures, are provided. Chapter 8 also addresses these issues, so we believe they will be adequately covered in the final SRREN.
United States (U.S. Department of State)	7	0	-	-	-	-	-	-	Cost of energy issues should be addressed in opening chapters to give context for cost of energy discussions across all renewables. Wind energy cost curve comparison with legacy fuels would be beneficial as well.	A good comment for the earlier chapters, but not a comment that applies to the wind chapter per se. Moreover, cost comparisons among RE technologies and conventional fuels are offered in the integrative chapters, and were explicitly excluded from the technology chapters, to minimize duplication and the possibility of inconsistencies in assumptions about, for example, the cost of legacy fuels.
United States (U.S. Department of State)	7	0	-	-	-	-	-	-	General comment. ¿carbon emissions¿ and ¿GHG emissions¿ are used somewhat interchangeably through the text. Perhaps ¿GHG emission¿ should be used throughout except where specific Carbon amounts are listed. However, this raises a related issue, in that the non-CO2 emissions attributed to the power-generation sector have both positive and negative (warming and cooling) forcings on climate. Uniformity should be checked for the entire document.	Though we cannot solve the uniformity issue for the entirely of the SRREN, we will seek consistency within chapter 7, where possible.
Lennart Söder (KTH, Royal Institute of Technology)	7	0	-	-	-	-	-	-	In general the integration challenges of wind power are described in a very good way in chapter 7.	Accepted

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Miriam Ester Limia (of Meteorology)	7	0	-	-	-	-	-	-	In general, chap. 7 is somewhat unbalanced, only eight pages about the potential resource and approximately 30 pages on technology	In fact, 15 pages are dedicated to technologies and applications, split among two distinct sections. The chapter authors feel that the present text is reasonably well balanced among the issues at hand, and while areas of expansion are always desireable, space constraints ensures that additional detailed material cannot be addded without reducing material that we believe is essential to the technology, application, and deployment of wind energy. Space constraints do not allow a detailed discussion of the wind resource on a country-specific basis, and the section on the global resource therefore focuses on the absolute scale of that resource globally and regionally. Given that focus, it seems unlikely that additional material in that section would really expand the understanding of the resource conditions beyond what is already included.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	7	0	-	-	-	-	-	-	In regards to document consistency, in looking at 2050 projections in chapter 7, we assume the projections are based on normal assumptions of increased load demands. The authors may want to consider including alternate scenarios, e.g. electrification of the transportation sector, and the implications of those alternate scenarios on both deployment and wind technology changes to support them. Recommend the author reference chapter 10's scenarios for the reader.	Chapter 10 provides details on electricity demand growth assumptions from the modeling literature, which includes both low and high demand scenarios, so readers should refer to that chapter for those details. As agreed in Oxford, the technology chapters were to focus our text on the figures provided by Chapter 10. Chapter 7 has done so. It is certainly correct that wind's contribution on an absolute basis and on a percentage basis may depend on electricity demand assumptions, but chapter 7 does not have the ability to unilaterally segment the chapter 10 results on this basis. However, to be clear on this point, we will in our text make clear that wind's contribution may depend on the electricity demand assumptions inherent in the underlying scenartios, that those assumptions (as shown in chapter 10) span a wide range, and that those assumptions are embedded in the figures presented in chapter 7. We will also point to chapter 10 for further information on the demand assumptions of the scenarios reported therein.
United States (U.S. Department of State)	7	0	-	-	-	-	-	-	It might be helpful to have a short discussion on the need for other transitioning economic sectors to coordinate planning phases better with the power-generation sector. For example, the automotive and public transport subsectors of transportation may experience rapid transition to electric-drive vehicles in the coming decades. In the case of public transport, if a new electric system of cars and stations coming online will draw substantial new electricity demand, it may be useful to know both what amount of new electricity capacity may or may not need to be added for the community/regional power infrastructure, and what percentage of that new capacity will be RE. This may call for more close coordination also between federal entities such as DOE, EPA, and DOT.	While a good comment, this comment is most properly addressed in Chapter 8 or in other "integrative" chapters of the SRREN. It is not the place of the wind chapter to address the electrification of transportation, as that issue crosses all of the renewable energy technologies more or less equally.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	7	0	-	-	-	-	-	-	Meeting desired carbon reduction goals requires wind deployment on a massive scale. 13% of the global electricity power produced from wind would meet Category 1&2 (300-440 ppm concentration) reduction objectives. The authors are using the conventional approach of focusing on individual turbine technology. In reality, the R&D issues, deployment challenges, control, integration, and interoperability are now focused on very large wind systems and not individual turbines. This large wind system scale construct more effectively conveys the scope of the IPCC report in mitigating climate change impacts on a global scale. It is time to start viewing wind technology in this light rather than continuing to examine individual turbine technology as the principal driving concern. It was suggested to the authors that this approach and concept could aggregate the material presented throughout the document.	We will seek to build this system-level perspective a bit more strongly in the final draft. When discussing siting/permitting, we can add text on the challenges of scaling to more-significant deployments. In Section 7 as well we will seek to add more of a systems-level perspective, and that will be introduced in Section 3. We will, however, focus on greater deployment more so that larger projects.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	0	-	-	-	-	-	-	Overall impression: nice chapter! Fairly easy to read, good structure and comprehensive representation of the overall situation for wind energy.	Accepted
United States (U.S. Department of State)	7	0	-	-	-	-	-	-	Overall, the report is very well written and informative. It is extremely difficult to combine diverse input from several contributing authors into a single, coherent document without repetitive and/or duplicative information. Although similar information is presented in several sections, for the most part other sections of the document are referenced for clarification and not repeated. There are significant style differenced in voice, tone and approach between topic areas and some organizational consistencies, such as summaries at the end of each section, would be very useful in synthesizing major points and conclusions. The chapter could use a good, detailed editing by a single lead author and standardization in terms of references and formats for metrics.	Perhaps an NREL editor can take a crack at it. As for summaries at the end of each section, at present, those summaries are provided at the beginning of each major section, and are also included in the SPM, TS, and executive summary. Additional summaries would be duplicative.
United States (U.S. Department of State)	7	0	-	-	-	-	-	-	Please place chapter though a general grammar and format edit.	Perhaps an NREL editor can take a crack at it.
United States (U.S. Department of State)	7	0	-	-	-	-	-	-	Terminology about wind farms/plants/stations/power plants should be standardized.	Accepted
United States (U.S. Department of State)	7	0	-	-	-	-	-	-	The authors may consider restructuring the material presented to facilitate a smoother flow of ideas.	This comment is not actionable at this time. The basic structure of the chapter has been determined 2 years ago, and has been refined in collaboration with the other technology chapters and the TSU. While alternative structures may be superior, it is not within the power of chapter 7 to alter the basic flow of ideas and structure at this time.

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Paul Leahy (University College Cork)	7	0	-	-	-	-	-	-	The TSU asked for areas where the length of the document may be reduced. One possible area is the discussion of future costs, particularly 7.8.4.1. The uncertainty and variability in learning curve rates appears to be high. Table 7.6 could be condensed or some salient points absorbed into the main text.	Chapter 7 authors believe that it is very helpful to have a single, comprehensive summary of the learning curve literature. Howeever, if space constraints preclude a chapter of the present length, we will consider eliminating this table and instead summarizing its findings.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	2	1	72	30	-	-	-	General comment on whole chapter: overall the quality of the chapter is fairly good but it has a potential for being improved. The executive summary is far too long, should be maximum 1 to 1 1/2 pages. There is a general need to polish the text, in some places it goes into tedious details and the text is often repeated again and again. The chapter conclusion/overall messages are unclear.	The executive summary is of the length agreed by all SRREN authors with the TSU. If the TSU offers guidance supporting an alternative length, the wind chapter will comply with those guidelines. The chapter will also go through an editorial review before publication. Overall, however, as per other comments received, the chapter authors feel that the main messages of the chapter are reasonably clear and well expressed, and most reviewers appear to agree with this sentiment. That said, again, a close editorial review will take place on the chapter, in part looking for unneccary repetition that occures outside the summary sections, and the LAs will of course review the full document before final submission.
China (China Meteorological Administration)	7	2	46	2	46	7.6.2.3	-	-	7.6.2.3 should be taken out of 7.6.2 as a new sub-section due to the different prospectives.	We prefer not to place undue emphasis on this impact, because the available literature is scant and somewhat problematic, as noted in the text. Moreover, all of these ecological impacts do have implications for humans, so the current location is not inappropriate. However, we do need to add a sentence linking local climate impacts to ecological impacts, so that the present location is appropriate
Sweden (Swedish Environmental Protection Agency)	7	4	27	4	27	-	-	-	"11% of global net electric", Change to: 11% of global new installed net electric	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	4	32	4	33	-	-	-	Brackets should not be used for complete sentences, delete sentence in brackets or brackets	Accepted
United States (U.S. Department of State)	7	4	12	-	-	-	-	-	Change "ample technical potential" to "ample potential"	The word "potential" alone, absent qualification, leaves very little impression on what it means: is it theoretical, realizable, somewhere in between? While it is true that technical potential is also problematic, and has varying definitions, it is at least included as a term in the glossary and conveys somewhat more informatiton. Additionally, it is technical potential that is the focus on the resource potential section. As such, we prefer to leave the somewhat more precise terms.
John Twidell (AMSET Centre)	7	4	15	-	-	-	-	-	conrinue sentence to have '¿.economically attractive in the absence of charging fossil fuel for its emissions (i.e. internalising the external costs of fossil fuel).	The point of comparison to conventional energy sources is, of course, difficult, but we will endeavor to make clear that we are comparing the cost of wind to the current price of conventional fuels, accepting that those prices may not fully reflect external costs. "In some areas with good wind resources and under current market conditions, the cost of wind energy is already competitive with fossil generation but, in most regions of the world, policy measures are currently required to ensure rapid deployment." This text or similar will allow us to avoid discussion of externalities in Chapter 7, as those issues are better addressed more holistially elsewhere in the SRREN
Antoine BONDUELLE (E&E Consultant)	7	4	-	8	-	-	-	-	Executive summary is balanced and reflects well on the content of the chapter	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Jos Beurskens (ECN Wind Energy)	7	4	28	-	-	-	-	-	It is not clear what is meant by ¿capacity¿. If the unit is MW (power) than it should be mentioned that the typical capacity factor of wind energy is 25% compared to coal fired base load plants (>90%), PV plants (10% in northern latitude and more in southern latitudes), peak load gas turbines approx 60% (?)). Just for clarification: the capacity factor of wind energy is a design parameter and is not a site specific parameter. Because of the dominance of cable cost for offshore applications offshore wind farms are designed for higher capacity factors, up to 40%. This is done by choosing a smaller generator rating per unit of rotor swept area for a given wind speed (which is site specific).	We will mention that this is referring to MW, but we will then leave it at that. The ES is not the place for detailed discussions of relative capacity factors among technologies, and how those are determined. In the body of the report, when we use this statistic, we may add a footnote noting capacity factor differences among various energy sources.
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	4	43	4	44	-	-	-	replace (excluding off-shore) by (on-shore only)	Accepted
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	4	44	4	44	-	-	-	replace (including on- and off-shore) by (on- and off-shore)	Accepted
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	4	29	4	29	-	-	-	US$57 billion need to be converted to USD2005	It is already in 2005$, as are all other cost data in chapter 7.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	4	43	4	45	Executive Summary	-	-	I suggest all energy figures to be translated to TWh instead of EJ/y if decision makers are to read this document.	We will insert TWh/y here in parentheses, as we do in the chapter itself, but also note that as per IPCC TSU agreements, we will remain focused on EJ as the primary unit, unless the TSU provides instructions otherwise. All chapters previously agreed to focus on EJ to ensure a level of standardization. As such, other chapters should be revised according to the early commitments.

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Glória Rodrigues (European Wind Energy Association (EWEA))	7	4	14	4	15	Executive Summary	-	-	The reference "policy measures are required to make wind energy economically feasible" is confusing and should be rephrased. Costs reduction, a crucial element for sector's competitiveness, is coming not only from policy support, but also from technology development and market push. Furthermore, authors should make clear that this support is often due to the fact that wind energy is not at the same level playing field as other already heavily subsidised power sources, and that the current electricity prices do not fully reflect the real economic, environmental and social costs of producing electricity. The interpretation that wind is inherently not competitive and needs policy support because of that should be avoided.	We will include "currently" in the text to clarify that this point applies to the present, and that policy is currently needed to create "substantial deloyment;" we may also use "under current market conditions." The following sentence addresses the possibility of technical advancement and future cost reduction which, of course, may make policy intervention unnecessary. The point of comparison to conventional energy sources is, of course, difficult, but we will endeavor to make clear that we are comparing the cost of wind to the current price of conventional fuels, accepting that those prices may not fully reflect external costs. "In some areas with good wind resources and under current market conditions, the cost of wind energy is already competitive with fossil generation but, in most regions of the world, policy measures are currently required to ensure rapid deployment." This text will allow us to avoid discussion of externalities in Chapter 7, as those issues are better addressed more holistially elsewhere in the SRREN
John Twidell (AMSET Centre)	7	5	32	-	-	-	-	-	add phrase so '¿curtailment, DIVERTING EXCESS WIND POWER TO FUEL PRODUCTION AND LOCAL HEATING, and increased...	Accepted
Australia (0)	7	5	35	5	37	-	-	-	"would be required" should be changed to "may be required". For wind to be efficiently integrated the trade-off between transmission costs and the quality of a wind resource need to be considered. Often it will be more efficient to connect a lower quality wind resource that is closer to existing network infrastructure.	True, though this text focuses on on "areas with the best wind resource conditions". Nonetheless, we accept that "may" is a better term given the range of location-specific factors involved. We will also amend the text of the chapter to note the transmission and resouce tradeoffs that are very common.
John Twidell (AMSET Centre)	7	5	49	-	-	-	-	-	...potential to produce negative impacts on ¿.human beings. INCORRECT IMPLICATIONS. Change to '¿potential to produce some negative impacts on avian ecology and on human VISUAL PERCEPTION. [It is wrong to suggest there could be physical and other material harm to humans]	We will use "impacts on human activities and well being", as more general text. However, these impacts go well beyond the visual, so we will not limit our discussion to visual impacts.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Jos Beurskens (ECN Wind Energy)	7	5	22	-	-	-	-	-	20% in stead of 10%. This applies to a smaller country or a larger region	To conserve on space, we prefer to not focus on individual countries in the ES, especially since the Denmark case is somewhat unique from an integration perspective. However, we will replace this by saying that Three countries (Denmark, Spain, Portugal) are at or over 14%...)
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	7	5	30	5	34	-	-	-	It should be added that modern (pitch-regulated, speed-variable) wind energy converters are able to provide downward and upward balancing power by themselves. However, upward balancing is only economical in extreme or emergency cases.	We prefer to not go into this level of detail in ES, but we will consider changing "output curtailment" with to "output control" here, and then in section 5 describing the nature of that possible control.
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	7	5	21	5	22	-	-	-	It should be added that wind energy supplies about 20% of aggregate annual electricity demand in Denmark.	To conserve on space, we prefer to not focus on individual countries in the ES, especially since the Denmark case is somewhat unique from an integration perspective. However, we will replace this by saying that Three countries (Denmark, Spain, Portugal) are at or over 14%...)
Jos Beurskens (ECN Wind Energy)	7	5	19	-	-	-	-	-	limited (but improving) predictability in stad of reduced predictability.	We will replace with "improving but limited" predictability
John Twidell (AMSET Centre)	7	5	37	5	40	-	-	-	PLEASE CHECK CAREFULLY. At low to medium levels of wind energy there are hardly any extra costs for adding wind power, it is only from medium to high levels that extra transmission (a capital cost) and extra 'standby' capacity is needed. THE PRESENT SENTENCE IS TOO NEGATIVE	We will seek to clarify this point here, and to a greater extend in section 5.
United States (U.S. Department of State)	7	5	17	-	-	-	-	-	Prior to the ¿Analysis and experience ¿¿ section, a summary paragraph on the current and anticipated utility scale turbine technology trends would be useful. The executive summary skips from resource and market to integration without a technology overview; assuming many readers will only read this section some summary status of size, scale, configuration for both land and off shore should be included. Some information is given on page 6, line 17 (Technology Innovation & COE) but not nearly to the fidelity or prominence required as a key topic area.	We will add a couple sentences in the "market expansion" section.
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	5	43	5	46	-	-	-	Rephrase: The energy used and emissions produced in the manufacture and installation of wind turbines are small compared to the energy generated and emissions avoided over the lifetime of wind power plants. The energy payback times are between three to nine months.	We will amend the text somewhat from what is proposed, but seek to eliminate the parenthetical.

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Sweden (Swedish Environmental Protection Agency)	7	5	17	5	40	-	-	-	The figure 30% on line 40 referes to a combination of high values for three parts of the integration cost. See comment on chapter 7.5.5. Maybe it is better to have a range og costs or in any case commnt on that the integration cost for most cases, even for up to 20 % penetration (as part of the energy inte electricity system) is much lower than 30%.	We will seek to clarify this point here, and to a greater extend in section 5.
Sweden (Swedish Environmental Protection Agency)	7	5	46	-	-	-	-	-	The lower values of 3 month seems rather short and the most values in table 7.3 indicates energy payback times more than 6 months. Maybe a clearification can be to write .. 3 to 9 months, to a large extent depending on the wind conditions of the site.	We prefer to simply present the range; the actual range may depend in part on assumed performance, but there are many other variations among the studies as well that would then also need to be mentioned, wasting too much space on an issue that is not so significant (whether 3 months of 9 months). The range does seem to be rather equal around 6 months as well, and does not appear to us to be terribly skewed towards one side of the range over another. We will consider presenting payback time as a multiple of the design life energy production instead, and we will push Garvin to do this.
Jos Beurskens (ECN Wind Energy)	7	5	35	-	-	-	-	-	There is virtually no electrical infrastructure offshore. Here the problem is fundamentally different from onshore applications.	While this is true, it does not seem that the text needs to address that issue specifically, here in the ES. In either instance, new transmission is needed, and cost and institutional barriers apply.
Australia (0)	7	5	37	5	40	-	-	-	This sentence may be misleading and needs to be updated to reflect comments on ¿page 38 line 7-14	We will seek to clarify this point here, and to a greater extend in section 5.
Simon Allen (IPCC WGI TSU, University of Bern)	7	5	13	5	16	ES	-	-	Citations are needed here - you say that 'research to date' has suggested that global climate change WILL alter the distribution of the wind resource, but do not provide any citations to this research.	Though citations cannot be provided in the ES, we accept that there is a discrepancy between the MAY in the chapter and the WILL in the ES. This difference will be rectified.
Gian-Kasper Plattner (IPCC WGI TSU, University of Bern)	7	5	13	5	16	ES	-	-	Comment by Simon Allen, Science Officer WGI TSU, University of Bern: Citations are needed here - you say that 'research to date' has suggested that global climate change WILL alter the distribution of the wind resource, but do not provide any citations to this research.	Though citations cannot be provided in the ES, we accept that there is a discrepancy between the MAY in the chapter and the WILL in the ES. This difference will be rectified.

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China (China Meteorological Administration)	7	5	37	5	38	Executive Summary	-	-	Add "in Europe and U.S.". At low to medium levels of wind electricity penetration (under 20% of total electricity demand), wind energy integrated studies have not been carried out in China. It is suggested that the above conclusions are restricted in Europe and U.S.	Accepted
China (China Meteorological Administration)	7	5	24	5	27	Executive Summary	-	-	At the end of the sentence, add "in Europe and U.S.". At low to medium levels of wind electricity penetration (under 20% of total electricity demand), wind energy integrated studies have not been carried out in China. It is suggested that the above conclusions are restricted in Europe and U.S.	Accepted
China (China Meteorological Administration)	7	5	41	6	15	Executive Summary	-	-	Impacts of wind power plants on the local climate should be added in this paragraph.	Use the same phrase as the new one in the TS
Glória Rodrigues (European Wind Energy Association (EWEA))	7	5	49	5	49	Executive Summary	-	-	Negative impacts on "human beings" is very general and can be led to wrong interpretations. I suggest replacing "human beings" by " human activities and well being".	Accepted
Glória Rodrigues (European Wind Energy Association (EWEA))	7	5	49	5	49	Executive Summary	-	-	Please add after "...and on human beings", "if not properly developped".	The text already includes the word "potential." In fact, all development will impact humans in some way, and this need not be conditioned on a "properly developed" project. The word potential offers a sufficient qualifier in our view.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	5	17	5	17	Executive Summary	-	-	Please modify the sentence: ..integration of "a large share" of wind energy is achievable.	"a large share" is vague, and would then need to be precisely defined. Moreover, what can be integrated is system specific. The text that follows this statement discusses integration experience and studies, with some representative penetration levels. However, we prefer not to use terminology such as "large share" without a precise definition, and the literature does not suggest any such definition.
John Twidell (AMSET Centre)	7	6	2	-	-	-	-	-	remove word 'social' to have '¿while prominent concerns include..radar¿	We are seeking to distinguish between environmental and human impacts, as per the chapter itself. We will consider a term other than social, but simply removing all terms here is not viable.

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Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	6	25	-	-	-	-	-	"Installation costs" should be replaced by "capital investment costs".	We will be using terminology agreed by SRREN: investment cost
John Twidell (AMSET Centre)	7	6	3	-	-	-	-	-	.. and the POSSIBILITY of radar interference [Note: software exists to remove wind turbine radar reflections, see www.bwea.com/aviation/radar.html and /www.bwea.com/aviation/ams_report.html]	Accepted
Jos Beurskens (ECN Wind Energy)	7	6	17	-	-	-	-	-	Add to the characteristics of modern wind turbines that they possess a high degree of controllability. This enables them to avoid excessive loads and make them so grid friendly that they can often support the grid, despite the stochastic character of the wind.	We will add a sentence on wind turbine technology and grid codes, and place it in the integration portion of the executive summary.
Norway (Climate and Pollution Agency)	7	6	34	6	37	-	-	-	An important factor for reduced cost of offshore wind is to "develop supplier capability and capacity and to ensure competitive supplier market". This element should be added.	This is a near-term constraint, and here we are focused on estimates for 2030 and 2050, presumably both of which are after any near term constraints are overcome. However, we will replace operational experience with simply experiene, as experience implies experience with operations and experience with installations, the latter of which will also increase supplier competition over time.
Jos Beurskens (ECN Wind Energy)	7	6	1	-	15	-	-	-	Environmental impacts offshore are forgotten. Possible negative effects include impact on the hearing capability of sea mammals during certain installation activities such as hammering, damage to fish larvae during hammering, forced deviation from birds¿ coastal immigration routes, morphological effects and its effects on benthos. However also positive effects have been noticed likes re introduction of fish like cod and other commercially interesting species. This is caused by growth on wind turbine foundations which attract fish and by the fact that a wind farms forms a refuge for fish (normally commercial fishery is prohibited inside and within a certain distance from the outer boundaries of wind farms.	These are absorbed by "habitat and ecosystem modification", but that is a very general term and does not mention offshore. To clarify that marine impacts are included therein, additional text will be added, though only very general text.
Jos Beurskens (ECN Wind Energy)	7	6	30	-	37	-	-	-	For the determination of onshore wind energy cost a lot of reference material is available to which statistics may be applied. However for offshore this is fundamentally different. There are only about 35 offshore wind farms (all in Europe except one in China) and they are all different. This is not a sound basis for making reliable cost estimates. But I do agree with the cost figures of the report.	Yes, this is a challenge, but we estimate future costs based on the available literature as it stands. In the chapter itself we will seek to clarify that experience with offshore wind is more limited, so that cost estimates are inherently more uncertain.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Sweden (Swedish Environmental Protection Agency)	7	6	26	5	26	-	-	-	Here it would be very valuable to put the text from page 50, lines 18-22: One notable feature of both of these planning efforts is that neither envisions a sizable technology breakthrough for wind energy in the years ahead: instead, the path forward is seen as many evolutionary steps, executed throug incremental technology advances, that may nonetheless result in significant improvements in the delivered cost of wind energy. This statement is very valuable to have inte summary!	We believe that the current text describes the situation relative well vis a vis mature onshore technology, and offshore having the possibliity of greater advancement. The added text would be somewhat duplicative, and seems uncesseary given space constraints.
David Clubb (European Environment Agency)	7	6	25	6	26	-	-	-	Incorrect statement: the cost of the installation is governed by the lifetime of the plant (last point) rather than the assumed economic life; the predicted lifetime will influence financing costs	We will clarify that these 5 factors are influencing "levelized" costs, in which case the economic life is the relevant characteristic.
Jos Beurskens (ECN Wind Energy)	7	6	20	-	23	-	-	-	Increase of energy capture can only be achieved by higher wind speeds and larger rotors. The improvement of aerodynamic performance and control mainly contributes to reduction of loads (and thus increase of service lifetime) and hardly to energy capture as we are already close to the theoretical maximum.	We agree with the comment. However, this is related to incremental advances that the section discusses.
Jos Beurskens (ECN Wind Energy)	7	6	22	-	-	-	-	-	More radical innovations: other examples are: very compact, light weight directly driven generators incorporating super conductors, very large rotor blades incorporating distributed (along the blade radius) aerodynamic control elements and integrated control on wind farm level securing among others maximum output, optimum capacity factor and highest degree of dispatchability of electricity.	Though these additional possibilities are useful addition, we do not have the space in the ES to address them. Nonetheless, we will consider including some of these possibilities in the full chapter text. But the new formulation that is developed in the full text of the chapter will then flow through this portion of the text as well.
Jos Beurskens (ECN Wind Energy)	7	6	25	-	-	-	-	-	Note that annual energy production is determined only by local wind speed and rotor swept area (and not by generator rating).	We do not believe that this detail is necessary in the ES; in addition, we disagree, as annual energy production is based typically on both the rotor swept area and the generator size. We will consider adding relevant text in the body of the chapter.
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	7	6	33	6	34	-	-	-	Offshore wind cost appear to be to low, cost for North Sea projects are about 18 ¿ct/kWh (2010).	Our LCOE calculations are based on the underlyng cost and performance data provided in the full report, which we believe reasonably represents existing shallow offshore projects. We will seek to clarify that these costs reflect recently built projects, and that new projects may have different characteristics.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	7	6	9	-	-	-	-	-	Proposed altered text: "... impacts wildlife through potential bird and bat collisions" Provided a good siting, there is no evidence that bird and bat collisions occur.	We are not aware of any study that has found that well-sited wind plants have not resulted in bird and bat fatalities; in fact, we are aware of many well-sited plants for which many fatalities have been documented. Though one may debate the substantive importance of the fatality numbers that are observed, we do not believe that one should imply that they are only a "possibility"
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	6	25	6	26	-	-	-	replace ""operating and maintenance costs"" by ""O&M costs""	Accepted
Henrik Stiesdal (Siemens Wind Power)	7	6	37	-	-	-	-	-	The cost reductions are likely to be higher - 20-40% until 2020, 40-50% by 2050	We base our estimates on the available literature. We will review that literature once more to determine if these higher numbers can be defended. We will note that our methods are conservatism, as per responses to earlier comments. We might also say that industry reviewers believe that greater cost reduction is possible. We may also add back in the carbon trust figure.
United States (U.S. Department of State)	7	6	38	7	8	-	-	-	The global CO2 reduction provided by wind technology is a critical number and principle topic of the report. Some reference should be made in the introduction as to the magnitude and quantity of the CO2 reduction potential. P. 69 lines 7-13 reference the specific numbers.	Some of the data on these lines are already provided here, in % terms. We must stay away from GHG terms here, as those are to be included in the mitigation chapter. We could insert additional information on EJ, but here we would simply be translating % to MWh and then to EJ, so other than unit conversions, no additional data would be provided. However, we will add information on the GHG concentration range that is associated with the percentages listed in the ES, as we assume that this is what the commentor is seeking.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Norway (Climate and Pollution Agency)	7	6	16	6	22	-	-	-	The substantial increase in turbine size over time is a key element. Also for future offshore wind turbines, the size may continue to increase, - to more than 10 MW. This should be included in the text	Already mentioned to a degree on the previous page based on historical evidence, but we may add text here on the still-planned further scaling going forward.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	6	32	6	37	-	-	-	What is the source of levelised cost figures presented here, what available literature is being referred to?	These details are provided in the full chapter, and references are not appropriate for the ES.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	6	31	6	33	Executive Summary	-	-	If references are added to the high levelised costs levels in low resource areas, references should also be given to low levelised costs levels in areas of high wind resource. Otherwise, delete this part of the sentence.	The first part of the sentence, referring to $50-100/MWh costs, is targeted to areas with "good to excellent" wind resource, so the text already includes a reference to the cost in excellent wind resource sites. As such, the authors believe that the present text is reasonably balanced in this respect.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	6	9	6	9	Executive Summary	-	-	Please modify the sentence: "could also impact widlife".	All wind project development will impact wildlife to some degree: this is a matter of degree, not whether or not such impacts will exist.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	6	21	6	21	Executive Summary	-	-	Please replace "component life" by "component lifetime".	Accepted
Glória Rodrigues (European Wind Energy Association (EWEA))	7	6	23	6	23	Executive Summary	-	-	Remove "-" between "more-fundamental".	Accepted
Glória Rodrigues (European Wind Energy Association (EWEA))	7	6	18	6	19	Executive Summary	-	-	The concept of "reasonably mature" is too vague. I suggest rephrasing it and/or replacing it by "Though on-shore wind energy technology is already being manufactured and deployed on a commercial basis (..)" as mentioned in section 7.3.1.	We will use the same term as agreed elsewhere

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Glória Rodrigues (European Wind Energy Association (EWEA))	7	6	28	6	29	Executive Summary	-	-	The reference "policy measures are required to make wind energy economically feasible" is confusing and should be rephrased. Costs reduction, a crucial element for sector's competitiveness, is coming not only from policy support, but also from technology development and market push. Furthermore, authors should make clear that this support is often due to the fact that wind energy is not at the same level playing field as other already heavily subsidised power sources, and that the current electricity prices do not fully reflect the real economic, environmental and social costs of producing electricity. The interpretation that wind is inherently not competitive and needs policy support because of that should be avoided.	We will include "currently" in the text to clarify that this point applies to the present, and that policy is currently needed to create "substantial deloyment;" we may also use "under current market conditions." The following sentence addresses the possibility of technical advancement and future cost reduction which, of course, may make policy intervention unnecessary. The point of comparison to conventional energy sources is, of course, difficult, but we will endeavor to make clear that we are comparing the cost of wind to the current price of conventional fuels, accepting that those prices may not fully reflect external costs. "In some areas with good wind resources and under current market conditions, the cost of wind energy is already competitive with fossil generation but, in most regions of the world, policy measures are currently required to ensure rapid deployment." This text will allow us to avoid discussion of externalities in Chapter 7, as those issues are better addressed more holistially elsewhere in the SRREN
John Twidell (AMSET Centre)	7	7	37	-	-	-	-	-	.. credited to James Blyth(July 1887), Charles Brush (December 1887)¿[Prof James Blyth, Glasgow, British `Patent 1891 see en.wikipedia.org/wiki/History_of_wind_power and Price, Trevor J (3 May 2005). "James Blyth - Britain's first modern wind power engineer" ([dead link]). Wind Engineering 29 (3): 191¿200	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.
John Twidell (AMSET Centre)	7	7	33	-	-	-	-	-	.. in East Anglia and the Rhine River Delta.	We will remove some of this detail from the final text to conserve space. There is no need to identify specific areas where wind was used, at this level of detail.
John Twidell (AMSET Centre)	7	7	32	-	-	-	-	-	¿ the British and Dutch..[see Musgrove for firm evidence of the key role of the British for deeloping horizontal axis wind mills]	We will alter the text to make it more general, and not so specific to individual countries.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	7	26	7	27	-	-	-	According to the Deutsches Schiffahrtsmuseum, depictions of sailing vessels from Egypt date to 3750 to 3500 BC.	We will make the timeline somewhat more general - the exact details can be debated, and are not so important.
John Twidell (AMSET Centre)	7	7	26	-	-	-	-	-	add reference to Musgrove, 2010 [this book has both a historical review and an engineering analysis of histric machines; P. Musgrove 'Wind Power', 2010, Cambridge University Press ISBN 978-0-521-74763-9]	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	7	7	45	7	47	-	-	-	Commercial rotor diameters up to 127 m (Enercon E-126), commercial tower heights up to 138 m (Enercon E-82).	Accepted
United States (U.S. Department of State)	7	7	3	7	8	-	-	-	Discussion of technology R&D and expenditures seems misplaced here and somewhat repetitive with the technology section on page 6 starting on line 16.	Some repetition is ok here, as the focus in this section is to emphasize what might be needed to achieve significant levels of penetration, and we wish to present the full list, even if some repetition is the result. That said, we will see if can reduce the repetition to some degree by mentioning the need for R&D, but perhaps not in as many words.
United States (U.S. Department of State)	7	7	25	7	41	-	-	-	Interesting but not critical to the follow-on content and could be reduced, paraphrased, or eliminated.	The introduction follows the agreed structure of the SRREN Technology chapters, and we do not find it to be overly wordy or lengthy. We choose to largely retain it as is, though some adjustments will be made to elements of the text as per other comments received.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	7	25	7	41	-	-	-	Interesting but not so relevant, but since the text needs to be shortened this should be deleted.	The introduction follows the agreed structure of the SRREN Technology chapters, and we do not find it to be overly wordy or lengthy. We choose to largely retain it as is, though some adjustments will be made to elements of the text as per other comments received.
United States (U.S. Department of State)	7	7	9	-	-	-	-	-	It is suggested that the authors reduce the discussion in the 7.1 Introduction.	The introduction follows the agreed structure of the SRREN Technology chapters, and we do not find it to be overly wordy or lengthy. We choose to largely retain it as is, though some adjustments will be made to elements of the text as per other comments received.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Sweden (Swedish Environmental Protection Agency)	7	7	22	7	24	-	-	-	It is true that the theoretically extractable energy scales with the wind to the power of three (wind cubed). I practice much a rather large part of the energy is captured above rated wind and changing the mean wind for a specific turbine makes the energy increase rathter to follow the wind to the power of two. I have made a study with power data for different tubines and found that the energy capture, for different webull distributed wind conditions wirh different mean wind speads, scaled with the mean wind to around the power of two. I dont have acess to the data more and can therefore not supply data. I however think thtat a footnote would be good here learning people that it is true that that the wind is the most important parameter to economy but not as important as the wind cubed. Suggestion for footnote. "The theoretically energy capture scales with the wind cubed. This means that a 1 % wind change gives a change of 3 % in theroretcal wind energy. Due to that the wind turbine operates over a large span of winds, and partially with the energy independendent of the wind over rated wind speed, the real practical energy change with mean wind speed is not as large the wind cubed. For changes in mean wind spead a practical value is that a 1 % 1 % wind change gives a 2 % change in energy capture	This is not appropriate to include in the introduction in our view, but we will consider such text in section 3.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	7	12	7	12	-	-	-	Reformulate: "¿.deployed in many countries. It is technically¿."	Accepted
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	7	25	7	41	-	-	-	The paragraph on the historical use of wind energy is very elaborate, but could be shortened, suggestion: Wind energy has been used for millennia (for historical overviews, see, e.g., Gipe, 1995; Ackermann and Soder, 2002; Pasqualetti et al., 2004). Sailing vessels relied on the wind from at least 3,100 BC. Mechanical applications of wind energy in grinding grain, pumping water, and powering factory machinery followed, first with vertical axis devices and subsequently with horizontal axis turbines. By 200 B.C., for example, simple windmills in China were pumping water, while vertical-axis windmills were grinding grain in Persia and the Middle East. The first successful experiments with the use of wind to generate electricity are often credited to Charles Brush (1887) and Poul la Cour (1891). However, the use of wind to generate electricity on a commercial scale began in earnest only in the 1970s, first in Denmark on a relatively small scale, then on a much larger scale in California (1980s), and then in Europe more broadly (1990s).	The introduction follows the agreed structure of the SRREN Technology chapters, and we do not find it to be overly wordy or lengthy. We choose to largely retain it as is, though some adjustments will be made to elements of the text as per other comments received.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	7	10	7	10	-	-	-	The sentence says: "This chapter addresses the potential role of wind energy in reducing GHG emissions. Indeed, but only in the last few pages of the chapter (i.e. pages 67 - 72). The chapter mainly describes the evolution of wind energy, its challenges, potentials, costs, barriers, etc.	All of the points included in the chapter are intended to build towards the final assessment of wind a GHG reduction tool. So, while it is true that the chapter traces many aspects of the wind "story", its fundamental purpose is ultimately to address GHG. The introduction is otherwise quite clear on the content of the chapter, but we will add text in the "roadmap" paragraph to link all of the topics that are covered to the underlying GHG purpose.
Jos Beurskens (ECN Wind Energy)	7	7	32	-	-	7.1	-	-	¿¿and adapted it for industrial applications such as grinding corn, sawing wood, making paper, mustard and paint and draining lakes ¿¿	Accepted
Jos Beurskens (ECN Wind Energy)	7	7	22	-	23	7.1	-	-	Delete ¿extractable¿. Suggestion: Add sentence: the theoretical maximum of extractable wind power from the wind is 16/17 (almost 60%), the Lanchester-Betz limit, of the power content of the undisturbed wind.	We will remove "theoretically extractable". We will not, however, reference the L-B limit here, as that limit is discussed later in the chapter, and was previously deemed too detailed to be included in the opening paragraphs of the introduction.
Jos Beurskens (ECN Wind Energy)	7	7	33	-	-	7.1	-	-	Suggestion (not essential): Rhine and Meuse River Delta.	We will remove text regarding both the Rhine and Meuse River, as this is overly detailed and unnecessary.
United States (U.S. Department of State)	7	8	1	-	-	-	-	-	A distinction should be made between shallow (<30 m), transitional (30-60m) and deepwater (>60m) offshore technologies; cost, resource, and technology platforms are very different and should be treated distinctly.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	8	5	8	6	-	-	-	Change "emphasizes"to "focuses".	Accepted
Sweden (Swedish Environmental Protection Agency)	7	8	1	8	4	-	-	-	I think it is important to point out that offshore wind likely not will be economically competitative to onshore wind at good sites. It shoold be noted that the resson that offshore wind will become more significant is due to conflicting interests for onshore sites, making offshore interesting. This is true for e.g. parts of western Europe.	An absolutely accurate point, and one that we make in the chapter itself. However, this level of detail is not needed for the introduction in our view.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	8	22	8	22	-	-	-	Why only focus on near-term grid integration issues? Medium to long term grid integration issues also very important in light of large offshore wind potential yet to be utilised.	This was the agreement made from the very beginning between chapters 7 ad 8. Long terms issues of integration are not so wind-specific, but are instead more dependent on the overall energy system, which is better addressed in chapter 8. As such, while perhaps not ideal, we will need to retain this emphasis, unless the agreement with chapter 8 is revised in the final analysis.
Jos Beurskens (ECN Wind Energy)	7	8	14	-	-	7.1	-	-	Split sentence. ¿¿under consideration. In addition to ¿¿.	Accepted
Jos Beurskens (ECN Wind Energy)	7	8	5	-	16	7.1	Box 7.1	-	Wind energy for rural and remote watersupply for three applications (domestic, cattle watering and irrigation) is still considered as a very important application. Not in terms of energy units but in terms of people served with water, an issue that is going to ber very important in de future!	These are covered in the following section on mechanical and propulsion needs, though that section does have a somewhat stronger emphasis on propulsion. We will seek to emphasize a bit more strongly the possibility of water pumping applications.
United States (U.S. Department of State)	7	9	0	-	-	-	-	-	Box 7.1 -Additional discussion might include a. water purification in rural and isolated areas; b. fuel production (hydrogen); c. storage ¿ pumped hydro and compressed air ¿wind systems optimized for applications other than energy production.	We will expand the mention of other applications to some degree, but cannot hope to be exhaustive here. Also, we will focus on wind-specific systems, not storage systems driven by wind.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Antoine BONDUELLE (E&E Consultant)	7	9	-	9	-	-	-	-	Box 7.1 gives useful information on small scale wind but lacks two important informations : an evaluation of the numbers of small machines in operation and some indication of their location; an order of magnitude of (a) the efficiency (b) the carbon content / energy content of these smaller machines compared with large scale wind turbines. This information would be useful for decision makers to avoid being mislead in favour of the "small-scale" wind. Larger turbines are presently much more productive and less costly in term of energy content. The latter can thus be collectively and socially more beneficial, outside the more marginal uses of small turbines described in the box.	Statistics on small wind are not very strong, so not much can be added, to our knowledge, on the location of their deployment, beyond what is already provided. We are not aware of any other available statistics that might provide a more thorough treatment. On economies of scale and carbon content: both of these factors are already described in the Text Box, and we do not believe need further emphasis, especially since small wind is not covered in depth for the reasons already discussed in the body of the introduction (i.e., not likely to be amajor contributor to GHG reductions, but instead likely to serve other markets altogether: e.g., remote markets that can absorb the cost and for which carbon content is not the policy driver).
Antoine BONDUELLE (E&E Consultant)	7	9	-	9	-	-	-	-	Box 7.1 lacks the mention of thermal production or recovery, e.g. through heat pumps or friction	We will expand the mention of other applications to some degree, but cannot hope to be exhaustive here. Also, we will focus on wind-specific systems, not storage systems driven by wind.
David Milborrow (Consultant)	7	9	-	-	-	Box	-	-	Its not immediately clear that high-altitude systems are conceptual	We believe that the text is clear on this point as it stands.
Jos Beurskens (ECN Wind Energy)	7	9	-	-	-	7.1	Box 7.1	-	Add water pumping and mention all applications See above). Add also wind energy for remote cooling for food conservation and desalination (e.g. by reverse osmosis. In the 70¿s and earlu 80¿s National programmes for water pumping, cooling and desalination especially targeted on developing countries were carried out in the Netherlands, UK, Germany, Sweden and Denmark. Potential and needs of these applications is still existent.	Accepted
Jos Beurskens (ECN Wind Energy)	7	9	-	-	-	7.1	Box 7.1 botto m	-	The text lacks critical approach to higher altitude applications. The least that can be done is to insert in the last sentence the following section: ¿¿ must be overcome before the proff of concept and thus a realistic estimate ¿¿.	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	7	10	40	-	-	-	-	-	Elliott et al. (1981) should be added to footnote 2 as a reference document	It is unclear what is meant by this comment: a reference for what purpose? This footnote simply traces out the history of the IPCC estimate, which does not seem to directly relate to the Elliott citation. We are unclear on the exact meaning of this concern.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	10	15	-	-	-	-	-	Make reference to studies mentioned here	This is unnecessary as the reference is made two paragraphs below when introducing Table 1.1.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	10	25	10	26	-	-	-	Sentence should be reformulate, e.g.: "¿., of which only 0.95EJ (0.2%) was being utilised for electricity generation in 2005.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	10	1	10	8	-	-	-	Somewhere in the introduction to the sub-chapter it would be appropriate with brief explanation/coverage of distinction between technical potential and realisable potential. The latter takes into account the various constraints (grid, economic, environmental, social, etc).	These explanations are offered in the glossary and in chapter 1 of the SRREN. To avoid duplication and the need to provide the same text in each of the technology chapters, we will not offer another definition here. However, we will better link to the glossary for those definitions, and will also try to draw the distinction between technical potential and what is realistitcally achievable. It is also true that clear and unambiguous definitions are not available consistently in the wind literature, and we will make this point as well, which also suggests that the terms used in Table 7.1 should not be applied all that literally.
United States (U.S. Department of State)	7	10	2	10	13	-	-	-	The author points out that potential resource calculation is related to the status of the technology. Some clarity is needed here as the extraction potential of an individual turbine is very close to theoretical limits. Are the authors referring to tower height providing greater access to larger energy potential, large wind farms under producing thus reducing the potential, and/or other potential enhancements or reductions? Same reference made in line 22.	We will emphasize wind turbine technology, and note HH/RT.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Sweden (Swedish Environmental Protection Agency)	7	10	2	10	13	-	-	-	The chapter does not fully describe what is meant by "technical potential". What is meant with technical potential, likely yalso differs in the quuted reports. In the summaries given in table 7.1 on page 11 the word "economic poettial" is used in the descrpition af Hoogwijk´s stydy. It would be good to have something written on the possible different types of potentioal used. One suggestion is to write "global ecomically viable potential" on line 2 and "ecomically viable resource potential" on line 21.	These explanations are offered in the glossary and in chapter 1 of the SRREN. To avoid duplication and the need to provide the same text in each of the technology chapters, we will not offer another definition here. However, we will better link to the glossary for those definitions, and will also try to draw the distinction between technical potential and what is realistitcally achievable. It is also true that clear and unambiguous definitions are not available consistently in the wind literature, and we will make this point as well, which also suggests that the terms used in Table 7.1 should not be applied all that literally.
United States (U.S. Department of State)	7	10	29	10	30	-	-	-	The following points are already in the text, but perhaps deserve to be moved up fron to the Executive Summary and/or Introduction: (1) The lower bound estimate from IPCC indicates that it is 3 times greater than the global electricity demand in 2007. (2) The underlying complexities stem from technical performance, economic modeling, and siting constraints. (3) There is no standardization for deriving these estimates.	The reference to the IPCC under-estimate will not be moved to the introduction or ES - the more important point in our view is not the "accuracy" of the IPCC estimate, but simply that the potential exceeds what will plausibly be deployed. Also already included in the ES is a statement that indicates that the tech potential is based on technology, economics and subjective judgements on constraints. The only additional point made here is that there is little to no standardization in making this assessments. This is very much true, and we will try to highlight this issue to a greater extent than the present text.
Jos Beurskens (ECN Wind Energy)	7	10	4	-	-	7.2	-	-	Add to sentence: ¿.. such as distance to electrical infrastructure and load centres and other uses of the land and sea.	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Juan Llanes (Centre for Environmental Studies)	7	10	-	-	-	7.2	-	-	review about technical potentials, to come to page 15, 7.2.2.2. Were we read that ¿wind resource assessments described above have historically relied primarily on relatively coarse and imprecise estimates of the wind resource, sometimes relying heavily on measurement stations with relatively poor exposure to the wind (rows 6,7,8)¿ . Data provided are more confusing than illuminating. Suggest to reduce space devoted to potential summarizing best available results and providing an unique rate of EJ to TWH if possible.	Our charge is to review the available literature, and that literature is not suffieiently strong to select a single number for the global wind resource, or even to select a more refined range based on a select set of citations. While such an approach would admittedly be preferable, details on the exact methods used in each study are not sufficiently robust to select a single "best" estimate. Regardless, the overall point of this section, to a degree, is to simply show that ALL of these estimates are sizable, and exceed global electricity demand. Regardless of the estimated resource, that resource will not seemingly limit the global wind resource.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	10	24	10	25	7.2.1	-	-	I suggest all energy figures to be translated to TWh instead of EJ/y if decision makers are to read this document.	We will insert TWh/y in parentheses wherer feasible,, but also note that as per IPCC TSU agreements, we will remain focused on EJ as the primary unit, unless the TSU provides instructions otherwise. All chapters previously agreed to focus on EJ to ensure a level of standardization. As such, other chapters should be revised according to the early commitments.
Norway (Climate and Pollution Agency)	7	11	-	-	-	7.2.2.1	-	-	Check if not the offshore potential is underestimated. The potential is increasing rapidly as water depth and distance from shore limits are pushed. As a minimum the assumed water depth limit/distance to shore limit used should be stated.	The citations provided are all accurately rendered, and footnote 3 provides some details on the assumptions used by these studies, as does Table 7.1. Further details of course can be found in the source documents, and we do not wish to expand the text further to cover these study-specific details.
Juan Llanes (Centre for Environmental Studies)	7	11	-	-	-	-	-	7.1	Suggest to review potentials estimates at the beginning of the chapter with those at 7.2.1. global technical resource potential.	They are consistent.
Antoine BONDUELLE (E&E Consultant)	7	11	-	12	-	-	-	7.1	Table 7.1 is essential source base, should not be edited	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	12	28	13	1	-	-	-	(sentence and footnote): as global studies, on the other hand, overstate accessibility in remote areas, the understatement due to coarse measurements might not bias results too strongly	This transmission constrainT is identified at the bottom of page 13, but we will raise the issue of remoteness more specifically in the text. This does not address technical potential per se, because technical potential does not often consider remote location to be a limit, but certainly that factor impacts the realizable potential and can and should be mentioned somewhat more clearly.
United States (U.S. Department of State)	7	12	0	13	0	-	-	-	Based on the potential inclusion of Capps, S. B., and C. S. Zender (2010), Capps, S. B., and C. S. Zender (2009), and Liu, W. T., W. Tang, and X. Xie (2008) noted earlier; footnote #3 on page 12, should include these references with corresponding summaries consistent with the other references in the footnote.	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.
United States (U.S. Department of State)	7	12	11	-	-	-	-	-	Change "expand to 70" to "expand from 70".	Accepted
Antoine BONDUELLE (E&E Consultant)	7	12	7	13	8	-	-	-	Comments on the table 7.1 suggests that recent assessments are larger. They could include the trend in the longer period in the larger energy assessments such as WEC or IEA to minimise until recently the potential of wind and other renewable energy (e.g. Grubb...)	We are uncertain of the comment here. The older assessment, from Grub b and WEC, are not IEA estimates? We are not in a position to want to speculate as to what political factors might have influenced these technical studies.
United States (U.S. Department of State)	7	12	1	-	-	-	-	-	Instead of "wind densities", it should be "wind power densities".	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	12	7	12	9	-	-	-	Sentence should be reformulate, e.g.: "The studies show show that the global (constrained) technical¿.".	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	12	15	12	15	-	-	-	Sentence should be reformulated: "¿¿ plants. The latter is related to hub height¿"	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	12	11	12	11	-	-	-	Sentence should be reformulated: "This ranges from one to fourteen times the global electricity demand".	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	7	12	21	12	24	-	-	-	The author may wish to consider: If we compare apples to apples, then in line 21 it is actually the "four most-recent studies" and not the "six most-recent studies". In line 22, delete "WBGU, 2004; Hoogwijk et.,2004". In line 24, instead of "a number of studies", be more precise and say "three of the older studies". If we want to list the studies, they are "Hoogwick et al., 2004; WEC, 1994; Grubb and Meyer, 1993".	Accepted
United States (U.S. Department of State)	7	12	28	-	-	-	-	-	The author should verify that resource estimate is valid only to water depths of 50m, and may want to consider further delineation to greater depths.	The total range presented here reflects a wide range of depths, as per the literature included in the footnote. Due to space constraints, we are not able to offer every last detail of each citation. However, in the text, we will more clearly state that offshore potential is highly dependent on depth and distance assumptions.
United States (U.S. Department of State)	7	12	8	-	-	-	-	-	The author should verify that the studies only included shallow offshore wind resource, and if so Insert the word "shallow", to read: "on- and shallow off-)..."	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	12	9	12	11	-	-	-	The text in the brackets should be moved to a footnote.	Accepted
United States (U.S. Department of State)	7	12	8	-	-	-	-	-	The value of 1,000 EJ/y is incorrect, because in WBGU (2004) this value is the Technical and not Technical Constrained potential. The constrained value in that study is 140 EJ/y. Instead of 1,000 EJ/y, the highest constrained value is 450 EJ/y from Archer and Jacobson (2005). Therefore, please use 450 EJ/y instead of 1,000 EJ/y.	We will need to review WBGU again before making this change. The challenge here is that there are no firm rules, and constraints are always a matter of degree. Is the WBGU sustainable potential more similar to the limited constraints or the more constraints cases? We will review the citation and use our judgement to determine the appropriate response, but understand the concern. We may also simply rename the WBGU estimates in the Results column to limited constraints and more constraints, to be consistent with the other citations.
United States (U.S. Department of State)	7	12	9	-	-	-	-	-	The value of 278,000 is incorrect and should be changed to 125,000 for the same reasons discussed for line 8 of page 12.	see response to comment above
Glória Rodrigues (European Wind Energy Association (EWEA))	7	12	11	12	12	7.2.1	-	-	The reference to "one and 14 times 2007 global electricity" require a reference to the 2007 demand. According to WEO 2009, pp 623, 2007 total generation was 19756 Twh.	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Greece (National Observatory of Athens)	7	12	-	-	-	-	-	7.1	PROPOSE TO DELETE REFERENCE Mayer(1993), the reason is that they do not add useful information and is better to keep info from 2000 and beyond	We prefer to maintain a comprehensive listing here, as otherwise somewhat arbitrary rules must be applied to determine which citations to retain, and which to exclude.
United States (U.S. Department of State)	7	13	8	-	-	-	-	-	"Elliot" should be "Elliott".	Accepted
United States (U.S. Department of State)	7	13	17	-	-	-	-	-	As noted in table 7.1 (Lu et al) footnote 3 after the words "(150,000 TWh/y)", insert: "at depths <200 m..."	Accepted
United States (U.S. Department of State)	7	13	30	-	-	-	-	-	footnote 5 should either be included in the main text after p13 line 8 as an additional paragraph or included in the section 7.6.2.3 discussion.	Accepted
United States (U.S. Department of State)	7	13	0	-	-	-	-	-	In the footnote on page 13, the reference to Heimiller et al (2010) should be changed to Schwartz et al (2010).	Accepted
United States (U.S. Department of State)	7	13	30	-	-	-	-	-	In the second to the last line of footnote 5, the phrase "research suggest effect sizes" is confusing. Please re-write this sentence or phrase.	Accepted
Juan Llanes (Centre for Environmental Studies)	7	13	11	-	12	-	-	-	What is the basis for the statement? Please explain and clarify.	The basis is the table and discussion that preceeds it, which clearly demosntrates that most of the recent literature has estimated technical resource potential at over 180 EJ. We will add a little bit of additional text to clarify that link.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	13	16	13	16	7.2.1	-	-	I suggest replacing "are likely to restrict growth" by "could be a limiting factor to growth".	The present text seems accurate enough to the authors. Relative to the global resource, which has been shown to not be a constraint, these other factors certainly are likely to constrain growth before the global resource is exhausted.
Antoine BONDUELLE (E&E Consultant)	7	13	-	13	-	-	7.1	-	Figure 7.1 shows well the innovations now being implemented for less developed zones (notably by 3TIER)	Accepted
Greece (National Observatory of Athens)	7	13	-	-	-	-	7.1 a,b	-	the 2 figures are too small and all info is not clear. I propose to eliminate the figure showing the 1981 data and leave only the global resource for 2009. This way it will be more evident where the resource is.	We will remove the NREL map
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	14	19	14	27	-	-	-	Technical potential might be significantly larger than electricity consumption in several regions but technical potential does not include accessibility of the resource - since parts of the potential might never be tapped, it would be helpful to include this indication here as an additional information to make the assessments more meaningful	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Glória Rodrigues (European Wind Energy Association (EWEA))	7	14	9	14	9	7.2.2.1	-	-	In the reference "Eastern Europe/CIS", please bear in mind that these two regions do not cover the same countries. The documents needs to be clear on the countries/regions it is making reference.	We will use IPCC regional definitions where possible; otherwise will note if using a different study definition.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	14	22	14	22	7.2.2.1	-	-	Please replace "former Soviet Union" to the current official designation of the considered geographical area: CIS countries or Russian Federation?	We are not aware of any official designation that covers exactly the FSU, and the studies in question use the FSU designation. As such, unless there is an exact alternative that can be used, we prefer to stay true to the use of FSU as applied in the papers themselves.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	14	2	15	4	7.2.2.1	-	-	There is also interesting study on EU technical resource potential you might consider taking into consideration in this section: Europe's onshore and offshore wind energy potential. http://www.eea.europa.eu/publications/europes-onshore-and-offshore-wind-energy-potential .	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.
Norway (Climate and Pollution Agency)	7	14	-	-	-	-	-	7.1	Check if not the offshore potential is underestimated. The potential is increasing rapidly as water depth and distance from shore limits are pushed. As a minimum the assumed water depth limit/distance to shore limit used should be stated.	The citations provided are all accurately rendered, and footnote 3 provides some details on the assumptions used by these studies, as does Table 7.1. Further details of course can be found in the source documents, and we do not wish to expand the text further to cover these study-specific details.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	15	27	-	-	-	-	-	footnote 13: either name some of these companies or leave out the footnote. No really new information is contained in this footnote	Accepted
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	15	17	-	-	-	-	-	footnote 6: another recent study on wind potentials in Europe is this one: European Environment Agency (2009), 'Europe's onshore and offshore wind energy potential'(6/2009), http://www.eea.europa.eu/publications/europes-onshore-and-offshore-wind-energy-potential	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.
United States (U.S. Department of State)	7	15	41	-	-	-	-	-	In footnote 7, replace "at the the state level" with "at the national and state levels".	Accepted
United States (U.S. Department of State)	7	15	8	-	-	-	-	-	The second "Elliot" should be "Elliott".	Accepted
United States (U.S. Department of State)	7	15	23	-	-	-	-	-	The word atlas' should be atlas. The apostrophe should be deleted.	atlases is apparently the appropriate plural of atlas

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Dr. Qamar-uz-Zaman Chaudhry (0)	7	15	28	16	-	7.2.2.2	-	-	Specific comment on Section 7.2.2.2 , the word ""Pakistan"" may be added after the word ""China"" in line No. 28 (at page 15) and the following para may kindly be added in Box 7.2 at appropriate place (at page 16) ""Pakistan Meteorological Department (PMD) completed a first specific study of its coastal areas for wind resource assessment in 2006. For this purpose wind masts were installed at 46 sites along Pakistan coast during early 2000s and wind data with one-minute average speed & direction, five-minute average temperature and ten-minute minimum and maximum wind speeds at 10 meters and 30 meters heights were collected for three years and analyzed. On the basis of this study, a wind corridor in south eastern parts of Pakistan (in Sindh province) with an area of around 9,700 sq. km. has been identified. The gross wind power potential of this area is 43000 MW and keeping in view the area utilization constraints etc., the exploitable electric power generation potential is estimated to be 11000 MW (Figure 7.2 (c))"".	Chapter 7 simply does not have the space to cover the wind resource condition of each country of the world. Box 2 focuses on China and Russia because of the size of these two countries, and because of advancements made in both countries in wind resource assessment techniques that provide a useful more-general message to the reader. However, we will clarify in TB2 that we have selected China and Russia because they represent 2 large countries, one of vast potential and one of significant current development, but this does not mean that wind resources do not exist elsewhere.
China (China Meteorological Administration)	7	16	-	16	-	Box7.2	-	-	In Box7.2, add advancement of wind resource assessment in U.S. Currently, many countries have assessed the wind energy potential in their own countries. But there is no comparability between their results due to more variations in technical methodology, wind speed assumed to be exploitable and land-use constraints for deployments. Comparatively speaking, the assessment on wind energy resource in U.S. is the most in-depth and well documented, in which advanced technologies are used and more comprehensive factors of wind power limitation have been considered. China, Republic of Korea and other countries assessed the wind energy potential by using the U.S methods, and it is believed, in the near future, that more and more countries will assess their wind energy potential following U.S. Therefore, the wind energy potential in U.S. may be used as an important reference to other countries.	This is an excellent comment, but the purpose of the Box is really to highlight the fact that increasingly other major countries are beginning to use sophisticated approaches. It is true that perhaps the US and EU are still using the most detailed methods, and these regions were also the first to do so. These points are made on page 15. The purpose of the box is simply to demonstrate that these advancements are beginning to spread, and also to demonstrate that both China and Russia also have sizable wind resource potential. On page 15, however, we will more clearly indicate that not only were these more-detailed techniques first used in the US and EU, but that the most advanced techniques are generally still used in those two regions. We do not, unfortunately, have the space to really describe these methods in technical depth, and we are also aware of not wanting to place undue emphasis on the US and EU in a chapter that needs to appeal to a broader, worldwide audience.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Dr. Qamar-uz-Zaman Chaudhry (0)	7	16	-	16	-	-	7.2	-	Specific comment, a new figure pertaining to Pakistan (which is attached separately with these comments sent via email) may please be added as Figure 7.2 © and caption may kindly be modified accordingly as ""Figure 7.2 (a,b,c). Wind resourse maps for China, Russia and Pakistan""	Chapter 7 simply does not have the space to cover the wind resource condition of each country of the world. Box 2 focuses on China and Russia because of the size of these two countries, and because of advancements made in both countries in wind resource assessment techniques that provide a useful more-general message to the reader.
Peter Johnston (Environmental & Energy Consultants, Ltd)	7	17	10	17	11	-	-	-	"unlikely that multi-year annual mean wind speeds and energy densities will change by .. +-25%"? Does this make sense. If wind speeds change by +25%, then energy in the wind will nearly (theoretically) double, i.e. 1.25 x 1.25 x 1.25. Speed & energy density won't both change by the same percentage so this sentence is unclear.	This is a fair comment and one that has arisen because of a wording change in response to the review comments from round one. The issue is that some studies directly 'treat' mean wind speeds, whereas others treat energy density. But, in synthesizing the literature, we are reluctant to "scale" the results of either sets of studies. We suggest a reword. From - Nevertheless, based on research to date, it appears unlikely that multi-year annual mean wind speeds and energy densities will change by more than a maximum of ±25% over most of Europe and North America during the present century. To - Nevertheless, research to date implies it unlikely that multi-year annual mean wind speeds or energy densities will change by more than a maximum of ±25% over most of Europe and North America during the present century. We will evaluate the literature further to assess whether more can be discerned and concluded on this basis.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	7	17	1	17	48	-	-	-	Often overlooked is the sensitivity of wind turbines to the quality as well as quantity of the inflow resource. The inflow quality is directly linked to the behavior of the Planetary Boundary Layer (PBL) which in turn is directly affected by climate change impacts ¿ from ground cover to boundary layer stability derived from winds aloft. The extent to which climate change affects the inflow resource both macro and micro effects is an issue worth mentioning and in need of future quantification through R&D.	We suggest the following wording change: From - There is increasing recognition that global climate change may alter the geographic distribution and/or the inter- and intra-annual variability of the wind resource, or alter the prevalence of extreme weather events that may impact wind turbine design and operation. To - There is increasing recognition that global climate change may alter the geographic distribution and/or the inter- and intra-annual variability of the wind resource, and/or the quality of the wind resource, and/or alter the prevalence of extreme weather events that may impact wind turbine design and operation. Further details beyond this simple reference are not neccessary given the aduence for this report.
Gian-Kasper Plattner (IPCC WGI TSU, University of Bern)	7	17	2	17	4	7.2.3	-	-	Comment by Simon Allen, Science Officer WGI TSU, University of Bern: On page 5 (lines 13 - 16), it was claimed that climate change WILL alter the distribution of the wind resource, whereas here this claim is downgraded, and you say that climate change MAY alter this distribution. In both instances, citations to scientific literature is lacking. Consistent wording is needed, based on cited scientific literature. If the available literature is insufficient to support any firm statement, then this should be noted.	We accept that there is a discrepancy between the MAY in the chapter and the WILL in the ES. This difference will be rectified.
Simon Allen (IPCC WGI TSU, University of Bern)	7	17	2	17	4	7.2.3	-	-	On page 5 (lines 13 - 16), it was claimed that climate change WILL alter the distribution of the wind resource, whereas here this claim is downgraded, and you say that climate change MAY alter this distribution. In both instances, citations to scientific literature is lacking. Consistent wording is needed, based on cited scientific literature. If the available literature is insufficient to support any firm statement, then this should be noted.	We accept that there is a discrepancy between the MAY in the chapter and the WILL in the ES. This difference will be rectified.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	7	18	7	18	7	-	-	-	1.5 MW is not a useful number for the upper range of turbine capacities. It should be changed to 2.5 MW as in figure 7.6 and p.20 line 17.	As per other comments, the important point here is that we are focused on the "average" turbine not the upper range. Were we focused on the upper range, we would have to admit that the MOD turbines of the 70s/80s were of the same size as the turbines in use today, so no upward scaling on that basis could be claimed. That is not the point, and would be highly misleading. The point is to describe what is being commercially sold, i.e., what is average, and for that 1.5 MW and larger is appropriate. We will therefore use the term "average" in the statement to make this clear.
United States (U.S. Department of State)	7	18	18	-	-	-	-	-	Actually, the engineering challenge is not efficiency ¿ this has been achieved for over a decade. Machines achieving the lowest COE and performing in accordance with designed reliability and sustained performance criteria is the engineering goal.	more cost-efficient wind turbines.
Antoine BONDUELLE (E&E Consultant)	7	18	4	18	6	-	-	-	Evolution of costs is also due to innovation in operation and maintenance, durability of equipment¿ The sentence implies that only design and building has evolved. Maybe add ""operation and maintenance improvements"" to the list.	Scientific and engineering expertise, as well as computational tools, design standards, production methods and operation and maintenance improvements have supported these technology developments.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	18	17	18	22	-	-	-	Given that the chapter has to be shortened, this paragraph could easily be deleted.	A previous reviewer wanted this information, so it will be retained.
United States (U.S. Department of State)	7	18	26	18	26	-	-	-	It is unlikely that any current multi-megawatt turbines utilize stall control to control power; for a multitude of reasons, full span pitch control is the industry standard.	There are turbines that use stall regulation (including active stall). Text modifed to state: either through stall control or pitching the blades or through a combination (active stall).

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	18	7	-	-	-	-	-	largest onshore wind turbines are more of a size of 2-3MW than 1.5MW	As per other comments, the important point here is that we are focused on the "average" turbine not the upper range. Were we focused on the upper range, we would have to admit that the MOD turbines of the 70s/80s were of the same size as the turbines in use today, so no upward scaling on that basis could be claimed. That is not the point, and would be highly misleading. The point is to describe what is being commercially sold, i.e., what is average, and for that 1.5 MW and larger is appropriate. We will therefore use the term "average" in the statement to make this clear.
Henrik Stiesdal (Siemens Wind Power)	7	18	25	-	-	-	-	-	Modern wind turbines often reach rated power at 10-11 m/s	Wind turbines operate over a very large range. We will extend the low bound to 10 m/s
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	18	30	18	31	-	-	-	not only is excess energy allowed to pass the rotor uncaptured when wind speeds are too high, but all energy, since the turbine will be turned out of the wind flow. The phrasing here suggests that part of the energy can still be used in this case	Paragraph will be revisited to clarify. Perhaps delete the last sentence.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	18	21	-	-	-	-	-	Please indicate source for Lanchester-Betz limit (maybe from textbook on wind energy if there is no article available)	Need a source that uses Lanchester-Betz.
Sweden (Swedish Environmental Protection Agency)	7	18	3	-	-	-	-	-	Put the word commersial in the first sentance. Modern commerisial grid-connected wind turbines have evolved from small, simple machines to large-scale,highly sophisticated devices. The reason is that in the late 70'ies and inte 80'ies a ratrer large number of large MW turbines was developed in Germany, USA, UK, Sweden, Denamrk and some other contries. These developent projects, however never reached commersial succes, but defintely contributed to the knowledge and develeopment of kwoledge through research programmes used when also commersial MW-turbines reach the market inte mid 90'ies.	Accepted
Antoine BONDUELLE (E&E Consultant)	7	18	3	18	5	-	-	-	Suggestion ""and siting"". The technology is not used only for design but also to get the most of the terrain	This section discusses wind technology; computational advances that improve siting are discussed elsewhere.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Antoine BONDUELLE (E&E Consultant)	7	18	8	-	-	-	-	-	The factor of five quoted line 8 does not apply to between late 1970s and now. This quote is misleading, because the costs per kWh have been cut by much more (depending on baseline) during the period. The sentence should be amended.	We are unclear on this point. The factor of five reduction was provided by the citation highlighted in the text. We would also note that a factor of five reduction seems to match the US experience, and may be even a little high based on US data and with costs up to the present, with the recent increase in wind power costs. Regardless, we will still with a factor of 5 as provided by the citation, and believe that that is a credible estimate.
United States (U.S. Department of State)	7	18	1	24	14	-	-	-	The technology section (7.3) was a bit mixed ¿ providing too much historical and evolutionary perspective rather than a concise technology assessment of today¿s multi-megawatt platforms for both onshore and offshore. Technology advancements presented as evolutionary changes derived from improved knowledge in the respective science and engineering disciplines would be more useful in understanding the remaining challenges and R&D requirements, and would provide better continuity with the technology innovation and COE reduction sections.	This section was intended to provide a historical perspective on wind technology development and illustrate the development in the different engineering disciplines. The section will be reviewed to clarify how today's technology has evolved.
Jos Beurskens (ECN Wind Energy)	7	18	27	-	-	7.3	-	-	Almost all turbines stop producing ¿¿	Accepted
Jos Beurskens (ECN Wind Energy)	7	18	6	-	8	7.3	-	-	As the nameplate capacity is a secondary parameter when characterizing a wind turbine¿s capacity to generate energy, I recommend to mention first the size of the rotor and than the associated power ratings.	Both factors are critical to determining a wind turbine's ability to generate electricity. Moreover, nameplate capacity rating, even if arguably not as important as rotor diameters, is more readily understood by the broader energy industry. Turbine rotor trends are provided in Figure 7.6, so are not ignored.
Jos Beurskens (ECN Wind Energy)	7	18	23	-	-	7.3	-	-	Modern large wind turbines, designed for non extreme wind regimes employ rotors ¿.	Rather than going to this depth, we will instead use the term "typically employ", which will allow us to save space that would otherwise be required to explain why turbines designed for extreme winds might have a different cut in wind speed.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Glória Rodrigues (European Wind Energy Association (EWEA))	7	18	7	18	7	7.3.1	-	-	I suggest replacing "1.5MW" nameplate capacity. In order to be consistent with the Economics of Wind power publication (in reference, page 40) 2MW nameplate capacity should be used. In this report it is said " It can be observed that the average size has increased significantly over the last 10-15 years, from approximately 200 kW in 1990 to 2 MW in 2007 (...)". Furthermore, later in the text (page 20, lines15 to 17) it is said that the "largest fraction of land-based wind turbines installed globally in 2009 had a rated capacity of 1.5 MW to 2.5 MW".	We will instead focus on AVERAGE ratings, as that better conveys the concept we are seeking to describe, and 1.5 MW and larger is accurate on an averaged basis.
China (China Meteorological Administration)	7	18	27	18	27	7.3.2	-	-	It is suggested that "approximately 25-30m/s" be changed into "approximately 25m/s for WTGS on land, 30m/s for WTGS offshore".	To our knowledge, there is no clear evidence that there is a distinction in cut-out speed for onshore and offshore turbines.
China (China Meteorological Administration)	7	18	22	18	22	7.3.2	-	-	It is suggested that 59% be changed into 59.3%. Betz limit is 16/27, normally one decimal figure is retained.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	19	2	19	4	-	-	-	Sentence starting with "Wind speeds also vary¿."can be deleted, it is repitition.	We are reviewing the introduction to Section 7.3.2. for clarity, but until that is complete, cannot ensure that this exact suggestion will be accepted.
Henrik Stiesdal (Siemens Wind Power)	7	19	12	-	-	-	-	-	The three blades are attached to a hub. Blades and hub together constitute the rotor.	Accepted
United States (U.S. Department of State)	7	19	1	19	4	-	-	-	Too general in tone and discussion and leaves the wrong impression; 1) wind increases as the 1/7 th power law; better resource and capacity factor potential, challenge is to build larger and taller machines to reduce COE. Wind shear as a design criteria is mentioned in the offshore section and a more thorough discussion would be helpful.	The standard power law assumption of 1/7th is too simplistic and turbine design and optimization is affected by many variables, not just shear, so we will not go to the level of detail suggested by the reviewer. However, we will consider clarifying the text.
Jos Beurskens (ECN Wind Energy)	7	19	-	-	-	7.3	-	-	Missing: one of the reasons to utilize rotors with three blades is the reduced acoustic noise emission as the tip-speed decreases with the number of blades (at constant diameter).	The technical detail behind trade-offs in noise and tip-speed ratio is too complicated for this general discussion in Section 7.3
Greece (National Observatory of Athens)	7	19	-	-	-	-	7.5	-	it will be neccesary to add one more figure of a gearless wind turbine, eg ENERCON TYPE	A gearless wind turbine figure does not add significant information to what is provided here, which is simply an illustration of the components of one common type of wind turbine,

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Henrik Stiesdal (Siemens Wind Power)	7	20	21	-	-	-	-	-	Even the largest of today's turbines operate at more than 10 rpm. Volume market machines in the 1.5-3 MW range operate at 12-20 rpm.	We will clarify this sentence that rotational speed decreases with turbine size; the acoustic noise resulting from tip ratios greater than 70-80 rpm provides the primary design criteria. We will provide a range of modern turbine rotational speed.
Miriam Ester Limia (of Meteorology)	7	20	15	-	-	-	-	-	If Figure 7.6 is removed, remove the reference to this figure	We will retain the figure, as noted elsewhere
Canada (Environment Canada)	7	20	20	20	23	-	-	-	Please verify: Rotational speeds of about 10 RPM seems low - the Vestas V80-2.0 MW turbine has a nominal RPM of 16.7.	We will clarify this sentence that rotational speed decreases with turbine size; the acoustic noise resulting from tip ratios greater than 70-80 rpm provides the primary design criteria. We will provide a range of modern turbine rotational speed.
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	7	20	28	20	31	-	-	-	Splitting of blades, tower sections and nacelles has already been commercially demonstrated. Therefore logistical constraints are not a big hindrance for growth in size of onshore turbines.	While component concepts to get around these constraints are possible, they are not currently widespread, and logistical issues remain a challenge. Even if solutions exist, the cost of those solutions also represents a logistical challenge.
United States (U.S. Department of State)	7	20	19	-	-	-	-	-	Statement "larger machines with rotor diameters and tower heights of 130 meters are operating" contradicts Figure 7.6, which shows 126m rotors as being far out in the future. Are these prototypes, demonstration models, or commercial turbines? Please reconcile.	Figure will be revised
United States (U.S. Department of State)	7	20	21	-	-	-	-	-	Suggests that rotation speed are linked to visual impacts and social acceptance; aeroacoustics limiting the tip speed to be 70-80 meters is the principal design criteria.	We will clarify this sentence that rotational speed decreases with turbine size; the acoustic noise resulting from tip ratios greater than 70-80 rpm provides the primary design criteria. We will provide a range of modern turbine rotational speed.
Henrik Stiesdal (Siemens Wind Power)	7	20	5	-	-	-	-	-	The power electronics is not inexpensive. What happened was that the costs continued to decrease; they remain substantial	We can write "the reduction in the cost of" instead.
United States (U.S. Department of State)	7	20	1	20	14	-	-	-	The significance of variable speed in terms of enhanced energy capture and the significance of improved control, performance, interconnection and reliability. Essential details of variable speed, full-span pitch and full PE conversion and the need to incorporate these technologies with size and scale are critical aspects of modern technology.	When we review Section 7.3., we will seek to ensure that modern technology concepts are addressed more clearly. However, we cannot ensure that this level of exact detail will be integrated.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	20	-	20	-	-	7.6	-	The figure should mention approximate power capacity.	Figure will be revised

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Miriam Ester Limia (of Meteorology)	7	20	-	-	-	-	7.6	-	This figure can be eliminated to reduce text	Wind turbine upscaling, as shown in the figure, has been the primary development pathway for wind technology. We need to improve this figure to represent rotor diameters and machine sizes that are more typical. But it should be retained.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	20	-	20	-	7.3.2.1	7.6	-	Please bear in mind that in 2010 there are already wind turbines with an higher rotor diameter than 110 m (Eg RePower turbines, according to BTM). Therefore, they should not be considered as "future wind turbines" as indicated in the figure.	Figure will be revised
Greece (National Observatory of Athens)	7	21	2	21	2	-	-	-	instead of wind projects it will be better to say WIND PARKS	We have standardized around the current verbiage based on previous comments, and will retain it.
Juan Llanes (Centre for Environmental Studies)	7	21	15	-	16	-	-	-	availability of what?. Please clarify	We will point to the glossary, or otherwise include a definition in a footnote on first use of this term.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	21	40	21	41	-	-	-	Delete "a potential reduction in the need for new, long distance, land-based transmission infrastructure". And delete also footnote 15. It is quite clear that large scale offshore wind, e.g. in the North Sea, will require land-based transmission investments since the electricity will have to be transported in in-land consumption centres.	We can clarify the text that it is by replacing distant onshore wind with local offshore wind that land based transmission might be reduced; this is true certainly in the US and China at least, though perhaps less so in the EU.
United States (U.S. Department of State)	7	21	20	-	-	-	-	-	did you mean deployment/installation rather than development?	No, we meant technology advancements, and we will rephrase as such.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	21	7	-	-	-	-	-	footnote 14: the reference to figure 7.3 is unclear, e.g. the figure does not show that aerodynamic efficieny is at a maximum if power level is below rated power. Also, there is no direct equivalence of rated power level to wind speeds since there is a whole range of wind speeds where turbine produces at rated power. Footnote information thus remains unclear, perhaps reformulation or clearer reference to (what part of) figure would be helpful	Foot note, 1st sentence: add (see Region II in Figure 7.3); Footnote, 2nd sentence: Aerodynamic efficiency is limited by the control system when operating at wind speeds above rated power (see Region III in Figure 7.3).

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	21	10	21	12	-	-	-	I don't see the point of having the domestic car comparison, it should be deleted.	The comparison to car operation will be deleted. New text: The design requirement for wind turbines is normally 20 years with 4,000 to 7,000 hours of operation each year depending on the characteristics of the local wind resource. This design requirement is challenging because the turbine operates many hours of the year over the lifetime of the turbine producing power from 0 to rated power.
David Clubb (European Environment Agency)	7	21	10	21	12	-	-	-	Irrelevant/false comparison: I cannot see the reason for this comparison; but if one is needed, surely something like a public bus service (in use typically 14 hrs per day) is more reasonable??	The comparison to car operation will be deleted. New text: The design requirement for wind turbines is normally 20 years with 4,000 to 7,000 hours of operation each year depending on the characteristics of the local wind resource. This design requirement is challenging because the turbine operates many hours of the year over the lifetime of the turbine producing power from 0 to rated power.
Norway (Climate and Pollution Agency)	7	21	9	-	-	-	-	-	Is this equivalent full load hours?	No, but we will clarify.
Finn Gunnar Nielsen (Statoil)	7	21	9	-	-	-	-	-	is this equivalent full load hours?	No, but we will clarify.
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	7	21	40	21	41	-	-	-	It is not clear why a potential reduction in the need for new, long-distance, land-based transmission infrastructure should occur.	We can clarify the text that it is by replacing distant onshore wind with local offshore wind that land based transmission might be reduced; this is true certainly in the US and China at least, though perhaps less so in the EU.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	7	21	38	-	-	-	-	-	It is not clear why offshore turbines should gain more economies of scale than onshore turbines. Offshore turbines need stronger foundations (depending on water depth and state of ground), face more stress (wind, waves, tides, currents) and higher risks (colliding vessel). Actually, today offshore turbines have more or less double the cost of onshore turbines in US$ per kW terms. Also O&M costs are higher due to large access distance and time, harsh weather conditions, etc.	We are stating potential gains in economy of scale - not stating that there is a positive economy of scale.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	21	35	21	41	-	-	-	Land-based spatial constraints should be included	p. 21, line 35; The primary motivation to develop offshore wind technology is to increase wind resource potential in areas where land is limited, particularly near highly populated regions. Other motivations for developing offshore include: (retain text in draft, but delete more-flexible turbine and mitigation of siting controversies)
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	21	31	21	31	-	-	-	Reformulate to: "¿¿.and Denmark. However, important developments are also taking place..."	Accepted
Babacar Sarr (ENERTEC-SARL)	7	21	10	21	12	-	-	-	Remove the car comparaison (By comparison¿hours each year).	The comparison to car operation will be deleted. New text: The design requirement for wind turbines is normally 20 years with 4,000 to 7,000 hours of operation each year depending on the characteristics of the local wind resource. This design requirement is challenging because the turbine operates many hours of the year over the lifetime of the turbine producing power from 0 to rated power.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	21	1	21	3	-	-	-	Suggest to delete this paragraph, it doesn't add any value. It includes a very big range for a typical wind park.	This language must be retained as it is used in a summry table that shows up elsewhere in the SRREN, which itself needs to reference chapter 7.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	21	9	21	10	-	-	-	The range of 4,000 to 7,000 hours of operation is incredibly high. It must be wrong, with excellent wind resources and onshore park could have around 3,000 full load hours at best, and an offshore park around 4,000. However, if the range is correct, please include reference/source.	The number of hours that a turbine operates is very different than the full load hours, as turbines do not operate at rated capacity continuously. But, we will try to clarify this in the text.
Henrik Stiesdal (Siemens Wind Power)	7	21	38	21	40	-	-	-	The ability to use more flexible designs is not relevant in practice and should not be stated as motivation..	Delete this text.
United States (U.S. Department of State)	7	21	10	21	13	-	-	-	This sentence should be a footnote for comparison.	The comparison to car operation will be deleted. New text: The design requirement for wind turbines is normally 20 years with 4,000 to 7,000 hours of operation each year depending on the characteristics of the local wind resource. This design requirement is challenging because the turbine operates many hours of the year over the lifetime of the turbine producing power from 0 to rated power.
Jos Beurskens (ECN Wind Energy)	7	21	31	-	-	7.3	-	-	¿. in other EU countries notably in the Netherlands, Sweden and Ireland.	The landscape shifts so frequently, we do not wish to name every country in which "significant offshore activity" is occurring, given the challenge of doing relative comparisons on this basis.
Jos Beurskens (ECN Wind Energy)	7	21	35	22	12	7.3	-	-	A number of technical reasons are mentioned to go offshore. Only at the end non technical reasons are mentioned (visual impact) suggesting that the drive to go offshore is mainly technical. I disagree. How can one go offshore if the cost now are twice as high as onshore and that it will require a huge effort to get the cost offshore at the same level as onshore? The reason is that the locations on land become so scarce because of public resistance (visual impact, environmental impacts, acoustic problems, only lower wind speed sites left) that the sites available are insufficient to meet the national targets. As circumstances offshore are relatively advantageous (shallow waters, close to load centers, high wind speeds, etc.), offshore is being developed. Another reason for offshore development is the opportunity to create a new economic industry segment.	We will change the ordering of the points made, as we very much agree with this comment.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Jos Beurskens (ECN Wind Energy)	7	21	13	-	28	7.3	-	-	For offshore the need for an integrated optimized O&M system is necessary including extended condition monitoring, service facilities on land or on artificial harbours at the ocean and access systems to lengthen the operational windows off shore. This aspect is described insufficiently prominent!	Already meantioned on P. 22, line 28-32. We will consider expanding the paragraph a bit to discuss the need for methodologies to reduce O&M costs. We already mention condition monitoring, service facilities on land and offshore. But, we are facing severe space constraints, and cannot go into detail.
China (China Meteorological Administration)	7	21	13	21	14	7.3.2	-	-	It is suggested that "Though domestically manufactured wind turbines in China are reportedly under-performing (Li.2010)...¿ be moved to other place, because the points made in this session are all common content.	We will retain the concept because otherwise the 97% availability citation is misleading as China is the world's leading wind market, but we will not focus on any individual country in the text. We will replace the text with "Though wind turbines are reportedly underforming in some contexts, data collected…"
Glória Rodrigues (European Wind Energy Association (EWEA))	7	21	12	21	13	7.3.2.1	-	-	Please add the source to the statement "¿component failure rates that have in some instances been higher than expected".	Standard language but we will look for citations
Glória Rodrigues (European Wind Energy Association (EWEA))	7	21	32	21	32	7.3.2.1	-	-	Please remove/replace "elsewhere". Elsewhere is a very broad concept, with the potential to be understood as "everywhere".	We will replace it with "and in other countries"
Glória Rodrigues (European Wind Energy Association (EWEA))	7	21	33	21	33	7.3.2.1	-	-	The concept of "relatively immature" is too vague. I suggest rephrasing it and/or replacing it by another more concrete expression.	Compared to onshore wind technology, offshore wind technology is less mature…
United States (U.S. Department of State)	7	22	23	22	24	-	-	-	"Wind turbine tip speed is often greater than for onshore turbines"; if true needs to be referenced and cited.	This is a potential design difference for offshore turbines, but may not be in practice yet. Text changed from "is often" to "could be chosen to be"
Finn Gunnar Nielsen (Statoil)	7	22	32	-	-	-	-	-	Add a sentence: new foundation solutions, including floating foundations, will open up large new areas for offshore wind development	These concepts are discussed in Section 7.7
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	22	21	22	27	-	-	-	additional changes: usage of downwind concepts to prevent the problem of blades coming to close to the tower --> possibility to use cheaper materials. Informations in Breton and Moe (2009)	New concepts for on and offshore wind are described in section 7; section 3 is focused on current technology, not the future. However, downwind concepts are addressed in section 7 already.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	22	14	-	-	-	-	-	Including also a reference to Breton and Moe (2009) (is cited in the technology concepts part of the chapter and already included in the reference list) would be good here, since they present different foundation concepts	We will review the citation and add it here as seems appropriate.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	7	22	29	-	-	-	-	-	Lower plant availabilities and higher O&M costs are not only the result of the relatively immature technology - inherently greater logistical challenges associated with offshore O&M (need for boats or helicopters, potentially lengthy waits for good weather conditions, etc) both decrease availability and make O&M costlier relative to onshore installations. Need to mention both factors here.	Accepted
David Milborrow (Consultant)	7	22	5	22	7	-	-	-	Peak aerodynamic efficiency is realised over a narrow range of wind speeds, only. Overall efficiency is lower	This comment refers to page 21, not 22. It is already addressed in footnote 14, but we will seek to offer some additional clarification in the body of the text/ consider adding "maximum" before coefficient of performance, line 6
United States (U.S. Department of State)	7	22	9	22	11	-	-	-	The author should consider adding: Deeper than 50 m of water, and certainly deeper than 200 m, floating designs will likely be more practical than bottom-mounted foundations, see section 7.1 to reflect the anticipated technology enhancements.	Future developments are discussion in section 7, and a link to section 7 is provided in the following paragraph. As such, no further changes are needed in this section.
Norway (Climate and Pollution Agency)	7	22	32	-	-	-	-	-	we propose that the following sentence is added: New foundation solutions, including floating foundations, will open up large new areas for offshore wind development.	These concepts are discussed in Section 7.7
Glória Rodrigues (European Wind Energy Association (EWEA))	7	23	19	23	20	7.3.4	-	-	I would suggest explaining between brackets what reactive power stands for. The concept could be probably added to the publication's Glossary.	check glossary to see if it is there; definition for reactive power should be in glossary.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	23	-	-	-	-	7.7	-	If additional shortening of chapter is necessary, consider dropping figure 7.7. Information in figure can easily be sketched in text since it is not necessary to the reader to know all these steps in detail (and, in case of more interest in the topic, references can be consulted)	The authors believe that the figure provides value in addition to the text. It will be retained.
David Clubb (European Environment Agency)	7	24	44	25	2	-	-	-	Partial duplication: This statistic is used earlier	The sentences at the beginning of each section provide a summary of the material to come, though admittedly it also creates quite a lot of duplication. We will look to remove some of the 1.8% references, but in general we are not inclined to remove the opening summaries, despite the eduplication that that creates, especially with the ES, intro, and final sections as well.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	7	24	23	-	-	-	-	-	Please place source.	The source is cited later in the section, and here we are simply summarizing the text that follows. So, no new citation is needed here, but the relevant citation is provided already.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	24	21	24	25	-	-	-	Suggest these unecessary sentences to be deleted. The 1.8% share is mentioned 6 times in the entire document and a few paragraphs further down on page 25, line 1. It should not be necessary for so much repitition.	These sentences at the beginning of each section provides a summary of the material to come, though admittedly it also creates quite a lot of duplication. We will look to remove some of the 1.8% references, but in general we are not inclined to remove the opening summaries, despite th eduplication that that creates, especially with the ES, intro, and final sections as well.
Miriam Ester Limia (of Meteorology)	7	25	-	-	-	-	7.8	-	Size can be reduced to eliminate pages	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.
Miriam Ester Limia (of Meteorology)	7	25	-	-	-	-	7.9	-	Size can be reduced to eliminate pages	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.
Brazil (Ministry of Science and Technology)	7	26	11	26	11	-	-	-	Concerning Latin America, Brazil, though still featuring a minor wind power installed capacity (606 MW by the end of 2009), is considered a potential wind energy giant: reserves are estimated over 350 GW, according to recent measurements carried out at 80 -100 meters, with additional advantage of having large unpopulated areas and a coastline of 9,650 km. Besides that, the country presents excellent seasonal complementarity between wind energy and hydro power: the dry season (lower water level in hydro power plants reservoirs) registers higher occurrences of wind than during the rainy period. Therefore, higher capacity factors in the wind power plants occur (Ref: GWEC ¿ Global Wind Energy Council - Global Wind Report 2009)	The wind resource of Latin America is described in section 2. This is not the place for those details, but they are provided at some level earlier. Country specific wind resource data are generally not provided due to space constraints. In the figure we present the capacity added to date, not future potential. However, in this section we will note that those regions that have not seen growth to date to have resource potential, and we will then link back to section 2.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	27	2	27	3	-	-	-	Suggest to line 2 and star this paragraph with the sentence: "a number of countries are beginning to ¿.".	Accepted
United States (U.S. Department of State)	7	27	8	-	-	-	-	-	The author should consider changing it to "end of 2009 wind capacity is capable of supplying"...	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	27	10	27	11	-	7.12	-	Is the figure showing annual average wind electricity penetration?	We will add "annual" to the caption and labels accordingly to make this more clear.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	28	27	28	27	-	-	-	Should read: "¿their home market. They are among¿".	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	28	40	28	46	-	-	-	Suggest a reformulation of paragraph to: "In many regions of the workd, wind energy remains more expensive than fossil-ful generation options, at least if nevironmental impacts are not internalized and monetized (NRC, 2010b). Wind energy faces also a number of other barriers, some of which are wind specific. The most critical barriers include:....".	Accepted
United States (U.S. Department of State)	7	28	40	29	5	-	-	-	Suggest a re-write that focuses on wind-specific barriers.	We believe that the barriers listed here are among the most important for wind. While they are not all specific to wind, they do uniquely impact wind relative to some of the other RE technologies. As such, we prefer to retain this text.
Juan Llanes (Centre for Environmental Studies)	7	28	-	-	-	7.4.3	-	-	Is not ¿that¿ relevant for the report, suggest it could be shortened.. Also with 7.4.4, impact of policies.	Industrial development is of great interest to policymakers, so this section fullfills the needs of some of the audiences of the IPCC report.
Jos Beurskens (ECN Wind Energy)	7	28	-	-	-	7.4.3	-	-	Missing: with the growing size of wind energy projects also the financial risks increase and become unmanageable for smaller companies. Only large multi nationally operating companies are able to handle the risks.	We will add some text on larger projects as one of the motivators for larger companies and consortiums, but we believe that the overall comment here is not entirely accurate.
Christoph von Stechow (IPCC WGIII TSU)	7	29	6	29	22	-	-	-	Although there is a whole section on technology learning in the chapter, this is not mentioned as a potential motivation for promotion instruments - despite a broad literature coverage of the topic. Please consider including some exemplary references.	We will add some broad text on this matter, as well as R&D
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	29	23	29	25	-	-	-	I know chapter 11 is supposed to be the one with information about renewables policies but some including some sources of papers on the discussion of different policy approaches here would be appreciated for a quick overview	Content must be included in chapter 11, as we were only alloted 1 page to cover policy issues as per IPCC agreements. We will review the literature and try to add a few strategic citations. We will look for Karnoe, Morthorst, Langniss, ReExpansion, other authors.
United States (U.S. Department of State)	7	29	34	-	-	-	-	-	The author should consider the following structure: "Successful frameworks for deployments should consider the following elements:" OR provide peer reviewed citation.	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Glória Rodrigues (European Wind Energy Association (EWEA))	7	29	3	29	3	7.4.4	-	-	The concept of "relative immaturity" is too vague. I suggest rephrasing it and/or replacing it by another more concrete expression.	Accepted
Michael Power (University College Dublin)	7	30	40	-	-	-	-	-	"Secondly" rather than "second"?	We will let a technical editor determine what the appropriate phraseology is.
Australia (0)	7	30	13	30	13	-	-	-	Change to " how to efficiently provide transmission capacity¿.." The connection of wind should not be undertaken at all cost, rather it should be economically determined.	Indeed adequate transmission capacity should be based on economic efficiency not on connection at any cost. The section text should also mention the tradeoffs between transmission cost and resource quality.
Australia (0)	7	30	8	30	8	-	-	-	Change to "institutional constraints may need to be overcome". A major review of Australia's national energy markets recently found that existing frameworks were capable of addressing challenges associated with the introduction of climate change policies	See response to comment in row 397
Paul Smith (University College, Dublin)	7	30	7	-	-	-	-	-	Citation required	See comments 398/399 above for clarification that we will provide. We will not add a citation here, because the introductory text simply summarizes the text and information provided in the body of the section, but with the revisions that we suggest above, this comment will be accomodated.
Michael Power (University College Dublin)	7	30	30	-	33	-	-	-	I understand this sentence but again it needs to be improved.	See comemnt row 94. This sentence appears to be confusing to multiple reviewers
Australia (0)	7	30	19	30	19	-	-	-	Insert "network management strategies that permit wind output curtailment and limits on wind ramp rates". It is important to include wind generation curtailment as a network management option.	Wind curtailment is a commonly proposed measure to mangae higher levels of wind penetration. It should be mentioned in the context of other options to increase penetration levels.
Lennart Söder (KTH, Royal Institute of Technology)	7	30	7	-	-	-	-	-	It is stated "(under 20% of total electricity demand)". Comment: I think "under" should be replaced with "up to" which is the definition used in page38. I also think that the text shold be changed to "(up to 20% of total electricity energy demand)" in order to clarify	This is a reasonable suggestion that does not substantially change the meaning of the sentence.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	30	14	-	-	-	-	-	Line 14: grid codes should be explained in a note on this page	Need to define grid codes before we use it.
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	30	16	-	-	-	-	-	Line 16: The chapter does not shed much light on the aspect of high wind energy electricity penetration?	the objective of this section is only to cover near-term, low to medium levels of penetration, not to cover higher penetration levels. We do however need to make sure that higher penetration levels are covered in Chapter 8.
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	30	3	-	-	-	-	-	Line 3: I do not quite understand this phrasing	Accepted
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	30	7	-	-	-	-	-	Line 7: I miss some arguments and references for choosing 20% when countries like Denmark goes for 50%. Is there a general discussion of how much wind power could be introduced in the global energy system and arguments for the 20% elsewhere in the chapter? Likewise I hope there is a discussion of onshore/offshore resources and industrialized countries/developing countries? Otherwise, see eg. "Realisable Scenarios for a Future Electricity Supply based 100% on Renewable Energies" Gregor Czisch, Institute for Electrical Engineering ¿ Efficient Energy Conversion University of Kassel, Germany and Gregor Giebel, Risø National Laboratory for Sustainable Energy, Technical University of Denmark. in Energy Solutions for Sustainable Development. Proceedings. Risø International Energy Conference 2007. Edited by Leif Sønderberg Petersen and Hans Larsen. Risø-R-1608(EN).	The choice of 20% as a representation of the 'near term' is not based on a specific break point or barrier, but is more to enable a separation of the discussion of impacts and solutions that have been evaluated for lower penetration levels vs. impacts and solutions observed at higher penetration levels; by agreement, higher penetration levels were to be covered by Chapter 8. We can seek to clarify that the focus on low to medium penetration levels (up to 20%) is not meant to imply a clear boundary, and that it was selected in part because operation experience and, of less importance, much (though not all) of the literature is focused on penetration levels of ~20%, or less; we will make that rationale more clear in the text. In the sentence here, we will also note that the 20% is an annual average, not instantaneous.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	30	6	30	9	-	-	-	Please cite some literature that makes this claim (i.e. that the only constraints are insitutional).	This sentence does not exactly state that the only constraints are institutional - it says that wind integration is technically and economically manageable but that institutional constraints will need to be overcome. The section includes many references and more discussion to support this statment - in particular Section 7.5.5 includes: "Regardless of the challenges to executing such studies, a number of significant wind energy integration studies in Europe and the U.S. have concluded that accommodating wind electricity penetrations of up to (and in a limited number of cases, exceeding) 20% is technically feasible, but not without challenges (Gross et al., 2007; Smith et al., 2007; Holttinen et al., 2009; Milligan et al., 2009). " Institutional challenges are also discussed with respect to transmission. As such, we need not bring these citation up to this summary in the intro to section 5. However, perhaps the issue here is that the challenges are not JUST institutional, but also technical. This is a good point, and we change "institutional constraints" to simply "technical and/or institutional challenges".
Michael Power (University College Dublin)	7	30	4	-	-	-	-	-	Should the reference include "e.g."?	This is an example of a reference that shows the increased concern about wind integration. The e.g. is therefore appropriate.
Michael Power (University College Dublin)	7	30	7	-	-	-	-	-	Should there be a citation for the 20% level? Would a better wording for this be "20% of electrical energy demand"?	See comments 398/399 above for clarification that we will provide. We will not add a citation here, because the introductory text simply summarizes the text and information provided in the body of the section, but with the revisions that we suggest above, this comment will be accomodated.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
David Clubb (European Environment Agency)	7	30	-	-	-	-	-	-	Suggested addition: It's probably worth mentioning, for context, that there were 2 occasions in 2009 when wind power supplied more than 50% of Spain's electricity (see, for example, http://greenmonk.net/spain-gets-53-of-its-energy-from-wind/)	We adequatly cover examples of high instantaneous penetration levels in Section 7.5.4.2
Michael Power (University College Dublin)	7	30	34	-	37	-	-	-	The wording in this paragraph needs to be improved. It should flow from the end of the previous paragraph.	Accepted
Michael Power (University College Dublin)	7	30	42	-	-	-	-	-	There are no citations to support the claim that rate of change of wind power is the most relevant characteristic.	Commenter is correct that we do not support the separation of planning and operations based on any referecnes. We should remove the language that says that the "most relevant characteristic" and instead rephrase it as an important characteristic (not necessarilly the "only" or "most reveleant").
Lennart Söder (KTH, Royal Institute of Technology)	7	30	34	30	37	-	-	-	There are three important component: A)Wind B)load C)Balancing resourses. All these three components have to be interconnected. A and B are mentioned but also C could be mentioned here since efficient balancing can require extra transmission (it is mentioned later)	We should ensure that balancing resources are adequately desctribed in 7.5.4 or 7.5.3. This comment, however, should be rejected here since it suggests that we should describe balancing reserves in a section about the charactersitics of wind resources. However, we do need to add text (but not in this section) indicating that increased interconnections can help not just link wind to load, but also help with balancing. This also reflects other comments received.
David Clubb (European Environment Agency)	7	30	14	30	21	-	-	-	These advanced measures are not necessary; see the example above	We say that higher levels of penetration "may depend" on these advanced measures, but do not state that they are necessary or at what exact penetration level. The current wording should be adequate, but to clarify we will instead write "may depend on or benefit from". We will alter the text in the remainder of the chaper to refelct this change as well.
Paul Smith (University College, Dublin)	7	30	15	30	21	-	-	-	This is a very long sentence. The major source of flexibility - flexible generation resources - are not mentioned	See comment 405 above. Adding more flexible conventional generation is also something that should be acknowledged.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Australia (0)	7	30	34	30	37	-	-	-	This section needs to redrafted to recognise the trade-off between the financial costs of transmission investment and the financial benefits of a better quality wind resource as per above. Suggest from line 35 " The network costs associated with connecting a more remote but high-quality wind resource need to be considered against connecting a lower quality wind resource located closer to the network and electricity demand centres".	We do not adequately describe the tradeoff between transmission cost and resource quality in section 7.5.2 or in 7.5.5. This sentence should be included either here or in Section 7.5.5.
Michael Power (University College Dublin)	7	30	26	-	28	-	-	-	This sentence could be re-written. I think "Better quantify" is unsuitable.	Accepted
Michael Power (University College Dublin)	7	30	15	-	21	-	-	-	This sentence is very long, I think the last piece after the semi-colon starting with "the deployment" could be removed.	The sentence is long, but removing the portion after the semicolon: "the deployment of a diversity of RE technologies may also help facilitate overall electric system integration" leaves only the addtion of more technologies as options to deal with penetration levels over 20%. It seems it would be better to rewite the sentence to be more clear without dropping the reference to diversity. We may try to break the sentence into pieces.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Paul Leahy (University College Cork)	7	30	-	39	-	7.5	-	-	The focus of section 7.5 is on near-term grid integration of up to 20% wind generation and measures to facilitate this. However considerable discussion is made of longer-term integration and greater penetrations in a later section (7.9). There is no detail on the technical measures (briefly mentioned in 7.5.1, e.g. electric vehicles, storage, demand side management) which are stated to assist greater wind penetration. In reality, some of these options, particularly demand side management and storage are now available and are being used in power systems, and have significant potential to assist wind integration in the near term, especially in power systems which already have high penetrations of wind.	The reader is referred to chapter 8 for discussion of measures to help with greater levels of wind penetration, as well more fundamentally to technologies for managing integration that are not unique to wind but would also assist other renewables. In addition this section does already meniton that "... in addition to flexible fossil units, hydropower stations, electrical storage, and various forms of demand response can also be used to facilitate the integration of wind energy." No additional text is warrented for chapter 7 because this is a wind-specific chapter, but this should be adequately covered in chapter 8 as that is the location to discuss these integration technology options. We will review the text to ensure that: (1) it is clear to the reader that some of these integration technologies (storage, demand response, etc) are covered in chapter 8, (2) that these technologies/options are covered in Chapter 8 because they are not unique to wind; and (3) that we focus on nearer-term / lower penetrations in chapter 7 in part because higher penetrations will increasingly require incorporating some of the technology options that are not appropriately covered in chapter 7. Footnote 31 also addresses some of these issues.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
China (China Meteorological Administration)	7	30	6	30	9	7.5.1	-	-	Add "in Europe and U.S.". The reason is that the conclusions about grid integration issues are summarized based on wind energy integration studies in Europe and U.S., but not considered the differences of resource condition, such as distances between wind power base and load center, peak load regulation capability due to electric power plant structure in different countries.	Commenter is correct that integration issues at low to medium penetration levels has not been evaluated to the same degree for countires like China with a large fraction of coal plants and a lack of economic dispatch practices. Section 7.5.5 does include studies of transmission between wind rich regions and loads in China. We will seek to make it more clear in the text that the operational integration studies and experience with higher penetration are very much focused on the US and EU at present.
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	7	30	18	30	19	7.5.1	-	-	and deployment of large scale energy storage	This comment would be redundant with the existing text: "..., increased deployment of other storage technologies…"
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	7	30	6	30	9	7.5.1	-	-	The shown limit (20%) is lower in weak electrical grids	There is no reference to a "limit" this is instead a reference to the scope of the information addressed in this section. The section 7.5 does include a discussion of the need to build additional transmission infrastruture (i.e. strengthen weak grids). We will look to alter the text of this sentence to a degree, however, by linking it more clearly to the previous sentence on integration issues being very system specific.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Juan Llanes (Centre for Environmental Studies)	7	30	29	-	30	7.5.2	-	-	Hard to believe that ¿integrating wind energy into electric systems relies on the same basic planning and operating tools¿ when compared with energy systems based mainly on fossil fuels due to variability and uncertainty of wind energy (same page, rows 12 and 13), page 31, rows 5 and 6, ¿wind power output has lower levels of predictability¿. Also ¿severe changes in electric system voltage¿ , page 33, row 2. Also 7.5.4, page 34 ¿The unique characteristics of wind energy, and especially power output variability and uncertainty, also hold important implications for electric system operations¿. Also page 35 rows 12/14 ¿¿the fact that increased wind energy deployment will require conventional generating units to operate in a more flexible manner than required without wind¿. Further page 40, rows 22,23 ¿the presence of wind energy will influence what types of power plants are built in the future; specifically, increased wind energy will tend to favour peaking plants over baseload units	The statement in 7.5.2 that "Integrating wind energy into electric systems relies on the same basic planning and operating tools that are used to ensure the reliable operation of electric systems without wind energy" is meant to imply that tools like loss of load probability analysis, forecasting, accounting for diversity, grid models, and grid codes are all tools that are used irrespective of whether or not a system has wind energy. The commenter does raise a good point that this sentence may be confusing in the context of highlighting what is different about variable genertaion relative to conventional power plants from a technical perspective. Bottom line: while the tools are the same or are very similar, what they tell us about how to reliably integrate wind IS different. We will alter the text to clarify these points.
Antoine BONDUELLE (E&E Consultant)	7	30	30	32	7	-	7.13	-	The example of aggregation in the production of turbines, given in figure 7.13 and in the text is rather extreme, because it includes times of no production at all in the whole country of Germany. In other cases such as France, this ""no production at all"" seldom occurs (e.g. RTE 2010). Thus there should be mention in the text that the example is ""conservative"" or ""extreme""... Mentioning the ""system specific"" characteristic is not enough.	This figure and the discussion in the text shows the smoothing benfit of geographic diversity, but does not discuss how often wind power output is high or low - only that it gets smoother. It doesn't make sense to add additional text explaining how often lulls occur in Germany or other countries, as this is an important but unrelated point to the one being made here.
United States (U.S. Department of State)	7	31	18	-	-	-	-	-	Author may consider inserting: insert a new sentences after "et al, 2010)." "By planning alignment of wind facilities along meteorological patterns, considerably more smoothing can be achieved than by long distances alone (Kempton et al, 2010)." Reference is: Willett Kempton, Felipe M. Pimenta, Dana E. Veron, and Brian A. Colle, 2010, Electric power from offshore wind via synoptic-scale interconnection. Proceedings of the National Academy of Sciences 107 (16): 7240-7245. (April 20, 2010) doi: 10.1073/pnas.0909075107	The Kempton paper does not appear to provide evidence that considerably more smoothing can be achieved by aligning wind facilities along meteorological patterns than by long distances alone. Though to a degree this is certainly true, it is already referenced in terms of "regional characteristics of weather patterns."

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Australia (0)	7	31	10	31	10	-	-	-	change to "which, depending on the electricity system, may have implications¿.."	Good point - it does depend on the electrcity system. A system with perfectly flexible units does not need to use multiple hour forecasts, whereas units that take a day to start up or shut down require very good long term forecasts.
Morgan Bazilian (UNIDO)	7	31	19	-	-	-	-	-	Figure 7.13 should have an a, b, and c associated with it and each described. Otherwise this statement is hard to follow.	Accepted
Michael Power (University College Dublin)	7	31	19	32	2	-	-	-	I don't understand this statement.	The fact that the aggregate output is relatively smoother than the individual turbines needs to be in this section, but it could be better described
Lennart Söder (KTH, Royal Institute of Technology)	7	31	10	-	-	-	-	-	It is stated "...which has implications for the ability of electric systems to manage wind¿", which I think should be modified to "...which has implications for the ability of electric systems and related trading markets to manage wind¿"	Accepted
Lennart Söder (KTH, Royal Institute of Technology)	7	31	16	-	-	-	-	-	It is stated: "...further apart are less correlated, and variability over shorter time periods (minutes) is less correlated¿". I think the word "correlated" perhpas could be defined better. There is the correlation between two time series but also between successive wind speeds (the correlation between wind at time t and wind at time t+delta_t). Since you here mention both distance and time, I think the sentence could be improved	Lennart has interpreted this sentence to be distinguising between the correlation between wind farms and autocorrelation of wind output with its own previous output. We always mean the correlation between different wind plants and do not mean the autocorrelation. This sentence can be clarified, but not in the way that he suggests.
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	31	3	-	-	-	-	-	Line 3: This note from chapter 8 (3) should be placed here instead: The capacity value (also known as capacity credit) of variable RE generation in a power system is equal to the amount of conventional generation capacity that can be replaced by this capacity without diminishing the security of supply level.	Some additional defintion will be offered, though not this exact one, and it will be placed under 7.5.3.4

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Paul Smith (University College, Dublin)	7	31	12	32	7	-	-	-	The point about correlation reducing with georgraphical spread is laboured in this paragraph. While this conclusion may be true in places like Denmark, Germany, Ireland etc. it is not universally true. There are places where topography means that outputs of separated wind farms are highly correlated (e.g. Southern Alberta)	We disagree - there may by differences in how far you have to go before wind variability is uncorrelated, but there is no place where you expect perfect correlation no matter how the wind plants are sited. Our statement that "This correlation, in turn, depends on the geographic deployment of wind power plants and the regional characteristics of weather patterns, and especially wind speeds..." is sufficient to indicate that there will be regional differences
Michael Power (University College Dublin)	7	31	15	-	-	-	-	-	There is no need for "and" after "patterns,".	Accepted
Sweden (Swedish Environmental Protection Agency)	7	31	9	11	-	-	-	-	ut out line 8-11 sentance "Despite those improvements¿¿". Such details are anyway treated in chapter 7.5.4.1	No reason to say "despite those improvements" - there is no reason why you'd expect improvements in forecasting to make longer horizon forecasts more accurate than shorter horizon forecasts. As such, some of the text will be eliminated, but the basic content will be retained here
Miriam Ester Limia (of Meteorology)	7	31	-	-	-	-	7.13	-	Size can be reduced to eliminate pages	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.
Michael Power (University College Dublin)	7	32	39	32	40	-	-	-	"implemented minimum interconnection requirements (sometimes called "grid codes") that.." could be re-written as "defined minimum connection standards in their grid codes which wind turbines..."	We need to define grid codes - in the current sentence we define grid codes as minimum connection standards. We lose this as a place to define grid codes if we accept this revision. We will reduce "minimum" from the text.
Michael Power (University College Dublin)	7	32	27	-	-	-	-	-	"non-standard" could be expanded. It's quite vague.	Could be changed to: wind turbines have electrical characteristics that differ from conventional synchronous generators
Michael Power (University College Dublin)	7	32	13	-	-	-	-	-	"operating" rather than "operation"	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Sweden (Swedish Environmental Protection Agency)	7	32	2	32	7	-	-	-	Cut out lines 2-7 sentnaces beginning " Since correlation ¿". Same info is in line 15-19 page 31	Disagree- The info on lines 15-19 talks about correlation, while the lines 2-7 talk about the smoothing implications of less than perfect correlation. The commenter assumes that the reader will know that less than perfect correlation implies smoothing
Paul Smith (University College, Dublin)	7	32	9	32	10	-	-	-	I find this confusing. It needs to be made clearer that future reliable real time operation requires long-term planning decisions now to ensure that all the required infrastructure and facilities are in place. This is nothing new.	This sentence should be clear in the point that "future reliable real time operation requires long-term planning decisions now to ensure that all the required infrastructure and facilities are in place."
Michael Power (University College Dublin)	7	32	32	-	-	-	-	-	I think this is incorrect use of the term "power quality" which has specific meaning in power system engineering and has specific standards. Should the title be "Reliability and Grid Codes"?	We will change the sub-heading: "wind power electrical characteristics and grid codes"
Michael Power (University College Dublin)	7	32	35	32	36	-	-	-	I think this should be "grid connection" rather than "grid interconnection". Interconnection implies connections between different networks. This was also the case in line 15 on page 32.	This is a difference in terminology between countries - we will stick to "connection" throughout to refer to the electrcial connection of a wind plant to the power system. We need to standardize terminology vis-à-vis interconnection and connection.
Lennart Söder (KTH, Royal Institute of Technology)	7	32	16	-	-	-	-	-	It is stated: "...the transmission infrastructure needs of wind energy¿" I think this should be modified to e.g. "...the transmission infrastructure needs of power systems with wind energy¿". I will discuss this later also. The question is always "who needs the grid?". If, e.g., Germany install a lot of wind power and this makes it profitable to build more transmission lines to Sweden so the hydro power owners can sell their hydro power to Germany. Is this then an "integration cost of German wind power"? or is it a business opportunity for Sweden/Swedish companies?	Accepted
Michael Power (University College Dublin)	7	32	11	-	-	-	-	-	Should this line read "....adequacy of the network to allow connection of generation and the adequacy of ...."	Commenter does not change the meaning of the sentence, but proposed revision may be more clear to an international audience
Lennart Söder (KTH, Royal Institute of Technology)	7	32	1	32	7	-	-	-	Smoothing effect is of couse important, but there is no value in it unless the transmission system is strong enough! It must be possible to send the wind power from the high wind areas to the low wind areas. An extra sentence could clarify this and/or refer to later sections where this is mentioned.	Add reference to the need for transmission/interconnector capacity to provide smoothing from geographic diversity
Paul Smith (University College, Dublin)	7	32	15	-	-	-	-	-	The term interconnection is understood differently in different places. It would be better in this case to use the word "connection".	We need to standardize terminology vis-à-vis interconnection and connection

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Paul Smith (University College, Dublin)	7	32	46	-	-	-	-	-	There are other comparative assessments of Grid Codes available which would be preferable as citations rather than a reference which is not yet published., e.g. Ciupuliga, A., M. Gibescu, et al. (2009) reference in Chapter 8	Accept as long as the reference is as comprehensive as the current reference; we will review reference.
Morgan Bazilian (UNIDO)	7	32	32	-	-	-	-	-	This section is a bit long and not entirely coherent. (i.e. it tries to say everything and ends up being a bit eclectic.	We will review the text to try to make it more clear.
Michael Power (University College Dublin)	7	32	13	32	17	-	-	-	Why are these 4 issues selected? This selection drives a large part of the chapter. Citations?	There was some judgement here of course, so we will simply note that we have selected 4 "technical" planning issues that are prominent, while noting that this is not an exclusive list.
Michael Power (University College Dublin)	7	32	24	-	-	-	-	-	Why mention specific products i.e. PSSE ? Remove commercial references?	Accepted
Sweden (Swedish Environmental Protection Agency)	7	32	37	-	-	-	-	-	Write out the name of the standard.	Accepted
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	7	32	14	32	14	7.5.2	-	-	to be added: and consumer characteristics (e.g. industries, households)	Consumer characteristics are not necessarily relevant to all of the issues considered in this section, e.g., grid codes. They are relevant to reasource adequacy, however, and to issues of net load, both of which are already addressed in this section. We will look to see if we can add a small amount of text in those sections noting their links to the overall demand pattern of the electric system. We have already also noted the possible use of demand management, and that is covered in chapter 8.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Glória Rodrigues (European Wind Energy Association (EWEA))	7	32	17	30	17	7.5.3	-	-	Is "resource adequacy" the right term? Or rather "generation adequacy"?	Resource adequacy is the term used in the US, and is technically accurate since generation resources are not the only resources that can contribute to reliability-transmission capacity, demand response, and storage resources can all contribute to resource adequacy. However, generation adequacy or capacity adequacy is more commonly used in Europe, so we will instead use generation adequacy as the term of art here. We will also standardize on capacity credit. We consider using generation adequacy and transmission capacity together.
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	7	32	-	-	-	7.5.3.1	-	-	An essential part of modeling will be the knowledge about the real grid environment, e.g. Generator models as well as actual protection relay settings. Combining this knowledge with real-time measurement data of voltage, current and power from Phasor Measurement Units (PMU) provides the necessary information to perform a Dynamic Stability Assessment (DSA) of the electricity system. DSA systems are currently developed in industry and will not only provide the operator with information on the actual stabilty status of the system but will also give information about possible future instabilities and countermeasures to prevent them.	This comment is a good point but perhpaps too specific to trends in the field of grid stability analysis and does not deserve special attention in a section on wind integration.
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	7	32	45	32	45	7.5.3.2	-	-	conditioning devices such as FACTS Controllers or energy storing elements (FACTS = Flexible AC Transmission Networks).	Again, a good point but too specific for an overview chapter on wind integration; may be better placed in chapter 8.
Sweden (Swedish Environmental Protection Agency)	7	32	-	-	-	7.5.3.2	-	-	The section can be shortened on several places. Sentance on lines 42-45 page 32 ans sentance on lines 8-10 page 33 can e.g. be cut out.	These sentences help to explain why grid codes include fault-ride through capabilities and how these grid codes can be met by wind generators/manufactures. The sentences should therefore stay in this section.
Australia (0)	7	33	21	33	36	-	-	-	This text needs to be changed to reflect earlier comments regarding the trade-off between network costs and the financial benefits of a high class wind resource.	Accepted
Michael Power (University College Dublin)	7	33	24	-	-	-	-	-	"at a distance" should read "remotely"	at a distance and remotely mean the same thing - either way will convey the right point

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Michael Power (University College Dublin)	7	33	29	33	30	-	-	-	"relative to the relatively" should be re-worded.	Can change to "relative to the shorter time"
Michael Power (University College Dublin)	7	33	4	-	-	-	-	-	"responded to" should read "was in response to"	Accepted
Lennart Söder (KTH, Royal Institute of Technology)	7	33	1	33	20	-	-	-	Concerning dynamics: There is a possibility for wind power plants with converters to damp oscillations in power systems, since one have the possibility to oscillate the power output in a controlled way and internally store the energy as kinetic energy (change speed). This is descrebed in the paper (available in IEEE Explore) : Elkington, K. Ghandhari, M. Soder, L. Sch. of Electr. Eng., R. Inst. of Technol., Stockholm, This paper appears in: Power Engineering Conference, 2008. AUPEC '08. Australasian Universities Issue Date : 14-17 Dec. 2008, On page(s): 1 - 6 Location: Sydney, NSW Print ISBN: 978-0-7334-2715-2 INSPEC Accession Number: 10561067 Date of Current Version : 10 April 2009	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.
Paul Smith (University College, Dublin)	7	33	8	-	-	-	-	-	Electric system planners is the wrong term. System operators, transmission providers, grid operators might be better terms.	Electric system planners (or organizations who plan electric systems) is a generic term that refers to planners at any organization that operates or builds infrastructure for the power system; we will clarify the use of this term in the glossary or in a footnote.
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	33	14	-	-	-	-	-	Line 14: Reactive power control should be explained in a note on this page	Accepted
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	33	19	-	-	-	-	-	Line 19: ramping and ramp-rate should be explained in a note on this page	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	33	22	-	-	-	-	-	Line 22: But still under 20 % ??	Should indicate that large quantities still refers to low to medium levels of wind penetration (as long as it is worth the transmission cost to access the higher quality wind resources), and also make this point somewhat less stridently.
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	33	32	-	-	-	-	-	Line 32: That is: More than 20 % ??	We currently say "Enabling high penetrations of wind electricity may therefore require proactive rather than reactive transmission planning " we can instead say "Enabling increased penetrations of wind electricity may therefore require proactive rather than reactive transmission planning " Or "Enabling medium penetrations of wind electricity..."
Sweden (Swedish Environmental Protection Agency)	7	33	32	36	-	-	-	-	The sentances on need for proactive planning should be included in the summary. Its a very important conclusion/statement.	Accepted
Australia (0)	7	33	3	33	3	-	-	-	The use of the word 'imposition' is loaded. Change to "the requirement for fault ride-through capabilities¿."	Accepted
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	7	33	28	33	29	7.5.3.3	-	-	add the grid connection to the value chain;	This section does not discuss any value chains. This comment is not clear.
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	7	33	32	33	33	7.5.3.3	-	-	Enabling high penetrations of wind electricity requires also proactive creation of the framework conditions	The commenter appears to be suggesting that the proactive steps to enable transmission expansion ahead of renewable development do not need to be limited to proactive transmision planning, but that creating a regulatory/economic framework for transmission to be built ahead of renewables is also a proactive step that can help solve issues surrounding the need for new transmission for remote generation.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	7	33	28	33	29	7.5.3.3	-	-	long time it takes to plan, site, permit, and construct depends on the region and ist legal and regulatory framework;	The legal and regulatory framework are important factors in the time that is taks to add transmission, This additional information should perhaps be added to the start of the next sentence (page 33 line 30-32)
Peter B¿rre Eriksen (Energinet.dk)	7	34	40	-	-	-	-	-	"changes in net demand greater"...? Check if this is right. In fig. 7.14 the read curve is above the blue?	Accepted
Lennart Söder (KTH, Royal Institute of Technology)	7	34	17	34	23	-	-	-	An important issue concerning capacity credit for wind power is the following: If one compare e.g. wind power with coal power then one need around 3 times more capacity in wind power than in coal power to get the same yearly energy. It is very often that one see this type of comparison concerning, e.g., prices of the two sources. If we then compare the capacity credit of these two alternatives, then one should compare the capacity credit of two alternatives with the same energy production (the same installed capacity credit), since it is the cost per kWh that is compared. If one make this comparison, which I think is correct, then the capacity credit for wind power is not so much lower. See, e.g., (available from IEEE explore) : "A review of different methodologies used for calculation of wind power capacity credit" Soder, L.; Amelin, M.; Power and Energy Society General Meeting - Conversion and Delivery of Electrical Energy in the 21st Century, 2008 IEEE Digital Object Identifier: 10.1109/PES.2008.4596666 Publication Year: 2008 , Page(s): 1 - 5	Capacity credit is a stand-alone number (i.e. it is irrelevant how much energy you get out of the generator), it is only important to be careful about using an energy-equivalent comparator plant when determining the relative economic value of the contribution toward capacity. This cost/difference in value is described in section 7.5.5. Perhaps it can be more clear in that section how the relative contribution toward capacity is translated into economic terms, and we will review the provided citation for possible inclusion.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	34	33	-	-	-	-	-	footnote 9: the sentence before the brackets explains what net demand is, why include an additional footnote saying the same?	This footnote is redundant - it can be removed without loss of clarity
Michael Power (University College Dublin)	7	34	22	-	-	-	-	-	Is "will therefore" too strong? It's a significant conclusion and will impact on power plant builders.	Can change to "will tend to increasingly shift towards “peaking” resources and away from “baseload” resources "
Michael Power (University College Dublin)	7	34	39	-	-	-	-	-	It should be emphasised that 40% penetration occurred in Ireland at low system demand and high wind production.	This refers to projections of average penetration levels to 40% (not instantaneous penetration levels). The commenters suggestion should be rejected, but the text can be clarified

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Paul Smith (University College, Dublin)	7	34	22	34	23	-	-	-	Many wind advocates believe that this is what should happen, but in a competitive market new highly-efficient base load plant may well be more attractive to developers and financiers as the new plant will be competitive and will displace older plant intended for base load operation. At best it can be said that the mix of conventional generation "may" shift towards low load-factor resources.	See comment in row 459 above
Richard Piwko (General Electric Company)	7	34	10	-	-	-	-	-	text says that pricing signals influence decisions about new generation that is built. Annual operating costs of existing plants will have a big impact on which existing plants might retire.	Can modify sentence to say that the relationship between prices and costs will influence which types of generation is built or retired
Paul Smith (University College, Dublin)	7	34	34	35	4	-	-	-	There is also work from various US integration studies that could be cited in this context.	U.S. references that show net load duration curve and ramp duration curves will be cited
Morgan Bazilian (UNIDO)	7	34	4	-	-	-	-	-	This capacity credit discussion is not great. It assumes a certain methodology, and does not offer insights into different ways of conceptualising the issue.	This comment should be rejected since the current discussion does not refer to any specific methodology for evaluating the contribution of wind to the load carrying capability of the system. There may however need to be clarification in the paragraph to better explain the contribtuon of wind to resource adequacy, and we will add a figure that presents various study results. We will add another paper / citation as well, recently accepted, that addresses methodological issues. We will also add another sentence that tries to more clearly indicate what the capacity credit represents.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Glória Rodrigues (European Wind Energy Association (EWEA))	7	34	11	34	12	7.5.3.4	-	-	It is not clear from this sentence why there is less capacity credit with increased deployment of wind energy.	This sentence needs to be slightly expanded to make it clear. Suggest something such as: "A second important characteristic of the capacity credit for wind energy is that its value decreases as wind electricity penetration levels rise. The capacity credit depends on the wind generation during the times of the greatest electric system risk. If wind power ouput at all potential generation sites is well correlated then as the level of wind penetration increases the period of greatest risk will shift to times with low average levels of wind power output (Hasche et al., 2010). Aggregating wind power plants over larger areas reduces the correlation between wind power outputs, as described earlier, and can therefore slow the decline in capacity credit as wind electricity penetration increases, though adequate transmission capacity is required to aggregate wind power plants over larger areas (Tradewind, 2009; EnerNex Corp, 2010)"
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	7	34	30	34	30	7.5.4.1	-	-	The operating cost vary depending on location (e.g. onshore/ offshore)	The main point is that the marginal cost (not necessarily the operating cost which may include fixed costs too) is much lower than fossil fuel plants. It is not important to distinguish between on-shore and off-shore operating costs (which may include both variable and fixed operating costs) for this sentence, though rather than saying near-zero we will instead write "very low"
Sweden (Swedish Environmental Protection Agency)	7	34	-	-	-	7.5.4.1	-	-	The two parathesises with percentage numbers (7,5 % and 40%) are best left out. The text refers to a gradual change with examples for 7,5 and 40% frpm figure 7.14. The text is better withot the twp parathesises	The penetration levels clarify what is being represented by the demand vs. net demand cases, so will be left in the figure caption. We will remove the data from the body of the text, however, as it is true that this detail is already provided in the figure.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Richard Piwko (General Electric Company)	7	34	-	35	-	-	7.14 d	-	Figure 7.14d seems to be incorrect. The text has then correct trend explained, but the figure contradicts the text.	Commenter is correct - the net demand should have the higher ramp duration curve, but the figure currenly shows that the net demand has smaller ramps than the demand
Morgan Bazilian (UNIDO)	7	35	7	-	-	-	-	-	I like the conclusion about prices, but I think it is very related to the type of market and market rules. It also probably requires some other references as it is a very strong point.	If space is available, this discussion should be expanded somewhat, though this point is very nuanced and debatable, and we do not want to place undue emphasis on an issue that is not specific to wind.
Australia (0)	7	35	11	35	11	-	-	-	It should also be noted that, depending on market structures, that the increases in wholesale electricity price volatility will also increase the overall cost of electricity as retailers will most likely have to hedge against the increased exposure and this will come at a cost.	We will note that price volatility will tend to increase, however, we are not aware of any literature that "proves" that such volatility will increase hedging costs, so that element of the comment will be ignored unless we identify appropriate citations.
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	35	13	-	-	-	-	-	Line 13: you could add that storage facilities need to be introduced	There is a wide literature that shows that conventional plants are operated in a more flexibile manner with the addition of wind, but there is not a corresponding body that supports the claim that you "need" storage when you add wind. This comment should therefore be rejected.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	35	22	35	22	-	-	-	Should read: "¿.geographically dispered wind power plants, additional¿.".	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Lennart Söder (KTH, Royal Institute of Technology)	7	35	5	35	16	-	-	-	There is a disssion in these two sections concerning "...Increased wind electricity penetrations will therefore tend to reduce average wholesale prices¿". It is correct that this is the result of many integration studies. The reason is that one start with a certain system and then one just add wind power to this system. Since wind power has nearly zero marginal cost then wind power will replace other sources and since one assue that the power price is set by system marginal cost then automtically the price will decrease. But exactly the same thing will happen if we in a certain system add nuclear power, solar power, CHP, i.e. sources with operating costs that are lower than the prices on the market. On the other hand: subsidizing wind power using certificates, fixed prices etc willin reality lower the prices since these sources would not have come in if we did not have these sponsoring systems. In any system the investors invest if the expected prices in combination with the risks are high enough to motivate the investment cost. This principle idea is valid for any power plant. My conclusion is that the connection between wind power investments and the impact on prices is rather complicated, and the text in this section should be modified. Concerning the impact from the way a simulation is performed, c.f. "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	We could revise the sentence that says:" Increased wind electricity penetrations will therefore tend to reduce average wholesale prices in the short-term, though in the long-run the average effect of wind energy on wholesale prices is not as clear as pricing signals begin to influence decisions about the type of new generation that is built " to "As with adding any low marginal cost resource to a power system, Increased wind electricity penetration will tend to reduce average wholesale prices in the short-term since the wind energy will displace a power souce with a higher marginal cost. In the long-run, however, the average effect of wind energy on wholesale prices is not as clear as pricing signals begin to influence decisions about the type of new generation that is built". We will also review the possible new citation.
Paul Leahy (University College Cork)	7	35	8	35	9	7.5.4.1	-	-	Increased wind electricity penetrations will therefore tend to reduce average wholesale prices in the short-term"". This statement may be hard to justify. A definition of what is short-term and what is long-term would help clarify. New peaking plant can often be constructed very quickly in response to pricing signals. Another aspect of increased wind generation is that uncompetitive generators may drop out of the system. Prices may become more variable and price spikes may occur as a result of increased wind, but it is hard to determine what will happen to the average price, as it will be sensitive to demand net of wind and available non-wind generation capacity.	Short-term in this context means before fixed capital investments are changed (and only variable production costs change). To clarify, this should be revised to say "Increased wind electricity penetrations will therefore tend to reduce average wholesale prices in the short-term (before changes are made to the mix of conventional generation), though in the long-run the average effect of wind energy on wholesale prices is not as clear as pricing signals begin to influence decisions about the type of new generation that is built (Lamont, 2008; Sensfuß et al., 2008; Sáenz de Miera et al., 2008; MacCormack et al., 2010). "

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	7	35	-	-	-	-	7.14	-	You need more explanation what ramp duration curve means as it is not popular terminonlogy.	Need to add a sentence explaining what is shown by a ramp duration curve and how to interpret it
Michael Power (University College Dublin)	7	36	48	-	-	-	-	-	"500 MW link" should be " 500 MW HV direct current (DC) link"	Accepted
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	7	36	18	36	19	-	-	-	"Wind power plants ... can provide some flexibility by curtailing output ¿" is to weak. Modern (pitch-regulated, speed-variable) wind energy converters are able to provide downward and upward balancing power if the wind blows. Therefore, extra ballancing requirements in high wind situation could be covered by wind turbines themselves. However, upward balancing is only economical in extreme or emergency cases.	Accepted
Lennart Söder (KTH, Royal Institute of Technology)	7	36	39	-	-	-	-	-	It is stated: "¿ because Denmark is well interconnected to two different synchronous electric systems.". Comment: This is correct but I think the word "synchronous" should be taken away. It seems like this is an important issue as it is written now, but the true value is that is as strong interconnections! There is a risk with the current formulation that one think that there is an extra value of beeing connected to un-synchronous systems. there is a beneficial consequence and that is that Denmark is interconnected with several HVDC-links that are comparatively easy to control, but then the controllability should be mentioned instead.	Accepted
Paul Smith (University College, Dublin)	7	36	48	-	-	-	-	-	Need to state that the link is DC	Accepted
United States (U.S. Department of State)	7	36	33	-	-	-	-	-	Please place source.	Penetration of 20% is shown earlier in the chapter, with source provided at that time
Paul Smith (University College, Dublin)	7	36	34	-	-	-	-	-	Reference to "system" here is confusing as Denmark encompasses two separate power systems. "Country" would be a better term, if appropriate.	Need to be more clear about who operates which portion of the power grid in Denmark.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	36	47	36	47	-	-	-	Should read: "..a single synchronous system; it's size is similar to the Danish system..".	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	36	43	36	44	-	-	-	Should read: "Balancing the Danish system is much more difficult during periods when one of the interconnections is down. More flexibility will be required if Denmark¿".	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
David Clubb (European Environment Agency)	7	36	19	36	23	-	-	-	Suggested additional reference: The curtailing of output from wind in Denmark is what is happening now that negative spot prices have been allowed (see http://archer-energy.com/index.php?option=com_content&view=article&id=69:danish-wind-farm-owners-face-negative-electricity-prices&catid=1:latest-news&Itemid=50 for example) (this backs up your comments about needing to reach the right market penetration)	Reference is a 2 paragraph web page article- not sutiable for citation
Morgan Bazilian (UNIDO)	7	36	1	-	-	-	-	-	This may need to be a separate section on markets, etc.	Markets are one way to ensure that fleixbility of conventonal power plants is available to help balance the system, but markets are not the only mechansim. It doesn't make sense to separate markets from the discussion of flexibility.
Australia (0)	7	36	19	36	23	-	-	-	Wind curtailment should be adopted when it is the most efficient option to manage network reliability/security. This may often be the case in network constraint issues. Theoretically, when factoring in the increased costs of wear and tear and 'longer run' opportunity cost of curtailing convention generation, curtailing wind could again be the most efficient option.	The research is not sufficient and the answer so system specific that there is no way of expressing a simple statement in this regard. However, curtailment may be important to manage these issues, and of course should be used when economically optimal to do so. We will add another sentence noting that network constraints and wear and team can impact curtailment, and that curtailment should be used when economically attractive.
Michael Dr. Weinhold (Siemens AG, CTO Energy Sector)	7	36	16	36	17	7.5.4.1	-	-	different energy storage technologies (e.g. H2, CAES, Redox flow¿) to be added/mentioned as valuable options besides electrical storage such as electrochemical batteries or supercaps.	We prefer not to mention individual storage technologies, as that is to be addressed in chapter 8. However, we can simply use the term storage devices rather than restricting this to electrical storage. This change will affect other portions of the text as well.
China (China Meteorological Administration)	7	36	48	37	1	7.5.4.2	-	-	Considering the practical experience of the island of Ireland (lowest load about 300 MW, interconnection capacity is limited to a single 500MW link, the installed wind power capacity by the end of 2009 was capable of supplying roughly 11% of Ireland¿s annual electricity demand), it is suggested to provide a supplementary description of the electric power generation structure.	We will add a small amount of information providing examples for what we mean by "has resulted in a very flexible electric system", e.g., large amount of natural gas capacity, etc.

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Peter B¿rre Eriksen (Energinet.dk)	7	37	21	-	-	-	-	-	"30% of the installed..". 1500 MW is NOT 30% of 8500 MW installed wind? Unclear.	Sentence will be revised to "On that day, ERCOT experienced a decline in wind power output of 1,500 MW over a three hour period, roughly 30% of the 5 GW of installed nameplate wind power capacity in February 2008. "
Michael Power (University College Dublin)	7	37	21	-	-	-	-	-	1500 MW drop is 18% not 30% of 8.5 GW	See comment 489
Michael Power (University College Dublin)	7	37	30	-	-	-	-	-	Actual operating experience, as outlined in chapter 7, is very limited. A lot more emphasis is placed on the studies rather than operating experience. I assume this is because we just don't have the experience as yet. It has taken over 50 years for us to learn how to operate conventional power systems proficiently and we still have blackouts. It should be remembered that the number of changes now being proposed to both generators and loads is very significant. A number of significant lessons will have to be learned before we will be able to operate RE based systems proficiently. I think the tone of the document in 7.5.4.2 and 7.5.5 is extremely optimistic, based on such a limited operating history.	A fair balance is struck with the sentence on page 38 line 12: "That said, concerns about (and the costs of) wind energy integration will grow with wind energy deployment and, even at medium penetration levels, integration issues must be actively managed." However, we do need to be clear that operating experience is limited, and that as more experience becomes available understanding of the issues will become more refined. We will review the document and alter text accordingly.
Peter B¿rre Eriksen (Energinet.dk)	7	37	7	-	-	-	-	-	Figure 15 must be changed to Figure 7.15	Accepted
Michael Power (University College Dublin)	7	37	7	-	-	-	-	-	Figure 15 should be Figure 7.15	Accepted
Paul Smith (University College, Dublin)	7	37	7	-	-	-	-	-	Figure 15 should be Figure 7.15	Accepted
Lennart Söder (KTH, Royal Institute of Technology)	7	37	1	37	14	-	-	-	I think it somewhere should be mentioned that new lines are only built if they are economically motivated. With wind power this value can increase since there without the line will be high price differences between the different areas.	This is a valid comment - need to be clear that transmission capacity should be increased if that is the more economically attractive option. However, the better place for this is elsewhere in the chapter, not when discussing the Irish case, but instead talking about the benefits of stronger interconnections from a balancing perspective more broadly..

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	37	15	37	28	-	-	-	Line 15 - 28: This section could be deleted	We prefer to keep this case, as it nicely highlights the importance of forecasting. However, we will be more clear on the non-wind factors that impact the story.
Paul Smith (University College, Dublin)	7	37	8	37	9	-	-	-	The concern is the reduction in system inertia, leading to greater frequency instability.	Clarify this sentence to indicate why the lack of inertial response is a problem
Peter B¿rre Eriksen (Energinet.dk)	7	37	15	37	28	-	-	-	The reader misses a desciption of the consequences. Was this a severe event? A brown out?	Text should be clarified to indicate that this event did lead to the curtailment of load that was participating in the load acting as reserve program.
Sweden (Swedish Environmental Protection Agency)	7	37	13	37	13	-	-	-	The words "reactive power control" maybe could be exchnaged with "voltage control". Voltage is likely to better understood by a generally skiled technical reader than reactive power. Since it is mainly the voltage that aims to be controlled, why not write out voltage control?	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	37	30	37	30	-	-	-	What high-quality studies are being referred to here? Add reference.	Instead of adding a reference to the studies here, this sentence will be clarified to indicate that the entire section describes and cites these studies.
Steve Sawyer (Global Wind Energy Council)	7	37	19	37	28	7.5.4.2	-	-	The reference to the ERCOT event is not appropriate and is an innacurate represention since non-wind generation decreased relative to its schedule including a 150 MW conventional energy unit tripping offline, and load rapidly increased to a level higher and earlier than expectedt. The wind forecasts that were available, but unused, forecast the decline in wind that day, so schedulers could have accomodated the impact.	The commenter describes the "combination of factors" that led to ERCOT implemeting its emergency curtailment plan. The commenter also indicates that this event could have been avoided if the forecasts that were available were used by the system operators. This is the same message as what the paragraph in the current version says. We will, however, provide a bit more information on the "combination of factors" to make it clear that these factors were not all related to wind energy.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Steve Sawyer (Global Wind Energy Council)	7	37	19	37	28	7.5.4.2	-	-	The reference to the ERCOT event is not appropriate and is an innacurate represention since non-wind generation decreased relative to its schedule including a 150 MW conventional energy unit tripping offline, and load rapidly increased to a level higher and earlier than expectedt. The wind forecasts that were available, but unused, forecast the decline in wind that day, so schedulers could have accomodated the impact.	The commenter describes the "combination of factors" that led to ERCOT implemeting its emergency curtailment plan. The commenter also indicates that this event could have been avoided if the forecasts that were available were used by the system operators. This is the same message as what the paragraph in the current version says. We will, however, provide a bit more information on the "combination of factors" to make it clear that these factors were not all related to wind energy.
Lennart Söder (KTH, Royal Institute of Technology)	7	37	-	-	-	7.5.5	-	-	I think that one should have a short discussion in the beginning concerning the challenge of setting up an integration study. If one want to study an integration of, e.g., 20 percent wind power then important issues are, e.g., if we do not build wind power, what do we build? what are the other sources in the system? will we use continous trade or only day ahead? will it be profitable to invest in more flexibility in the rest of the system (Alston are discussing flexible nuclear) etc. More information is available in the article "On methodology for modelling wind power impact on power systems" mentioned above.	The focus of this section is to describe results of integration studies, not to describe in detail how to perform an integration study. We pulled text about the methodologies used in integration studies out of this section after an earlier review by expert reviewers suggested that we were offering too much technical detail. As such, to refelect those earlier comments, we will continue to exclude these details from the text here.
Richard Piwko (General Electric Company)	7	38	7	38	14	-	-	-	Although many past studies have calculated values that were believed to be integration costs, recent analysis have shown many of those calculation methods to be in error. Instead of calculating legitimate costs related to wind power, they included costs related to the time-of-use (spot price) value of the energy, which is greater at peak load than at minimum load. A UWIG meeting in June 2010 addressed this issue and confirmed that many previous integration cost study results were based on erroneously methods.	Integration costs are ill defined and there has not always been a clear separation between time-of-delivery energy value and balancing costs. We can acknowledge these differences in the discussion of methodologies for calculaing operational integration costs more clearly. Just relaying the lessons learned from a June 2010 UWIG workshop, however, is not the same as pointing to peer reviewed literature - we need citations in order to incorporate his comment.
Lennart Söder (KTH, Royal Institute of Technology)	7	38	45	-	-	-	-	-	Footnote starts with "Section 8", but all these figures are found on the next page ??	Footnote should be revised to make it more clear that the purpose of the footnote is to show how we dervied the 30% figure.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Lennart Söder (KTH, Royal Institute of Technology)	7	38	12	-	-	-	-	-	It is stated "not exceed 30%". This expression must be stongly modified. I am aboslutely sure that if it is not modified, then we will see a lot of studies where one just add 30 percent to consider integration costs !!!! I do not say that it is wrong but for abolutely most studies, the cost is significacly lower !!! This must be much clearer in the text. All the costs this level is based on is maximum costs at 20 percent wind energy where all transmission costs are allocated to wind power. If we se, e.g., wind power in Europe, then additional transmission (where wind power can trigger the investment) also has a high value for other power plants. Norway has a large hydro resource and they see a large potential to use this for balancing of Central European wind power. Does that mean that this transmission line is an "integration cost" of wind power. It is correct that it is an efficient solution. Why is the term "integration cost" only used for wind power and never for, e.g., nuclear power or coal power. France is exporting a lot of power and that of course require transmission lines. Is that an "integration cost" of French nuclear power? In the Nordic system Finland is building a new nuclear power station and this means that it is ratinal to have increased transmission to Sweden. Is this then an "integration cost" of nuclear? The answer was NO when I asked. The motivation was that "it is beneficial for the system with more lines in this new situation". This is of course correct, but the same way of thinking should of course be applied to all power sources. We should have exactly the same treatment of wind power, coal power, nuclear etc concerning these sysetm issues. I think this should be commented in the chapter.	This is a valid comment - the transmission expansion costs are not necessarily all attributable to wind, the 30% figure is the high end, and transmission costs need to also be included in the levelized cost of electrcity from other forms of generation. We will also be presenting a cost range now, rather than a maximum.
Lennart Söder (KTH, Royal Institute of Technology)	7	38	9	-	-	-	-	-	It must be clearer that "low to medium" is the same as "up to 20%"	We can reiterate that low to medium referes to the up to 20% penetration figure presented at the start of the section
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	38	15	37	34	-	-	-	Line 15 - 34: Could be deleted	The first paragraph should be largely retained, as it makes a number of points of importance. The second paragraph has text that can be rearranged and altered somewhat. Some of the text in lines 23-27 can be eliminated. Overall, this entire section could be more clearly organized however, and we consider restructuring the overall content of the section to more clearly indicate the main points.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	38	7	-	-	-	-	-	Line 7: references?	This paragraph is based on the aggregation of the information presented between page 38 line 35 and page 39 line 37. Aside from the individual references in those paragraphs, there is not a reference that provides the 30% of levelized cost estimate.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	38	32	38	32	-	-	-	Should read: Ïn addition, integration¿".	Accepted
Australia (0)	7	38	5	38	5	-	-	-	Suggest removing "fossil fuel usage". Other than reduced CO2 (which is noted) it is not clear what the benefits in reducing fossil fuel usage are?	Avoiding fossil fuel usage (and capacity) also reduces the variable costs of generating electriciy (i.e. you don't pay for fossil fuel that isn't burned). This is an important economic benefit of wind energy and needs to be highlighted. Sentence can be revised for clarity.
Australia (0)	7	38	7	38	14	-	-	-	This section is misleading and such a generalisation adds little benefit. The additional network costs of wind will be system dependent and potentially significantly less than 30% of wind generation costs. This is better handled in Ch 8 p5 lin 31-35	We will be revising these figures by representing a range rather than a high cost estimate
Richard Piwko (General Electric Company)	7	38	1	38	2	-	-	-	This statement is incomplete. A major objective of many studies has been to quantify the ability of the electric power grid to operate with high penetrations of wind generation. Issues include ramping capability, regulation, operation at minimum load, and several others.	Change sentence to "...but typically seek to evaluate the capability of the power system and quantify the costs and benefits of operating electic power systems with increased wind energy. "
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	7	38	7	38	9	-	-	-	You must mention that the integration costs are not large only if the penetraion rate is small AND power systems have enough flexibility with hydro and fossil fuel power. The discrition here gives wrong impression to the readers that the integration costs are always small. Long-term scenarios often assume very inflexible power generation systems (with high amount of nuclear and CCS) and/or high penetration of intermittent renewable in addition to wind. You have to explicitly acknowledge that you do not tknow the costs of integration in this case.	We need to make clear that integration concerns and costs are system specific. This is already mentioned, but will be re-emphasized in this section. Also, the integration studfies largely cover the US and EU, and this also will be made more clear. The issues of high penetration studies will not be addressed directly here because they cover longer-term issues, and our mandate was to cover nearer term integration issues.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
China (China Meteorological Administration)	7	38	9	38	12	7.5.5	-	-	Add "in Europe and U.S.". The reason is same as in No.10 comment.	Commenter is correct that integration issues at low to medium penetration levels has not been evaluated to the same degree for countires like China with a large fraction of coal plants and a lack of economic dispatch practices.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	38	32	38	32	7.5.5	-	-	Please correct "in additional".	Accepted
Sweden (Swedish Environmental Protection Agency)	7	38	-	-	-	7.5.5	-	-	The figure 30% on line 12 on page 38 seems to rather high compared to estimates in the IEA task 25 study (Holttinen et.al. 2009). The text and figure 57 on page 172 of the IEA task 25 report gives a range og costs from 1,4-5.6 $/MWh as noted on page 39 line 5 in SSREN_Draft 2. This cost refers to the increase in balancing and operation cost and should also include some of the cost for ensuring adequacy (I think so, or even most of the cost?). Is not the balancing cost to a large extent the system operatots cost for the winds less adequacy? The total cost in footnote 21 of 5+10 $/MWh seems high in comparison to the compilations of the IEA task 25 study. I think that adequacy costs should be better explained in chapter 7.5.5 The cost of adding new transmission in footnote 21 i also rather high. In footnote 21 the highest values of cost for variability, adeqacy and transmission are just added and the combined result is therefore a real maximum estiamte which at least should be noted. When discussing the cost for added transmission for wind energy it should be added a discussion of the cost added transmission for other energy production sources (e.g. nuclear, coal, natural gas or other fuel based production or other renewables). The cost for added transmission for wind energy is not the same as the added transmission cost compared to transmission cost for some "base load production".	The figure in the IEA Task 25 is the additional cost of balancing reserves, but does not include the relatively lower value of a resource with low capacity credit relative to a baseload comparator plant. It is therefore reasonable to add these costs together. The commentor is correct in that the adequacy cost can be better explained and the cost of transmission for wind should be compared to the cost of transmission for whatever technology would be used instead of wind; we will add these clarifications. Instead of presenting maximum values, we will also now present a range of values.
Australia (0)	7	39	17	39	37	-	-	-	Transmission costs are likely to be site specific and vary significantly across market structures. This issue is addressed more effectively in Ch 8 p 20 lines 40-47 This section should also include a balanced discussion of the trade-off between network costs and the financial benefits of connecting a high quality wind resource. As outlines above it may be more efficient to connect a lower quality wind resource that is closer to the existing network.	This section should better explain the drivers and beneficiaries of transmission expansion in addition to the total capital costs. The costs in Section 8 are from the exact same references as the costs in this section. These two chapters need to be reconciled.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Lennart Söder (KTH, Royal Institute of Technology)	7	39	0	-	-	-	-	-	Especially concerning transmission cost one should at least divide into 1:"connection costs" and 2:"transmission costs". But there is here also a discussion concerning the division of "connection cost" into "wind farm cost" and the connection. Sometimes the internal grid in the wind farm is seen as a wind power plant cost and sometimes not. When costs are used it is important that grid costs are only added once. Concerning part 2, as discussed above, investments for interconnection of different areas to "trade wind power" and/or "trade balancing power" is absolutely not trivial concerning allocation of costs. But sometimes (as I heard about some US studies) most of the costs are of type 1, and then it is a "wind power cost", while lareger studies in Europe often have costs of type 2.	There are important distictions between shallow costs (costs to connect the wind plant to the network) and deep costs (costs to upgrade the network to move power to demand). The costs reported in these studies are generally deep network upgrades - but it is not always the case. The relative lack of clear definition and the incorrect implicit assumption that these costs are entirely attributed to wind should be acknowledged.
United States (U.S. Department of State)	7	39	39	40	16	-	-	-	In the general environmental benefits, water savings should be called out specifically, and quantified. There are a lot of good, publicly available data showing the water savings associated with wind deployment. A good source would be the U.S. Dept of Energy's 20% by 2030 report.	We do not plan to quantify the benefits. But, we will more clearly identify that wind does not use any meaningful amounts of water, as per other comments received as well.
Paul Smith (University College, Dublin)	7	39	17	39	37	-	-	-	It should be mentioned here that the difficulty of implementing transmission expansion may be even more significant an issue than the anticipated cost.	This issue is already dealt with on page 33 line 28-32: "One of the primary challenges with transmission expansion to accommodate increased wind energy development is the long time it takes to plan, site, permit, and construct new transmission infrastructure relative to the relatively shorter period of time it takes to add new wind power plants. The institutional challenges of transmission expansion, including cost allocation and siting, can be substantial "
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	39	18	-	-	-	-	-	Line 18: which penetration level is this number corresponding to?	This is a 20% wind energy scenario
Leif Sønderberg Petersen (Risø National Laboratory for Sustainable Energy, the Technical University of Denmark)	7	39	19	-	-	-	-	-	Line 19: I miss a comparison with the transmission costs for other types of power plants to understand the magnitude of the cost for transmitting wind energy	See comment on row 500; though it is not the place of the wind chapter to present transmission costs for other technologies, we will add text indicating that wind is not alone is having such costs.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Australia (0)	7	39	13	39	16	-	-	-	the relative cost of of wind adequacy also depent of the nature of energy market systems and how resource adequacy requirements are calculated.	Accepted
Morgan Bazilian (UNIDO)	7	39	38	-	-	-	-	-	This section seems out of place in this chapter to me.	Comment is the result of only receiving a subset of the chapter text, and having a stray section heading at the end of that text. No change needed.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	39	-	39	-	7.5.5	-	-	Possibly this section of various integration cost elements could be ilustrated with some figures.	We will consider adding two new graphics: one on integration cost with penetration by study, and one on capacity valuation with penetration by study.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	40	31	-	-	-	-	-	Consider using Gt rather than MMT	These terms must follow the agreed upon terminology for the report.
United States (U.S. Department of State)	7	40	32	41	11	-	-	-	Move the last sentence of section 7.6.1.2 to after the first sentence of section 7.6.1.2	We fail to see the benefit of moving this sentence earlier, and it seems better to report the result from the table after presenting the table.
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	40	7	40	7	-	-	-	Run-on-sentence, divide: ...emissions of conventional plants. Such effects need to be substracted…	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	40	8	40	8	-	-	-	Should read: "¿.from the gross benefits in order to estimate¿.".	Accepted
Glória Rodrigues (European Wind Energy Association (EWEA))	7	40	1	40	1	7.6	-	-	"Human impacts" is very general and can be led to wrong interpretations. I would suggest replacing it by " impacts on human activities and well being" or "social impacts".	We will use impacts on human activities and well being, and then contract it as necessary as human impacts in the text as needed.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	40	21	40	24	7.6.1.1	-	-	In the first part of the sentence I would clarify that the "new generating plants", could be both fossil fuelled or renewable energy. Also, I would replace "peaking plants" by "flexible plants".	We will use the terms peaking and intermediate because the literature cited here focuses on the shift from baseload to peaking/intermediate. It is also true that there will be a shift towards flexible plants, however, so we will alter the text to say "flexible peaking and intermediate plants" or equivalent. We do not feel the absolute need to clarify the first portion of the sentence, but will seek to do so.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Steve Sawyer (Global Wind Energy Council)	7	40	13	40	16	7.6.1.1	-	-	It is not the point that wind "can reduce need for cooling water" - wind does not need any cooling water. As wind is having one of the lowest water consumption of RE technologies, which has correctly stated in chapter 9, this issue should be introduced here in more detail. It should introduce the water consumption in more detail and to state clearly also in this chapter that wind needs insignificant amounts of water.	The sustainable development chapter will be covering cooling water issues holistically, so other than noting that wind does not require cooling water, we will leave the remaining comparisons to the appropriate location: Chapter 9.
Steve Sawyer (Global Wind Energy Council)	7	40	13	40	16	7.6.1.1	-	-	It is not the point that wind "can reduce need for cooling water" - wind does not need any cooling water. As wind is having one of the lowest water consumption of RE technologies, which has correctly stated in chapter 9, this issue should be introduced here in more detail. It should introduce the water consumption in more detail and to state clearly also in this chapter that wind needs insignificant amounts of water.	Accepted
Glória Rodrigues (European Wind Energy Association (EWEA))	7	40	26	40	26	7.6.1.1	-	-	Please remove/replace "Despite these complications". Complications is a subjective concept. What is complicated for one person might be very simple for another one.	Accepted
Paul Leahy (University College Cork)	7	40	32	41	11	7.6.1.2	-	-	Other environmental impacts from wind farm construction include loss of soil carbon when wind farms are constructed in sensitive areas such as peatlands, as is often the case in locations such as Scotland and Ireland, where peatlands generally have good wind resources and low surface roughness. Carbon is lost through drainage, disturbance and removal of peat for turbine foundations, hardstandings and road construction. The Scottish government report (Nayak, D. R.; Miller, D.; Nolan, A.; Smith, P. & Smith, J. (2008), 'Calculating carbon savings from wind farms on Scottish peat lands - a new approach', Technical report, Government of Scotland) summarises many of these issues. There is additional material in Renou-Wilson, F. & Farrell, C. Peatland vulnerability to energy-related developments from climate change policy in Ireland: the case of wind farms Mires and Peat, 2009, 4.	These considerations would, ideally, be included in the full LCA literature already cited. Moreover, while these considerations are certainly important, they are very specific to individual project locations, and it seems inappropriate to go into the level of detail suggested by the reviewer given space constraints. If we did so, there certainly would be an expansive literature of site-specific LCA impacts that we would also need to summarize and discuss.
Steve Sawyer (Global Wind Energy Council)	7	41	7	41	7	-	-	-	Should read, "¿ranges from 4.6 to 27 gCO2/kWh, the lowest of all technologies assessed in this report." See esp. Chapter 9 (Annex A) and Chapter 10 of this SOD.	Comparisons across technologies need to occur in other chapters of the SRREN
Steve Sawyer (Global Wind Energy Council)	7	41	7	41	7	-	-	-	Should read, "¿ranges from 4.6 to 27 gCO2/kWh, the lowest of all technologies assessed in this report." See esp. Chapter 9 (Annex A) and Chapter 10 of this SOD.	Comparisons across technologies need to occur in other chapters of the SRREN
Paul Leahy (University College Cork)	7	41	0	-	-	-	-	7.3	Additional references on LCA of wind energy : Crawford, R. H. Life cycle energy and greenhouse emissions analysis of wind turbines and the effect of size on energy yield. Renewable and Sustainable Energy Reviews, 2009, 13, 2653-2660; Lee, Y.-M. & Tzeng, Y.-E. Development and life-cycle inventory analysis of wind energy in Taiwan. Journal Of Energy Engineering-ASCE, 2008, 134, 53-57.	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	42	32	-	-	-	-	-	something is missing/wrong in that sentence	Accepted
Steve Sawyer (Global Wind Energy Council)	7	42	42	43	49	7.6.2.1	-	-	As the conclusion is the bird impact is far less than other impacts and does not cause meaningul imapcts, this should be included from the start of the section, and not buried at the end.	These issues are highly sensitive, and reviewers provide wide ranging views on how the impacts associated with wind should be communicated. Because impacts are site and species specific, and comparative assessments are few, wide-ranging and scientifically based conclusions on relative impacts are challenging to make. The conclusions reached towards the end of this section are appropriate, but are also nuanced, so we believe it is best to get to them at the end of discussing the scientific literature rather than starting with what is a complicated and nuanced overall statment.
Steve Sawyer (Global Wind Energy Council)	7	42	42	43	49	7.6.2.1	-	-	As the conclusion is the bird impact is far less than other impacts and does not cause meaningul imapcts, this should be included from the start of the section, and not buried at the end.	These issues are highly sensitive, and reviewers provide wide ranging views on how the impacts associated with wind should be communicated. Because impacts are site and species specific, and comparative assessments are few, wide-ranging and scientifically based conclusions on relative impacts are challenging to make. The conclusions reached towards the end of this section are appropriate, but are also nuanced, so we believe it is best to get to them at the end of discussing the scientific literature rather than starting with what is a complicated and nuanced overall statment.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Germany (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	7	43	41	43	45	-	-	-	Comparision of the magnitude and population-level consequences of bird and bat collision fatalities caused by different human activities is in a case of offshore-windenergy in our opinion speculative. There are the following three points to consider: 1. Actually there are not enough data to justify the conclusion made by the two sentences. 2. The methodology to measure the mortality of bird caused by offshore-windenergy is currently to imprecise (collision risk of bird migration during night and bad weather conditions) to justify an acceptable comparison with other human activities. 3.The magnitude and population-level consequences for birds depends on natural migration rates. The influence of offshore-windfarms on bird migration and the migration barrier effect can only be estimated when all planned windfarms for a specific region have been built.	We believe that the current text is an accurate reflection of the literature, and we provide citations noting that offshore wind impacts do not appear disproportionately large compared to onshore wind. We also note the need for more research on these topics. The text mentioned here focuses on impacts to date and, as such, is accurate. That text does not extrapolate into the future with higher levels of offshore wind penetration.
United States (U.S. Department of State)	7	43	38	-	-	-	-	-	Remove "avoiding lattice support towers", peer reviewed references exist that confirm lattice support towers do not contribute to bird fatalities.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	43	29	43	33	-	-	-	Should be rephrased. E.g. The impact of wind power plants on bat populations is of particular contemporary concerns. This is is due to ¿.	Accepted
China (China Meteorological Administration)	7	43	7	43	7	7.6.2.1	-	-	¿(e.g., (De¿ should be expressed as ¿(e.g., De¿.	Accepted
China (China Meteorological Administration)	7	43	3	43	3	7.6.2.1	-	-	In "turbine size and design", please add "turbine sizes, hights and designs"	Accepted
Germany (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	7	44	5	44	6	-	-	-	Beside the collision risk and the migration barrier effect there is the risk of habitat loss for sea birds (sea ducks and divers) in a wind farm area during construction and operation. (e.g. Garthe, S, Hüppop, O.)	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter. This fit under 7.6.2.2.
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	44	2	44	5	-	-	-	incomplete sentence	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	44	32	44	32	-	-	-	Maybe worthwhile mentioning that impacts will vary depending on phase of plant (i.e. installation phase, operation phase, decommissioning phase).	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Germany (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	7	44	5	-	-	-	-	-	You should insert a Chapter 7.6.2.2 with the title:Effects on marine mammals.With regard to the marine fauna marine mammals are likely to be most severely affected by offshore wind turbines with effects on marine mammals being predominantly linked to the noise emitted from offshore wind turbines into the water. The installation of pile foundations for offshore wind turbines by impact pile driving and other activities that generate intense acoustic impulses during the construction are likely to disrupt the behavior of marine mammals at ranges of several kilometers and have the potential to induce hearing impairment in these animals. A Danish study (Tougaard et al. 2009) documented significant changes in behavior of harbor porpoises (Phocoena phocoena) over a distance of at least 21 km from pile driving at a wind farm site. The source levels of acoustic impulses from pile driving (Betke 2004) can reach levels well above the threshold for temporary shift in hearing sensitivity in harbor porpoises (Lucke et al. 2009). Safe distances mainly depend on the power applied to install the pile, the pile diameter, bottom substrate and sound propagation conditions and can vary widely (Madsen et al. 2006). No studies have directly measured the behavioral responses of marine mammals to noise from operating wind farms. Madsen et al. (2006), however, have modeled the potential effect of operational wind turbines on four representative shallow-water species of marine mammals. Their results indicate that operational noise of offshore wind turbines is unlikely to impair the hearing sensitivity of marine mammals, but could lead to behavioral responses from species with good hearing sensitivity at low frequencies. No comparable studies exist so far on seals which also have a very sensitive hearing system. The marine mammal fauna is exposed to a multitude of acoustic impulses during the construction of a single wind turbine. While thresholds for the exposure of some marine mammal species have been determined for single acoustic impulses so far the effect of exposure to multiple impulses cannot be assessed yet, but is likely to have more severe effects. Impacts on marine assemblages as a whole are largely unknown and little research, especially on long-term consequences, is available.	We will review these citations for consideration. Marine life consideratons are currently covered under 7.6.2.2, which is admitedly not ideal as the impacts described here include both direct and indirect influences. However, the literature is rather scant, certainly compared to bird and bat collisions, and most of the marine impacts tend to more-indeirect habitat/modification in nature and less direct in terms of fatalities. As such, we prefer to maintain the current structure and discussion. We will seek to expand the discussion, however, including some number of the additional references mentioned here.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Glória Rodrigues (European Wind Energy Association (EWEA))	7	44	7	44	38	7.6.2.2	-	-	The section mentions twice the prohibition for construction of wind power plants in ecologically sensitive areas (lines 20-21 and 36-38). While factually correct, these sentences should not be leading to the interpretation that the a-priori prohibition and exclusion of wind power development is always a positive practice. Each plant should be assessed in its specifics and on the extent of the potential impact on the habitats/species of ecological value.	We believe the current text has already addressed these tradeoffs to an adequate degree.
Steve Sawyer (Global Wind Energy Council)	7	44	-	-	-	7.6.2.2 1st paragraph	-	-	Chapter 9 page 28 reads: "With appropriate precautions, there is almost no effect on biodiversity." This should be the main message of section 7.6.2.2 as well, instead of elaborating on uncertainties without reaching meaningful conclusions.	Impacts are project and site specific, and the wind chapter does not believe that the sweeping statement made in Chapter 9 can be fully and comprehensively defended based on the available scientific literature. All reviewers are sensitive to the use of language in these sections, and chapter 7 authors therefore chose to somewhat dispassionately and perhaps conservatively report the scientific literature, without making broader statements.
Steve Sawyer (Global Wind Energy Council)	7	44	-	-	-	7.6.2.2 1st paragraph	-	-	Chapter 9 page 28 reads: "With appropriate precautions, there is almost no effect on biodiversity." This should be the main message of section 7.6.2.2 as well, instead of elaborating on uncertainties without reaching meaningful conclusions.	Impacts are project and site specific, and the wind chapter does not believe that the sweeping statement made in Chapter 9 can be fully and comprehensively defended based on the available scientific literature. All reviewers are sensitive to the use of language in these sections, and chapter 7 authors therefore chose to somewhat dispassionately and perhaps conservatively report the scientific literature, without making broader statements.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Steve Sawyer (Global Wind Energy Council)	7	44	-	-	-	7.6.2.2 2nd paragraph	-	-	In chapter 9 of this SOD (p.28) it reads: " For off-shore wind power farms, no significant negative effect was found, and in some areas, biodiversity has increased due to artifical reefs appearance (Danish Energy Authority, 2006)" In general a more positive effect is found which is not sufficiently reflected in the current wording of the paragraph.	Impacts are project and site specific, and the wind chapter does not believe that the sweeping statement made in Chapter 9 can be fully and comprehensively defended based on the full available scientific literature. All reviewers are sensitive to the use of language in these sections, and chapter 7 authors therefore chose to somewhat dispassionately and perhaps conservatively report the scientific literature, without making broader statements. The text does note the possible positive impacts already, and notes that any negative impacts do not appear to be disproportionately large.
Steve Sawyer (Global Wind Energy Council)	7	44	-	-	-	7.6.2.2 2nd paragraph	-	-	In chapter 9 of this SOD (p.28) it reads: " For off-shore wind power farms, no significant negative effect was found, and in some areas, biodiversity has increased due to artifical reefs appearance (Danish Energy Authority, 2006)" In general a more positive effect is found which is not sufficiently reflected in the current wording of the paragraph.	Impacts are project and site specific, and the wind chapter does not believe that the sweeping statement made in Chapter 9 can be fully and comprehensively defended based on the full available scientific literature. All reviewers are sensitive to the use of language in these sections, and chapter 7 authors therefore chose to somewhat dispassionately and perhaps conservatively report the scientific literature, without making broader statements. The text does note the possible positive impacts already, and notes that any negative impacts do not appear to be disproportionately large.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
China (China Meteorological Administration)	7	44	40	44	43	7.6.2.3	-	-	Author only points out reducing wind speed, he or she should also mention the changing wind direction.	As such, we prefer not to note these impacts. This is a fair comment – there may be an effect due to Ekman turning… I suggest a rewording; "Though intuitively turbine wakes must increase vertical mixing of the near-surface layer, and thus may increase atmosphere-surface exchange of heat, water vapour, and other parameters, the magnitude of the effect remains uncertain." To "Though intuitively turbine wakes must increase vertical mixing of the near-surface layer, and thus may increase atmosphere-surface exchange of heat, water vapour, and change other parameters (such as wind direction), the magnitude of the effect remains uncertain."
China (China Meteorological Administration)	7	44	39	45	24	7.6.2.3	-	-	Section 7.6.2.3 should be taken out of 7.6.2 as a new sub-section. Because 7.6.2.3 does not belong to section 7.6.2 - ecological impacts. It presents the impacts of wind power plants on local climate. It is an important topic. It should attract attention by policy makers and public in a new sub-section.	We prefer not to place undue emphasis on this impact, because the available literature is scant and somewhat problematic, as noted in the text. Moreover, all of these ecological impacts do have implications for humans, so the current location is not inappropriate. However, we do need to add a sentence linking local climate impacts to ecological impacts, so that the present location is appropriate
Japan (the Japanese Ministry of Foreign Affairs)	7	45	41	-	45	-	-	-	The sentence should mention conflict with fishery rights, if not elsewhere in Chapter 7.	Accepted
China (China Meteorological Administration)	7	45	7	45	8	7.6.2.3	-	-	Add radiation after rainfall, clouds,	I believe this is a reasonable request therefore reword; these local effects could have secondary impacts on rainfall, clouds, and other climate variables. To these local effects could have secondary impacts on rainfall, radiation, clouds, and other climate variables.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Glória Rodrigues (European Wind Energy Association (EWEA))	7	45	13	45	13	7.6.2.3	-	-	Please clarify between brackets or in a footnote what "invariant momentum sinks" mean.	Invariant momentum sinks means that these studies are based on methods wherein the aerodynamic effect of wind turbines is treated via an increase the surface roughness. This is akin to assuming that the wind turbines are operating all the time to decrease the wind speed irrespective of the incident wind speed. So this approach does not, for example, incorporate non-linearity due to the dependence of the turbine thrust coefficient on incident wind speed. We will try to formulate this as a footnote.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
China (China Meteorological Administration)	7	45	4	45	7	7.6.2.3	-	-	Temperature changed by even exceeding 1 ?. Please specify how many km2 areas are influenced by 1?.	This varies by study and is not always reported, so we are not able to go into these details comprehensively. In addition, there are methodological problems with these studies, as discussed in the following paragraph. But, as noted, the impacts discovered are "local" as opposed to "global." We suggest a reword of... From - “These studies have typically analyzed scenarios of substantial wind energy deployment, and have found changes in local surface temperature of up to or even exceeding 1°C, and in surface winds of several meters per second (Keith et al., 2004; Kirk-Davidoff and Keith, 2008; Wang and Prinn, 2010);” To - “These studies have typically analyzed scenarios of substantial wind energy deployment, and have found changes in local surface temperature of up to or even exceeding 1°C, and in surface winds of several meters per second over areas of up to 200´200 km2 for a scenario in which 10% of the worlds global energy demand was met by wind installations (Keith et al., 2004; Kirk-Davidoff and Keith, 2008; Wang and Prinn, 2010);” The precise figures we are reporting here derive from the most recent paper – Wang and Prinn 2010, so some editing of this text will be needed.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	45	25	47	44	7.6.3	-	-	"Impacts on humans" is very general and can be led to wrong interpretations. I would suggest replacing it by " impacts on human activities and well being" or "social impacts".	We will use impacts on human activities and well being, and then contract it as necessary as human impacts in the text as needed.
United States (U.S. Department of State)	7	46	10	-	-	-	-	-	Possibly include Terrain masking as a form of mitigation for RADAR and turbines.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	46	13	46	13	-	-	-	What is TV and GPS. Please right in full with abbreviation in brackets.	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Glória Rodrigues (European Wind Energy Association (EWEA))	7	46	42	46	45	7.6.3.3	-	-	Add "considered" between "are sufficient".	Accepted
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	47	25	47	28	-	-	-	Since there are restrictions in a lot of places on how close wind turbines can be build to e.g. buildings, I'd guess these restrictions also take possible accidents into account, so I would't say that there are no standards to prevent such accidents	Accepted
United States (U.S. Department of State)	7	47	30	-	-	-	-	-	The author should consider starting the paragraph with "It is unclear if the visibility of wind power..."	We will not use this exact language, but we will reflect the general concern with revised text.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	47	26	47	26	7.6.3.3	-	-	From the current version of the text is is not clear what can "collapse entirely". Is it the turbine, the blade? Please clarify.	Accepted
Glória Rodrigues (European Wind Energy Association (EWEA))	7	47	13	47	15	7.6.3.3	-	-	In the current version of the text, readers might be led to think that the technology efforts to reduce noise are meaningless. I propose rephrasing the sentence to "In addition to these efforts, predictive models and environmental regulations to manage noise impacts have improved".	Accepted
Steve Sawyer (Global Wind Energy Council)	7	47	32	47	32	7.6.3.4	-	-	references "health and safety concerns" though there are none defined in the report, reference should be deleted.	The text addresses possible health concerns (noise) and safety concerns (blade shedding and accidents), so the heading is appropriate as those issues ARE covered in the subsection. Moreover, this latter reference is appropriate as even CONCERNS about those impacts might impact propoerty values, at least theoretically. Nonetheless, we will add "perceived cocnerns" to the language because it really is perception and reality that impact property values.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Steve Sawyer (Global Wind Energy Council)	7	47	32	47	32	7.6.3.4	-	-	references "health and safety concerns" though there are none defined in the report, reference should be deleted.	The text addresses possible health concerns (noise) and safety concerns (blade shedding and accidents), so the heading is appropriate as those issues ARE covered in the subsection. Moreover, this latter reference is appropriate as even CONCERNS about those impacts might impact propoerty values, at least theoretically. Nonetheless, we will add "perceived cocnerns" to the language because it really is perception and reality that impact property values.
Antoine BONDUELLE (E&E Consultant)	7	48	1	49	11	-	-	-	No mention of organized opposition is made in this part of the text. There should be a mention that in some countries (e.g. Britain or France), construction is slowed or stopped by such lobbying.	It seems unnecessary to mention this, as such organized opposition exists in all phases of human development. We are clear that public opposition can impede project development already, in several places in the text.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	49	34	50	22	-	-	-	Given the dominant role Europe has had in development of onshore and offshore wind, I think it would be appropriate to add some info on EU-funded R&D efforts, e.g. in addition to TPWind, mention some figures on wind related R&D funding in EU and the UpWind project - funded under EU's Sixth Framework Programme (FP6). The project looks towards the wind power of tomorrow, more precisely towards the design of very large wind turbines (8-10MW), both onshore and offshore.	We will add mention of the Upwind project, but we will not expand the discusssion of funding to specifically include EU R&D.
David Clubb (European Environment Agency)	7	49	15	49	16	-	-	-	Imprecise/unscientific: It is not a 'rule of thumb', it's a precise mathematical relationship. And it doesn't 'tend to increase' at that ratio; it increases at exactly that ratio.	The "square-cube law" is a mathematical relationship that states that as the wind turbine diameter increases, its theoretical energy output increases by the square of the rotor diameter, while the volume of material (and therefore its mass and cost) required to scale at the same rate increases as the cube of the rotor diameter, all else being equal.
David Clubb (European Environment Agency)	7	49	22	49	22	-	-	-	Unneccessary text: Do they alter design 'rules', or alter the design?	" optimizing designs"

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
China (China Meteorological Administration)	7	49	11	49	11	7.6.5	-	-	Add one paragraph to emphasize that more attention should be given to environmental and social impacts . It is lack of studies on this issue in present time.	We believe that the present paragraph in this section already clearly indicates the need for further research, as does the text provided in the section as a whole. In the interest of space constraints, we prefer not to further expand on a point that we believe is already relatively clear.
Jos Beurskens (ECN Wind Energy)	7	49	23	-	-	7.7	-	-	Add: using advanced materials with a better strength to mass ration and compliant components to reduce fatigue loads. (Both elements are crucial for up scaling).	This is currently discussed in 7.7.3.2, but will be expanded somewhat.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	50	36	50	37	-	-	-	Change "material and installation costs"with "capital investment costs".	Accepted
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	50	10	-	-	-	-	-	Could you give an example (maybe from the reference given here) on how frowind public R&D efforts in other regions bear note?	We will alter the text to remove "also bear note", since that text is not clear; we can simply say that there is growing R&D support in other countries.
Sweden (Swedish Environmental Protection Agency)	7	50	33	50	38	-	-	-	The sentances starting "Ultimately" until the end og line 38. The sentances explains obvious things.	We are reformulating this sentence to expand the definition of system to address other comments; and we will try to clarify the complexity of the challenge to optimize components and systems to achieve low-cost energy production.
Jos Beurskens (ECN Wind Energy)	7	50	17	-	-	7.7	-	-	Rephrase TP Wind¿s focus area¿s in: wind power systems, offshore applications, grid integration and wind resources. TPWind does not only foresee incremental improvements. On the component level TPWind foresees spectacular rotor size growth and incorporated, highly innovative distributed aerodynamic blade control (essential for up scaling) and new generators, possibly utilizing superconductors to make the concepts les vulnerable to the volatile cost of copper and the availabbilty of raw materials for the production of permanent magnets.	The official TPWind project areas are as follows: we will include a more descriptive explantion in parentheses. Wind Power Systems (new turbines and components in a wind power system), Offshore Deployment and Operation, Wind Energy Integration, Wind Energy Resource(wind resource assessment and design conditions): www.windplatform.eu/61.0
Oluf Ulseth (Statkraft AS)	7	51	3	-	-	-	-	-	The capacity factor needs a reference. European capacity factor does not reach this level, as a comparison it was in the low twenties in 2007.	The reference to the table is already listed: US DOE 2008. This capacity factor increase is focused on the US, where the data do support this statement.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Antoine BONDUELLE (E&E Consultant)	7	51	8	57	27	7.7.3	-	-	Although this section is quite interesting and well researched, maybe some editing could bring the chapter to its proposed size. In some instances, mentioning or listing the possible improvements is enough.	We do intend to have the entire chapter edited, but wish to retain the technical detail to provide the reader with adequate description of the technical advancement potential.
Norway (Climate and Pollution Agency)	7	51	-	-	-	-	-	7.4	As the baseline for this table is 2002, the relevance may be questioned. Significant development has taken place since then. Further: The table seems to reflect onshore development only. For offshore turbines relevant keywords may be: new foundation concepts, including floating, improved reliability/ reduced O&M, improved access systems, reduced top head mass, park optimization etc.	This table is sourced from a published document and it is only relevant for onshore wind. The footnote does describe some improvements since 2002. Text in the previous parapraph will be added to note that a similar study for offshore wind is underway, but not yet completed.
Norway (Climate and Pollution Agency)	7	52	11	-	-	-	-	-	2001 reference too old?	We continue to look for more recent citations showing this relationship.
Finn Gunnar Nielsen (Statoil)	7	52	11	-	-	-	-	-	2001 reference too old?	We continue to look for more recent citations showing this relationship.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	52	18	52	29	-	-	-	Can you give a source for the information on new airfoil shapes?	We will look for citations
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	52	43	52	43	-	-	-	Should read: "¿and wind power plants, onshore and offshore".	Accepted
Norway (Climate and Pollution Agency)	7	52	-	-	-	7.7.3.3	-	-	Add a statement that for large offshore wind farms, with several hundred MW installed power, optimization with regards to siting and operation becomes very important. I.e. optimization of single turbines is not suffient.	p. 52, line 43 mentions individual turbines and wind power plants
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	53	37	53	37	-	-	-	"as" missing?: ...concepts such "as" manufacturing…	Accepted
Sweden (Swedish Environmental Protection Agency)	7	53	23	53	23	-	-	-	I have always thougt that the reason for using distributed multiple generators is to be bale to use cuttent generator tehnology and not to reduce weight. I doubt that it can reduce size and weight.	p. 53, line 23 - reducing component size and weight.
Sweden (Swedish Environmental Protection Agency)	7	53	12	53	14	-	-	-	It would be very interesting to but inte share new installed capacity that are direct drive turbines. Or is 10 % referring to the new istalled turbnes 2009?. It should be clearer what 10 % stands for.	It refers to newly installed turbines in 2009. We will make this more clear.
United States (U.S. Department of State)	7	53	45	-	-	-	-	-	Should the text read instead "...some of these advances may be driven by on-shore wind energy...."?	No. To clarify the text, we will add "may even be driven" to clarify the point.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
John Twidell (AMSET Centre)	7	53	9	-	-	7.7.3.4	-	-	I would expect comment on variable speed rotors with DOUBLY FED INDUCTION GENERATORS which are now in widespread use	DFIG generators are commonly used today, thus not relevant to Section 7.7.3.4. They are mentioned in Section 7.3.4.
China (China Meteorological Administration)	7	53	9	53	31	7.7.3.4	-	-	Regarding the wind turbine driving system set forth in 7.7.3.4, at present there is a new type of driving system in the world, it is used with fluid power variable moment, which can save converter speed change by using synchronous motor directly, the German company VOITH has applicated this technology in the 6.5MW wind turbine developed by BARD company in Germany, it is suggested that some description be given to this system.	We will add p. 53, line 23 - new types of drive train concepts are under development, but do not wish to go to the level of technical depth and detail suggested by the comment here.
Glória Rodrigues (European Wind Energy Association (EWEA))	7	53	15	53	18	7.7.3.4	-	-	The statement "decreased cost and increased availability of rare-earth permanent magnets" is not correct and should be reviewed. Please consult the following references for support: 1. Kingsnorth D.,(2008), ¿Rare earths at the crossroads¿, Industrial Minerals Magazine, Septermber 2008, online: http://www.ggg.gl/Assets/Rare%20Earth%20Industry%20Overview.pdf 2. Lynas corporation, Annual Report 2009, online: http://www.lynascorp.com/content/upload/files/Reports/Annual_Report_2009_778195.pdf 3. OECD, (2009), ¿Export restrictions on strategic raw materials and their impact on trade and global supply¿, Workshop on raw materials.	We will re-forumulate this statement based on more recent trends in rare-earth material.
Norway (Climate and Pollution Agency)	7	53	-	-	-	7.7.3.6	-	-	Add a statement about offshore access systems. Presently access to offshore wind turbines has severe weather restrivtions for access. However, new advanced systems are under development and testing. These systems will lift the restrictions signifcantly	These issues are addressed already beginning on line 4 of page 54. It is unlear what additional information is suggested by the reviewer. Change p. 54, line 7 "evaluated" to "under consideration and development"
Norway (Climate and Pollution Agency)	7	53	-	-	-	7.7.3.6	-	-	We propose to add that floating foundations make it possible to make a full assembly of the wind turbine in sheltered water. This will reduceinstallation costs and make the installation less weather sensitive.	p. 54, line 35 mentions simplified installation practices for floating turbines, which we believe is sufficient.
Finn Gunnar Nielsen (Statoil)	7	55	13	-	-	-	-	-	Replace ""‥ 2-bladed downwind.."" by "" 2-bladed and downwind..""	Accepted
Norway (Climate and Pollution Agency)	7	55	13	-	-	-	-	-	Replace ".. 2-bladed downwind.." by " 2-bladed and downwind.."	Accepted
Glória Rodrigues (European Wind Energy Association (EWEA))	7	55	18	57	27	7.7.4	-	-	I suggest this section to be shortened. It is very focused on meteorological aspects, whereas basic research is also required on other fields.	We believe it is important to convey the very significant possibilities for continued technical advancement in wind, as this underlies the cost improvement possibilities and therefore also the GHG potential. The reader of course is not required to read these sections.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
China (China Meteorological Administration)	7	55	18	57	27	7.7.4	-	-	In this session, we suggest to add some content about research on extreme weather (e.g. typhoons, low temperature, lightning strike, etc.) that affect the wind turbines.	p. 56, line 4, add after "environment" - "including extreme weather events and impact on wind power plants"
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	55	-	-	-	-	7.16 a	-	Please add to the figure the names of the different foundation concepts. Also make proper reference to the EU-funded project UpWind (www.upwind.eu).	This figure is a product of the Upwind project but is not published independently. Therefore the reference is accurate. We will consider modifying the graphic to include names of the different foundation concepts.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	55	-	-	-	-	7.16 b	-	Text in figure is impossible to read	The figure will be revised.
Paul Leahy (University College Cork)	7	56	47	-	-	7.7.4	-	-	... Lighter, more reliable and higher performing turbines"". I would add the additional potential advantages of cheaper manufacture and operation.	This section is focused on underpinning science to improve the design of wind turbine components; it is not appropriate to discuss manufacturing processes here.
Norway (Climate and Pollution Agency)	7	57	29	57	42	-	-	-	An important factor for reduced cost of offshore wind is not mentioned. Should add to "develop supplier capability and capacity and to ensure competitive supplier market" as an important element.	This is simply a summary opening paragraph, and it is not the place for this level of detail. However, these details are already provided in the text that follows in this section.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	57	45	57	45	-	-	-	Change "installation costs"with "capital investment costs".	The entire SRREN will be standardizing on terms, and we will go along with whatever terms are agreed upon. We prefer capital cost.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	57	35	57	35	-	-	-	Delete "Because" and start the sentence with: "The degree to which¿".	Accepted
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	57	28	57	28	-	-	-	delete footnote, as information applies to whole report	Though we certainly agree, a previous reviewer suggested that we keep this footnote in so that absolutely no confusion exists.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	57	30	57	30	-	-	-	More appropriate wording would be: "¿., policy measures aim to make¿".	We will be revising this text based on a different comment, so this comment will no longer be relevant

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Glória Rodrigues (European Wind Energy Association (EWEA))	7	57	29	57	31	7.8	-	-	The reference "policy measures are required to make wind energy economically feasible" is confusing and should be rephrased. Costs reduction, a crucial element for sector's competitiveness, is coming not only from policy support, but also from technology development and market push. Furthermore, authors should make clear that this support is often due to the fact that wind energy is not at the same level playing field as other already heavily subsidised power sources, and that the current electricity prices do not fully reflect the real economic, environmental and social costs of producing electricity. The interpretation that wind is inherently not competitive and needs policy support because of that should be avoided.	We will include "currently" in the text to clarify that this point applies to the present, and that policy is currently needed to create "substantial deloyment;" we may also use "under current market conditions." The following sentence addresses the possibility of technical advancement and future cost reduction which, of course, may make policy intervention unnecessary. The point of comparison to conventional energy sources is, of course, difficult, but we will endeavor to make clear that we are comparing the cost of wind to the current price of conventional fuels, accepting that those prices may not fully reflect external costs. "In some areas with good wind resources and under current market conditions, the cost of wind energy is already competitive with fossil generation but, in most regions of the world, policy measures are currently required to ensure rapid deployment." This text will allow us to avoid discussion of externalities in Chapter 7, as those issues are better addressed more holistially elsewhere in the SRREN
China (China Meteorological Administration)	7	57	44	59	2	7.8.1	-	-	Politics and grid availability should also be considered as cost factors.	As noted in the previous paragraph, "the costs of integration and transmission are not covered here, but are instead discussed in Section 7.5. However, in the first sentence of section 7.8.1 we will further clarify this point by saying the "generation cost." The text already notes that policy also influences costs. We should, however, clarify that our installed costs sometimes does and sometimes does not include interconnection costs.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	58	4	58	10	-	-	-	Delete paragraph, this is all more or less repitition	We have tried to discuss each of the factors listed earlier in the text. It creates some repetition in this case, but that repetition does not seem severe.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	58	1	58	3	-	-	-	Delete the sentence starting with: "Available support policies..". It is already mentioned in the paragraph before that subsidies will not be covered.	We prefer to repeat this sentence to make things very clear about what is and is not included
Norway (Climate and Pollution Agency)	7	58	-	-	-	-	-	7.5	Does civil work include foundation?	Yes, it does
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	58	-	-	-	-	-	7.5	Please consider turning the table into a pie diagram	Because the table presents ranges it cannot be translater into a pie diagram
Sweden (Swedish Environmental Protection Agency)	7	59	14	-	-	-	-	-	¿cannot easily¿ should be replaced with: ¿need special attention to be¿. Rationale: see next sentence, row 17!	This comment applied to page 64, and is a good one that will be addressed.
Miriam Ester Limia (of Meteorology)	7	59	8	-	-	-	-	-	If Figure 7.17 is removed, remove the reference to this figure	We will not remove the figure, for reasons noted elsewhere
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	59	13	59	13	-	-	-	Should read: "¿are highly site-specific, and have historically¿".	Accepted
Miriam Ester Limia (of Meteorology)	7	59	-	-	-	-	7.17	-	This figure can be eliminated to reduce text	We believe that a presentation of historical wind capital costs is important for the chapter, unless severe space constraints exist.
John Twidell (AMSET Centre)	7	60	12	60	13	-	-	-	Add sentence. 'Note however that capacity factor depends significantly on the site wind regime for each locality and period'. [note to authors: capacity factor can change because annual wind speed distributions change	We will not use this exact text,but we will reiterate the level of site-specificity in capacity factors on line 4 of page 60.
Miriam Ester Limia (of Meteorology)	7	60	12	-	-	-	-	-	If Figure 7.18 is removed, remove the reference to this fugure	We will not remove the figure, for reasons noted elsewhere
Miriam Ester Limia (of Meteorology)	7	60	-	-	-	-	7.18	-	Size can be reduced to eliminate pages	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	61	10	61	31	-	-	-	This paragraph repeats itself, consider reformulating to have the information only once	Accepted
John Twidell (AMSET Centre)	7	62	13	-	-	-	-	-	Add '¿depending on the wind resource, which varies by location and period [some years and more windy than others]	Accepted
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	7	62	14	62	15	-	-	-	It is correct that average capacity factor for Germany¿s installed plants ist about 20.5%. But new (modern) onshore turbines in Germany reach at least 25%, in better wind regions (due to new dedicated development zones or repowering within existing zones) also well above 30%.	This is useful information, but distinguishing between older and newer plants across all regions would take up considerable space.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Miriam Ester Limia (of Meteorology)	7	62	26	-	-	-	-	-	It should be added at the end the following: In countries affected by extreme weather, including hurricanes, the proper selection of the turbines in accordance with weather hazards reduces O&M costs (Moreno, 2007).	This is not the location to provide that detail, though it is certainly an accurate observation.
Antoine BONDUELLE (E&E Consultant)	7	63	27	64	11	-	-	-	This part of the text is confused. It compares non homogeneous studies and inevitably concludes that ranges of results vary. This would be the same for any other industrial products (cars, TVs, etc¿) if we mix the continents and the type of products. Only a few studies should be mentioned.	We believe it is useful to summarize the full literature in order to reflect different views and the breadth of work completed, but the text itself focuses on the caveats and issues to using the literature in this way. As such, we do not feel the need to make revisions to the text as it stands. We will change the order of the text to make the discrepancies more clear, however, moving the 4-32% range towards the end, after discussing inputs. And then placing more emphasis on the narrower 10-17% range.
Wilfredo Jara Tirapegui (Endesa Eco S.A.)	7	63	3	-	-	-	-	-	US$3,900/KW"", the unit shoud be ""US$3,900/kW""	Accepted
Glória Rodrigues (European Wind Energy Association (EWEA))	7	63	18	63	20	7.8.4	-	-	The concept of "relatively immature" is too vague. I suggest rephrasing it and/or replacing it by another more concrete expression.	Accepted
Antoine BONDUELLE (E&E Consultant)	7	63	-	-	-	-	7.19	-	The figure page 63 uses static cost values from 2009 and is thus misleading for future projects. Projections of future production capabilities and increased competition from China and others, as well as technical improvements described in table 7.4 make this representation obsolete. Figure 7.20 is probably more useful for this publication.	In our view, both figures are important in order to show actual current costs, as well as possible future costs.
Sweden (Swedish Environmental Protection Agency)	7	64	9	-	11	-	-	-	It is noted here that the most recent learning curve studies for wind power suggest a learnig rate of 10-17 percent. This can be very misleading since, as the authors note later on, different studies differ in the assumptions they make concerning the geographical domain of learning. In the research group which I lead we have made a meta analysis of learning rates for wind power, and this shows that this assumption is by far the most important determinant of the estimated learning rate. So a doubling of capacity in, say, Denmark is likely to result in rather modest cost reductions compared to the case where global capacity doubles.	This range only focus on studies that use global installed capacity as the independent variable, investment cost as in the independent variable, and published sincve 2004. These thresholds were applied precisely to minimize the concern raised here. We will underline some of the text to make this point more clear.
Antoine BONDUELLE (E&E Consultant)	7	64	-	-	-	-	-	7.6	Too many studies from too different frameworks bring confusing results and no hierarchy. The table could be replaced by a short discussion.	We believe there is value in presenting the full peer-reviewed literature in tabular form, and the variations and difficulties in that literaturte are already described in the text.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	7	64	-	-	-	-	-	7.6	You need very strong caveat that most estimates are based upon the data before 2000 and the costs are flat or increasing since then up to 2008.	Such text is already included as the final sentence of this section, and is also discussed elsewhere in this section. We may add more text to this effect, however, specifically referring to the citations in the table.
Sweden (Swedish Environmental Protection Agency)	7	65	12	-	-	-	-	-	I agree that the innovation system for wind power is largely global in scope, but there are also clear regional and even national tendencies (and influences). This notion is strengthened by the fact that many countries are keen on bulding up their own wind turbine industry (thus perhaps resulting in fewer knowledge spillovers across countries). The fairest assumption is that technology learning comprises both a global and a domestic component.	We use the terminology "most", which we believe to be accurate, though to be more clear, we will change this to "much of". The goal to build local industries is often based on a desire to build local employment, not because there is some sense that cost reductions will occur as a unique result of country specific support.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	66	22	67	4	-	-	-	Delete paragraph, unecessary text.	We have chosen to have an opening paragraph of each section, and this one builds from previous sections of the chapter to suggest that wind's GHG reduction potential is sizable. As such, we believe it offers a useful transition to this section.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	66	5	-	-	-	-	-	footnote 28: You indicate that the absolute range suggested by the studies is larger than the one you use. You should explain this restriction, otherwise it gives an impression of omission of data because it didn't fit the argument	We will add text describing that our approach of future costs being based on a 2009 starting point is conservative, so that there may be more reason for lower costs than higher costs in the future. We will also add more information on the datapoints that were excluded when developing the range.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Paul Leahy (University College Cork)	7	66	-	72	-	7.9	-	-	If possible, references to scenarios from the literature should be expanded. There is to my mind an over-reliance on sources which could perhaps be accused of a ""pro-wind"" bias, i.e. EREC/GPI and GWEC/GPI. This gives a fairly limited spread of opinion on the future potential deployment of wind generation.	The Figures 7.21 and 7.22 include a large amount of literature from diverse sources, as described in Chapter 10. As such, the scenarios covered in this section are as broadly representative as possible. The reviewer may be focusing on the few sources that we specifically reference (e.g., Table 7.8), which tend to include IEA and then also some parties that are quite favorable towards wind. Where those are focused on, it is because they uniquely provide information on, for example, offshore wind deployment or regional deployment, whereas the many other scenarios included in Figures 7.21/7.22 do not provide those details.
Paul Leahy (University College Cork)	7	67	-	69	-	7.9.2	-	-	In the long term, there is potential for some energy intensive activities to gradually relocate to locations of high wind generation, especially activities with some load flexibility. Therefore the transmission problem can be examined from the perspective of moving loads closer to generation, as well as delivering power from wind generators to the locations of current loads. Large scale wind generation has the potential to change the geographical distribution of energy usage.	While this is technically true, it is a detail that is not needed in this section and will, it seems, be at most a modest influence
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	68	-	-	-	-	7.21	-	It is not exactly clear, what do the coloured boxes, the thick black lines in the boxes and the ranges (dashed lines) represent in this figure. Text regarding figure 7.21 does not explain well enough.	We will seek a description from chapter 8 that we can use, as can others. We will also ask for a 1 paragraph footnote on the source and nature of the chapter 10 scenarios overview from chapter 10 to include it here. Also, we would like a legend for the figure that describes what it is presenting - and will ask for it from chapter 10.
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	7	68	-	-	-	-	7.21	-	This diagram is highly missleading. Remove the error bars and error boxes. This diagram misleads the readers that the box bars show the conclusion by the report and error bars are not important. However, the frequency of the reports are nothing to do with the probability. To avoid such confusion, just show the range by lines and shadows to show the range of reports, remove boxes and bars that look like probability range.	This figure was delivered to us by Chapter 10, and Chapter 7 does not control its design or formatting. If Chapter 10 delivers to us a revised Figure as per this comment, Chapter 7 will happily rely upon that updated figure as we are in some agreement with the comment that the present figure is somewhat misleading.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	69	14	69	15	-	-	-	Should read: "¿.is great, and result in a wide range ¿...".	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	69	-	-	-	-	7.22	-	It is not exactly clear, what do the coloured boxes, the thick black lines in the boxes and the ranges (dashed lines) represent in this figure. Text regarding figure 7.22 does not explain well enough.	We will seek a description from chapter 8 that we can use, as can others.
Taishi Sugiyama (Central Research Institute of Electric Power Industry (CRIEPI))	7	69	-	-	-	-	7.22	-	This diagram is highly missleading. Remove the error bars and error boxes. This diagram misleads the readers that the box bars show the conclusion by the report and error bars are not important. However, the frequency of the reports are nothing to do with the probability. To avoid such confusion, just show the range by lines and shadows to show the range of reports, remove boxes and bars that look like probability range.	This figure was delivered to us by Chapter 10, and Chapter 7 does not control its design or formatting. If Chapter 10 delivers to us a revised Figure as per this comment, Chapter 7 will happily rely upon that updated figure as we are in some agreement with the comment that the present figure is somewhat misleading.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	70	23	70	23	-	-	-	Should read: "¿supplies would be necessary, ¿".	We do not believe that a statement that is this firm is appropriate. Wind energy cost reductions, if coupled with an increase of fossil fuel costs, could yield a lot of deployment without explicit policy intervention.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	70	11	70	12	-	-	-	Should read: "One explanation for this result is that wind energy (onshore) is already comparatively mature¿.".	Accepted
Gerrit Hansen (TSU)	7	70	26	72	8	-	-	-	the numbering behind the bold heading should be omitted	We do not understand the meaning of this comment.
United States (U.S. Department of State)	7	70	43	-	-	-	-	-	The reference to technology knowledge transfer (page 70, line 43) should be expanded to a brief conversation of the dilemma between protecting intellectual property rights (makers of the ¿latest and greatest¿ turbines), and the need to get cleaner energy to developing nations faster (they are the elephant in the room in terms of future emissions). This was a major issue at Copenhagen. The author should include a citation.	This is squarely a policy issue, and should be covered either in the policy chapter or the sustainable development chapter as it affects all of the renewable energy technologies equally, not only wind.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	7	70	26	72	30	-	-	-	These paragraphs do really add anything new and should be deleted. The points are or should have been addressed in the earlier sub-chapters (resource potential, technology and application, market status and industry development, grid integration issues, environmental and social impacts, cost trends, etc.)	These paragraphs and their structure were agreed to among all of the technology chapter of the SRREN (in the interest of summarizing consistent information), so cannot be altered at this time, though we do agree that they create a certain amount of duplication.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Juan Llanes (Centre for Environmental Studies)	7	71	9	-	-	-	-	-	Technology and economics, ¿technology and costs¿ is better. Technology and economics, ¿technology and costs¿ is better. Technology and economics, ¿technology and costs¿ is better.	This title was agreed by all of the technology chapters, so even if superior terminology is available, to ensure consistency the present terms will be retained.
China (China Meteorological Administration)	7	71	19	71	21	7.9.2	-	-	Add "in Europe and U.S.". The reason is same as No.10 comment.	Though we will make this suggested change elsewhere, we do not believe it is needed in this case because the studies/experience from US and Europe can be loosely extrapolated to other markets,and because the text uses the terms "suggest" and "many", which provide adequate caveats already/
Paul Leahy (University College Cork)	7	71	0	-	-	-	-	7.8	Scenarios from the literature e.g. ""Energy Revolution"" and ""BLUE"" are not adequately explained in this document.	The citations are provided, and the underlying documents provide those details. We do not wish to discuss the fundamental underlying characteristics of all of the scenarios presented in this section, due to space constraints.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	72	30	-	-	-	-	-	consider to add "and the ability of electric supply systems to integrate wind."	Present text already seems to directly make this point - we do not understand the benefit of the addition of this point to the one already made on this same subject.
China (China Meteorological Administration)	7	72	21	72	24	7.9.3	-	-	Add "in Europe and U.S.". The reason is same as No.10 comment.	The discussion in Section 7.9 focuses on GLOBAL modeling, which includes China and everywhere else. These are not limited to the US and EU, so this change cannot be accepted.
Jos Beurskens (ECN Wind Energy)	7	72	23	-	-	7.9.3	-	-	Skip ¿reach or¿.. The success of new renwable sources also dedends on the success of implementing energy saving and efficiency measures!	We see no reason to make this change. Though the point on energy demand is true, we do not see how it influences the argument here.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Paul Leahy (University College Cork)	7	72	18	72	30	7.9.3	-	-	The conclusions are not fully supported by what has been presented in section 7.9. Most of the emphasis was on near-term (2015) or longer term (2050) but 7.9.3. refers only to 2030.	Though there was some emphasis on 2015/2050 earlier, there was also discussion of 2030. 2030 is especially important because the IPCC AR4 focused on 2030, and one purpose of this section was to compare the recent literature to the IPCC AR4 estimate. That is the principal reason that we refer to a 2030 value in the conclusion, though the conclusion also mention a longer term possibility of 20%. We do believe that the text in this section supports the figures provided here. See figure 7.22 as well as the text underneath the figure on the 2030 median case.
Germany (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	7	74	36	-	-	-	-	-	Betke, K, Schultz-von Glahn, M, and Matuschek, R (2004) Underwater noise emissions from offshore wind turbines. Proc CFA/DAGA 2004, Strasbourg.	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.
United States (U.S. Department of State)	7	78	6	-	-	-	-	-	"Elliot" should be "Elliott".	Accepted
United States (U.S. Department of State)	7	78	8	-	-	-	-	-	"Elliot" should be "Elliott".	Accepted
United States (U.S. Department of State)	7	78	10	78	11	-	-	-	The reference is incorrect. This paper is 6 pages (not just 2 pages), and it is published in IEEE Power Engineering Review. The correct reference is given below. Elliott, D., 2002: Assessing the world's wind resources. IEEE Power Engineering Review. Vol. 22, No. 9, 4-9. I am not exactly sure how to specify the information for the reference, but the paper is on pages 4-9 of the publication.	Accepted
Germany (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	7	79	32	-	-	-	-	-	Garthe, S. and Hüppop, O. (2004). Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. Journal of Applied Ecology. 41:724-734.	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	7	81	20	81	22	-	-	-	Replace the reference by Heimiller et al on page 81 since that was a draft tbd document. Marc Schwartz is the lead author on the final published document. Replace it with the following: Schwartz, M., Heimiller, D., Haymes, S., Musial, W. 2010: ¿Assessment of Offshore Wind Energy Resource for the United States¿, NREL/TP-500-45889. 104pp. National Renewable Energy Laboratory, Golden, CO.	Accepted
Germany (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	7	86	3	-	-	-	-	-	Lucke, K., Siebert, U., Lepper, P.A., Blanchet, M.-A., 2009: Temporary shift in masked hearing thresholds in a harbor porpoise (Phocoena phocoena) after exposure to seismic airgun stimuli. Acoustical Society of America, 4060-4070	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.
Germany (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	7	86	19	-	-	-	-	-	Madsen P.T., Wahlberg M., Tougaard J., Lucke K. and Tyack P. (2006) Wind turbine underwater noise and marine mammals: Implications of current knowledge and data needs - Review. Marine Ecology Progress Series, 309: 279-295.	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.
Miriam Ester Limia (of Meteorology)	7	87	25	-	-	-	-	-	If the proposed test in comment # 11 is added on page 62, insert the following bibliography: C. Moreno, J. M. Martínez, G. Leyva, A. Roque, R. Novo, A. Costa, C. Llanes, O. Herrera, A. Sarmiento, R. Pérez, M. Limia, A. Montesinos and M. Menéndez, 2007: Ten Quenstions and Answers About Wind Power (in Spanish), Editorial CUBASOLAR, Havana, Cuba, 335 pp.	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.
Germany (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)	7	92	39	-	-	-	-	-	Tougaard, J., Carstensen, J and Teilmann, J. (2009) Pile driving zone of responsiveness extends beyond 20 km for harbor porpoises (Phocoena phocoena (L.)) (L) J. Acoust. Soc. Am., Vol. 126(1): 11-14.	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.
Juan Llanes (Centre for Environmental Studies)	7	-	-	-	-	-	-	-	Chapter comment: Please provide information about energy potentials from windfarms and space needed (GWe/ m2)	This information is already provided on page 45.
Patrick Matschoss (TSU)	7	-	-	-	-	-	-	-	check definitions in glossary: p. 8, l.17-20; liaise with chapter 1 if not consistent	Accepted
Finland (Finniah Meteorological Institute)	7	-	-	-	-	-	-	-	Could one add here some examples on practical RE policies, like the EU's target for the renewables and IRENA?	Policy details of this nature are discussed in the Policy Chapter of the SRREN. Each technology chapter was given just 1 page to discuss policy issues.
Ladislaus Rybach (Geowatt AG Zurich (company))	7	-	-	-	-	-	-	-	My comments to Chapter 7 of the FOD have been considered, except: The Executive Summary still needs to include numbers about costs.	As per the ZOD comment, information on costs is now provided in the executive summary, see page 6.
Peter de Haan (Ernst Basler + Partner AG)	7	-	-	-	-	-	-	-	no comments from Reviewer P de Haan	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Morgan Bazilian (UNIDO)	7	-	-	-	-	-	-	-	Overall, very well written and coherent. Very technical and for a specific power system audience.	Accepted
Dr. Md. Sirajul Islam (North South University)	7	-	-	-	-	-	-	-	WIND: Once ship run by wind¿whether a combination of wind+other to run ship is possible	The possible use of wind in marine transport is covered in Box 7.1. It is unclear what other material is desired by this reviewer.
Jos Beurskens (ECN Wind Energy)	7	-	-	-	-	7.2	-	-	General comments on chapter 7.2: The content of this chapter is excellent. However I am missing three elements which I consider important: 1. A remark on the height the resource is measured. As the wind speed and thus the power density inceases considerable with height this issues needs to be mentioned in relationship with the rotor height. This aspect however is mentioned on page 19, but needs to addressed briefly in this chapter as well. 2. Some remarks on the variability of the wind: over the years (e.g. in the Netherlands + or ¿ 30% compared to the long term average of the energy density), over the 24 hour day, the seasons, the direction. 3. The significance of the use of a wind atlas in the development of wind energy in general. In Europe it was the European Wind Atlas, developed within the Wind Energy Programme of the European Commision under the leadership of Risø, Denmark and theUS Resource studies (Batelle).	1. Height is addressed in Table 7.1, where available, but we will note that this factor impacts resource potential in the text as well, especially when referring to technology advancements. 2. Some discussion is offered in section 7.5, as mentioned in the introduction to section 7.2. 3. However, yearly changes is missed. In the introduction to the resource potential section, we refer to section 5. But, in the intro to Section 2, we can be more clear that variability over multiple time scales, including interannual, are addressed in section 5. Then, on page 30/line 38, we would add more information on variability over multiple time scales. We will add some additional text on page 15 adding the importance of wind resource mapping at the start of a country's wind development.
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	-	-	-	-	7.2.1	-	-	Extensive use of footnotes to provide information that cannot be deleted is impairing readability. Please limit length and amount of footnotes.	The many footnotes have been added due to past review comments on the chapter. Removal of these footnotes would therefore be inconsistent with our incorporation of past review comments.
Finn Gunnar Nielsen (Statoil)	7	-	-	-	-	7.2.2.1	-	-	Same comment as for table 7.1	The citations provided are all accurately rendered, and footnote 3 provides some details on the assumptions used by these studies, as does Table 7.1. Further details of course can be found in the source documents, and we do not wish to expand the text further to cover these study-specific details.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Jos Beurskens (ECN Wind Energy)	7	-	-	-	-	7.3	-	-	General comments on chapter 7.3: Up scaling of wind turbines beyond 80 to 100 meters of diameter is driven by the cost breakdown of offshore wind turbines. Offshore foundations are very expensive and relatively insensitive to the load they need to carry. Thus the larger the tyrbine the better from the cost point of view. Furthermore the fewer wind turbines are being applied in a certain area, the fewer cable connections need to be realised. That saves cost and increases reliability. These elements are not well pointed out. In the future energy efficiency of wind farms can be increased by new ways of laying out the individual wind turbines and associated control systems. This issue has not been mentioned.	Comment already addressed adequately in section in our view. Section 7.7.3.6 - second sentence: Upscaling provides an opportunity to reduce overall offshore wind electricity costs. The second point is discussed in 7.7.3.3.
Antoine BONDUELLE (E&E Consultant)	7	-	-	-	-	7.3.3	-	-	Section 7.3.3 (standards and certification) is quite useful and should be retained	Accepted
Peter B¿rre Eriksen (Energinet.dk)	7	-	-	-	-	7.5	-	-	Easy to read and follow.	Accepted
Peter B¿rre Eriksen (Energinet.dk)	7	-	-	-	-	7.5	-	-	Good and logic overall structure with a clear description of concepts status.	Accepted
United States (U.S. Department of State)	7	-	-	-	-	7.5	-	-	It is the consensus of the review panel that section 7.5 is well written and should be used in the final IPCC report. The authors should, however, ensure that the information in Chapter 8 regarding grid integration of wind power does not overlap with information in section 7.5. Chapter 7 should be inclusive of wind-specific integration issues only.	Section 7.5 should focus only on wind integration, particularly at low to medium pentration levels. 7.5 and chapter 8 should be coordinated to avoid overlap.
Charlie Smith (Utility Wind Interest Group)	7	-	-	-	-	7.5	-	-	Section 7.5, Near-term Grid Integration Issues, is very well organized and is presented in a very clear, concise, and authoritative manner. It was obviously written by experts in the field who knew what they were talking about, and were able to provide insights into system planning and operation with significant levels of wind power. The judicious use of references illustrates familiarity with the literature, and particularly the most recent results from the large and comprehensive studies carried out in Europe and North America, without being overdone. Given the density of the information and the tightness of the text, I would not look to make cuts in this section to meet the page count.	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Sweden (Swedish Environmental Protection Agency)	7	-	-	-	-	7.5	-	-	The division in subchapters like "results from integration studies" and "operating electric systems with wind energy" naturally results in quite a bit of the same information occuring twice in the report. Maybe the whole chapter 7.5 could be shorteneed by lookikng att passages that are redundant since the same thing is aleradey said. The words "Near-term" in the title could be taken away. "Long-term" integration is never treated, I guess since the it is not defined what Near-term is. Name the chapter "Grid integration issues"	The discussion of wind integration issues in Chapter 7 section 5 deals only with low to medium levles of wind penetration which implies that these are near term issues. Higher levels of penetration were intended to be addressed in Chapter 8 (for the reasons discussed in the response to the next comment), and we do not have the discretion to change the title of the section at this time as it was agreed to by the IPCC plenary. It is worth reviewing section 7.5 to ensure that there are no redudant sentences within the chapter and between 7.5 and 8, however, and we will endeavor to do so.
Antoine BONDUELLE (E&E Consultant)	7	-	-	-	-	7.5	-	-	This section insists on the difficulty of integration of wind, but does not emphasis that integration to the grid may be a universal character of any technology. Maybe this could be mentioned in introduction 7.5.1.	We believe that the section provides a balanced perspective, and opt for conservatism where conservatism seems warranted. The addition of natural gas plants to a power system, for instance, is not a simple task, but the issues related to adding a small synchornous, flexible power plant to the power system are very different than location constrained variable generation. We should not downplay the importance of making changes to the power system to manage variable generation. However, in the introduction of the section, we will note that wind is not completely unique here: other renewables and even non-renewables also have integration issues to address, as are covered in Chapter 8.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Jos Beurskens (ECN Wind Energy)	7	-	-	-	-	7.5.4.1	-	-	One issue that is not addressed deals with the lower efficiency if certain fossil fueled plants are being used to balance supply and demand. With increasing penetration of wind energy the average load of fossil plants may decrease and thus the average efficiency as well. This has a slightly negative effect on the reduction of GHG of wind energy. Could also be added to section 7.6.1.1 Other issues which have not been (sufficiently) addressed: The use of interconnectors between countries (Norway-Netherlands, Netherlands-GB, Norway-Denmark, etc.) provide an extra dimension for balancing. E.g. wind and hydro as a fast balancing option. Some of these interconnectors have already been installed and others are under construction or in the preparation phase. Untill now these interconnectors proved to be very successful. In a recent phd study by Ummels of the TUDelft he showed that international trade of electricity will increase the maximum allowable penetration degree of wind energy considerably and thus making the use of expensive storage systems obsolete.	The first comment about the lower efficiency and the emissions implications is dealt with in section 7.6.1.3 (Indirect variability impacts), but we should note the impact on fossil plant efficiency near the top of page 36 as well. The second comment regarding the role of interconnector capacity as a source of balancing has not been adequately addressed in this section (although in the introduction we say that "...improvements in the interconnections between electric systems..." will be dealt with in Chapter 8), and we will seek to include a reference to the importance of interconnector capacity to wind balancing in the text of section 5, perhaps on page 35.
Paul Smith (University College, Dublin)	7	-	-	-	-	7.5.4.2	-	-	Electric power system blackouts, or even limited interruptions of firm supplies, occur due to relatively infrequent incidents. Therefore the fact that individual power sysetms have survived short periods of high instantaneous wind penetration does not mean that these situations were secure.	The commenter is correct - we should be careful not to point to these examples as proof that the systems were always operated with the same level of reliability as they would have been without wind. Right now the first sentence indicates that these systems were always secure ("Actual operating experience...demonstrates that wind energy can be reliably integrated into electric systems."). This sentence should be revised. The same revision will then need to flow through to all aspects of the chapter/ES/TS/SPM. We will also qualify the statements, citing recent research (2010 EirGrid) and the need to do more.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	7	-	-	-	-	7.6	-	-	A more systematic risk analysis is needed for evaluating the ¿nature and magnitude¿ of the ecological risks because, as the authors point out, the potential effects are very site specific and diverse. NREL funded the development of this type of risk framework for gigawatt scale deployments in order to move forward with this analysis. The reference is below and could be included. Below are a couple of quotes that could be used: ¿We have to better understand how reducing the potential local risks of wind deployments compare with the option of not deploying wind and, therefore, not reducing our carbon footprint over time.¿ ¿Loss of species from climate change and mountaintop removal are examples that need to be weighed against what now appears to be relatively localized and temporal environmental effects from wind turbines at individual sites. Albeit greater risks to endangered species, species of concern, and critical habitat raise an important conundrum that requires open debate and decision making among stakeholders within the context of wind and other renewable energy benefits." Ram, B. 2009. An Integrated Risk Framework for Gigawatt-Scale Deployments of Renewable Energy: The U.S. Wind Energy Case, (NREL/SR-500-47129). National Renewable Energy Laboratory, Golden, CO.	We prefer to focus this section on peer-reviewed scientific literature, where possible. The text already makes the case for the site specificity of the impacts, the impacts from other generation sources and climate change, and the need for better comparative assessments. Further more-detailed discussions of the need for comparative assessments and relative risk are better placed in the Sustainable Development chapter perhaps than in the wind chapter per se, though the point is of course a good one. We will review the citation for possible inclusion, as well as locations in the text for addressing relative risk a bit more strongly. TSU should send this comment to Chapter 9 for consideration.
United States (U.S. Department of State)	7	-	-	-	-	7.6.1	-	-	One pretty important environmental benefit, in terms of the GHG reduction opportunities by wind, that should be mentioned here is that it has a low "carbon opportunity cost" associated with it relative to other generation options. In other words, MW of wind can be deployed and achieving emissions reductions far more quickly than, say, a nuclear plant, which can require four or five times longer to come online. See Mark Jacobson (2009), "Review of energy solutions to global warming, air pollution, and energy security" in the journal Energy and Environmental Science.	In multiple places in the text, the chapter authors have described the ability of wind to offer a near-term and speedly method of reducing CO2 emissions, so we believe that this point has already been adequately covered. The process of describing carbon "opportunuity cost" specifically does not seem worth the space required. In addition, the relative speed of constructing wind relative to nuclear or CCS requires comparing wind to conventional energy options, something that the wind chapter has tended to try to stay away from, as those comparisons are better left to the SRREN intgrative chapters.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Steve Sawyer (Global Wind Energy Council)	7	-	-	46	-	7.6.3.1	-	-	p30 of chapter 9 states: "turbines can easily and safely coexist with all types of radar radio installations" this should be the main message.	The message of the section is largely consistent with this statement already, but is focused on scientific studies rather than sweeping statements. We prefer not to make sweeping statement due to site-specific impacts and to avoid concern that we are overstating the case.
Steve Sawyer (Global Wind Energy Council)	7	-	-	46	-	7.6.3.1	-	-	p30 of chapter 9 states: "turbines can easily and safely coexist with all types of radar radio installations" this should be the main message.	The message of the section is largely consistent with this statement already, but is focused on scientific studies rather than sweeping statements. We prefer not to make sweeping statement due to site-specific impacts and to avoid concern that we are overstating the case.
Japan (the Japanese Ministry of Foreign Affairs)	7	-	-	-	-	7.6.3.3	-	-	The discussion that infrasounds have no impact on human health is written in Chapter 9 Page 29 lines 20-22 and not spotlighted at all here, in this section dedicated to "noise, flicker, health and safety." If there is really enough evidence to prove that there low frequency noise is indeed harmless to human health, it should be discussed here as well.	Infrasound impacts have received very little scientific attention focused on wind specifically, but have generated a lot of controvery. Since little is absolutely known in this area, we have chosen to keep the text somewhat general. Nonetheless, we will review this literature again to determine what can, and what should not, be said at this point based on the available literature.
Patrick Eickemeier (Potsdam Institute for Climate Impact Research)	7	-	-	-	-	7.6.3.3	-	-	The heading is an inconsistent listing, as health and safety are no "Impacts on humans" (heading 7.6.3)	We fail to see how impacts on human health and safety are NOT "impacts on humans." As such, we will leave the text as is. It is true that the impacts are not sizable, in general, but that is discussed in the text. The heading therefore seems appropriate.
Jos Beurskens (ECN Wind Energy)	7	-	-	-	-	7.7	-	-	General comments on chapter 7.7: It is important to state in the beginning of this chapter that technology includes not only the wind turbine and its components but also the wind power plant (wind farm and its connection to the grid), installation and transport (In particular relevant for offshore applications) and O&M systems. This chapter is excellent, although it could be more compact and structurised.	We agree, and will seek to weave this thread of project-level optimization (especially given larger project sizes onshore and offshore) in at the beginning of this section, and then throughout. Define "system" in first sentence of section 7.7 and in 7.7.2.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Peter Johnston (Environmental & Energy Consultants, Ltd)	7	-	-	-	-	7.7	-	-	Regarding R&D and future prospects for wind energy, two areas seem to be missing: a) prospects for cost-effective wind energy in regimes with low wind speeds. Is much research underway for developing wind electric systems in areas where the wind speed is typically < 5m/s? b) small wind systems. The trend is ever larger systems, with most (?) current work on 2+MW turbines. In many locations in small, less developed tropical countries, practical wind systems would be those that are considerably less than 1 MW in low windspeed regimes. Is there much prospect for development?	This concept, along with others, will be integrated in Section 7.3.2 to address several similar comments, but perhaps not to the depth requested here.
Jos Beurskens (ECN Wind Energy)	7	-	-	-	-	7.7.2	-	-	Suggestion: add: The European Integrated wind energy project UpWind will produce an cost engineering model by means of which also the impact of innovations in up scaling, concept and components on the cost of energy is analysed.	Add mention in 7.7.2, focus on offshore
Finn Gunnar Nielsen (Statoil)	7	-	-	-	-	7.7.3.3	-	-	Add a statement that for large offshore wind farms, several hundred MW instaled power, optimization wrt siting and operation becomes very important. I.e. optimization of single turbines is not suffient.	p. 52, line 43 mentions individual turbines and wind power plants
Finn Gunnar Nielsen (Statoil)	7	-	-	-	-	7.7.3.6	-	-	Add a statement about offshore access systems. Presently access to offshore wind turbines has severe weather restrivtions for access. However, new advanced systems are under development and testing. These systems will lift the restrictions signifcantly	These issues are addressed already beginning on line 4 of page 54. It is unlear what additional information is suggested by the reviewer. Change p. 54, line 7 "evaluated" to "under consideration and development"
Finn Gunnar Nielsen (Statoil)	7	-	-	-	-	7.7.3.6	-	-	Floating foundations make it possible to make a full assembly of the wind turbine in sheltered water. This will reduceinstallation costs and make the installation less weather sensitive.	p. 54, line 35 mentions simplified installation practices for floating turbines, which we believe is sufficient.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	-	-	-	-	7.7.4	-	-	Large shares of the information given in this section could be included in the respective subsections in 7.7.3 and 7.7.2. Moreover the whole section sounds like there is a necessity to justify ongoing research in all areas concering wind energy. Reorganizing/Renaming could maybe decrease this impression.	Ongoing research in wind energy provides an opportunity for achieving greater cost reduction and performance improvements. Thus we retain this section.
Sweden (Swedish Environmental Protection Agency)	7	-	-	-	-	7.7.4	-	-	The whole section can be removed. The references are generally rather old and the fact that further development needs underpinning science knowledge should be rather obvious, The listing of areas that need fundemental science includes almost all areas of wind energy. It seems to be no focus of the most important areas but just a listing of what different sources pointed out as important.	This section provides a very brief historical perspective on research advances including contemporary work. We retain this section as we believe it provides important context for the techical advancements and cost reduction potential for wind.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Sweden (Swedish Environmental Protection Agency)	7	-	-	-	-	7.8.3	-	-	It not clear to what exten the values of installed cost in chapter 7.8.3.1 and later as cost per MWh in chapter 7.8.3.4 includes the cost for transmission (investments and grid operating costs)	As noted in the intro text, "the costs of integration and transmission are not covered here, but are instead discussed in Section 7.5. However, in the first sentence of section 7.8.1 we will further clarify this point by saying the "generation cost," and we will look for ways to integrate this language later in the chapter as well.
Sweden (Swedish Environmental Protection Agency)	7	-	-	-	-	7.8.3.3	-	-	In the fiirst paragragh in section 7.8.3.3 it should be pointed out that one of the main reasons for the increaes capacity factor is due to the trend towards larger rotor diameters for a given installed capacity. This results in larger capacity factors at the same type of sites with newer turbines with more swept area per kW name plate power. Capacity factor is not always such a good meassure of the energy production. Think of two turbines with 2 MW namplate capacity. One has a 80 meter diameter and the other a 100 meter diamater. The incerase in swept area of 56 will result in substantial incerase in energy caputre, lets estimate 40% (some of the energy is captured above rated wind for which the power will be 2 MW fro both mascines). The capacity factor (full load hours) will thus incerase by the order of 40% (e.g. from cf=25% to 35%) with same wind condition. Partly this is commented in line 22 at page 62. However, I think that it should be elaborated a little bit around the fact that the higher capacity values in some nwer markets compared to older European markets is due to newer turbines with larger swept area per installed power.	This point is addressed adequately in 7.8.2.3, and in footnote 26, in our view..

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Steffen Schlömer (IPCC WGIII)	7	-	-	-	-	7.8.4.3	-	-	You present future LCOEs as percentage cost reductions over time based on a review of more complex models that take into account feedbacks between deployment and costs as well as engineering cost models. Presenting future LCOEs independent from deployment levels is masking feedback effects from learning-by-doing and, hence, should be used with caution (as you rightly pointed out). I think it is important to maintain consistency between future cost ranges and future deployment levels as analysed in the scenario analysis of chapter 10. I proposed a way to ensure this, which needs quite a bit of cooperation across chapters. Irresptively of how this will be perceived by the other chapters, you should probably make the deployment level ranges at 2020, 2030, and 2050 transparent and try to ensure consistency, I think. Below the methodology part of my comment to All SRREN on "future cost projections": "Collect the following data: - current deployment figures, e.g. for 2008 -> should be available for all technologies - ranges of current LCOEs -> available in AnnexIII - ranges of LRs for all technologies -> partly available, negative for hydro (resource constraint)? - lower and upper bound of future deployment forecasts from scenario analysis by 2020, 2030, 2050 -> available from scenario analysis? The lower range of LCOE by each respective year could then be calculated as LCOE(2020) = f (current deployment, high current LCOE, low LR, lower bound of deployment by 2020). The upper range and LCOEs for 2030, and 2050 could be calculated accordingly. This approach would ensure consistency between a presentation of future LCOE as a function of time and future LCOE as a function of future deployment."	We are not able to and do not want to link our cost ranges with specific levels of deployment, as those details are not offered in all of the studies on which these cost reductions are based. In addition, we find severe limits to the use of past learning rates for future costs. It perhaps would also suggest a level of precision that simply does not exist. All of that said, further cost reductions certainly depend on some level of deployment: if deployment stopped today, there would be no motivation for further advancements. As such,we will include some text indicating that the future cost reductions presented are dependent on reasonable levels of deployment. On the recommended cross-chapter approach, we do not believe that this should be pursued, for exactly the reasons that are described in the learning curve section chapter 7: the available learning curve literature simply is not up to the task in preparing future costs, across technologies. Even within wind, absent learning estimates for LCOE, which do not exist, we would not know how to extrapolate capital cost learning rates to LCOE estimates.

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Jos Beurskens (ECN Wind Energy)	7	-	-	-	-	7.9	-	-	General comments on chapter 7.9: The section on supply issues is a bit meager. The time dimension is missing. The availability of expertise and skilled personnel is a serious constraint. It should be addressed as well. This needs timely measures, to be initiated about 5 years preceding the actual needs. Vessels constitute a serious component in the supply chain for offshore applications. The grid needs to be in place before wind farms are being realized offshore! Planning takes more than 5 years. And there are more examples to be mentioned.	This will not be addressed in this section because supply-chain issues are of short-term nature, and this section is focused on 2050 long-term forecasts in which supply chain issues are presumed to be resolved. We will raise these issues earlier in the chapter, however, as these are major near term challenges. They will therefore be addressed earlier in the chapter.
United States (U.S. Department of State)	7	-	-	-	-	References	-	-	The authors may wish to add the following references to the chapter. These references utilize resource assessment methods based on satellite observations and the inclusion of these data, based on validity and consistency with the other data reported, made at the authors discretion. Capps, S. B., and C. S. Zender (2010), Estimated global ocean wind power potential from QuikSCAT observations, accounting for turbine characteristics and siting, Journal of physical Research, 115, D09101, doi:10.1029/2009JD012679. Capps, S. B., and C. S. Zender (2009), Global ocean wind power sensitivity to surface layer stability, Geophys. Res. Lett., 36, L09801, doi:10.1029/2008GL037063. Liu, W. T., W. Tang, and X. Xie (2008), Wind power distribution over the ocean, Geophys. Res. Lett., 35, L13808, doi:10.1029/2008GL034172.	We will review the citation for possible inclusion. It will be added if it adds useful content to the chapter.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	-	-	-	-	-	7.1	-	I don't really see how these two maps can be compared. They use different measurement heights, different color codes and it is not clear at all that wind resource in the older map should be smaller (apart from some areas for which there is no data in the left graph). I suggest using one of these maps to illustrate wind resource assessments and drop the comparison as it is more confusing than helpful in my opinion	We will remove the NREL map
Antoine BONDUELLE (E&E Consultant)	7	-	-	-	-	-	7.11	-	This figure is quite useful in the discussion on impacts on carbon emissions	Accepted

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Antoine BONDUELLE (E&E Consultant)	7	-	-	-	-	-	7.12	-	This figure is difficult to read, maybe only a cumulated figure (not historical) could suffice	We will add "annual" to the caption and labels accordingly to make this more clear.
Sylvie Ludig (Potsdam Institute for Climate Impact Research)	7	-	-	-	-	-	7.14	-	Color coding: in the top graphs, demand is given in blue and net demand in red and vice versa in the lower graphs. This is highly confusing and should be corrected. Maybe also include a more detailed information about what a ramp duration curve is into the text	Accepted
Antoine BONDUELLE (E&E Consultant)	7	-	-	-	-	-	7.2	-	Figure 7.2 is less useful because it lacks off-shore resources, is has a strong divergence between sources, and it does not match resource with likely energy demand (useful for other chapters¿). Maybe it could be removed.	Though we basically agree with the comment, we do believe it is useful to visually demonstrate that wind resource assessments and wind resource potential exists in many regions of the world, and these two graphics, even if not ideal, do serve that purpose/
Antoine BONDUELLE (E&E Consultant)	7	-	-	-	-	-	7.21	-	Figure 7.21 (absolute energy figures) is redondant with figure 7.22 (relative figures)	Based on inter-chapter discussions among the LAs for the SRREN, both figures are to be presented, especially since the SRREN TSU has asked all chapters to emphasize EJ figures, as per IPCC convention.
Rainer Walz (Fraunhofer Systems and Innovation Research)	7	-	-	-	-	-	7.6	-	add year of publication of the reference	There is no publication per se associated with the figure; it is instead a figure on file at NREL
Finn Gunnar Nielsen (Statoil)	7	-	-	-	-	-	-	7.1	Check if not the offshore potential is underestimated. The potential is increasing rapidly as water depth and distance from shore limits are pushed. As a minimum the assumed water depth limit / distance to shore limit used should be stated.	The citations provided are all accurately rendered, and footnote 3 provides some details on the assumptions used by these studies, as does Table 7.1. Further details of course can be found in the source documents, and we do not wish to expand the text further to cover these study-specific details. We will provide clarification that offshore potential depends on distance from shore and depth, but that these are also highly dependent of economics, and we will link this to where projects are really located as per these variables.

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	7	-	-	-	-	-	-	7.1	Comments and suggestions for this table include: 1. Krewitt et al. (2009) updated Hoogwik and Graus (2008), according to the text in the Methods and Assumptions. In the Results column, the potential from Krewitt is called "Technical" whereas the potential from Hoogwik and Graus is called "Technical/Economic". However, from the information presented, it's likely that Krewitt potential is actually "Technical/Economic" and not just "Technical". For example, the updated potential in Krewitt is about 10% greater than the technical/economic potential in Hoogwik and Graus, which makes sense from the revised offshore assumptions in in the updated study. Therefore, please change "Technical" to "Technical/Economic" in the Krewitt row. 2. The different variations for the terms in the Technical in the Results column is confusing throughout the table. The four variations are: 1) Technical, 2) Technical (limited constraints), 3) Technical (more constraints), and 4) Technical/Economic. It seems the results in 1, 2, and 4 are all based on "limited constraints" such as some exclusions etc. Only the results in 3 are based on more constraints which vary from 4% to 20% of the technical potential. To avoid confusing the reader, It is recommended that in 2, the term "Technical (limited constraints)" be changed to the term "Technical". In 3, It is recommended that the term "Technical (more constraints)" be changed to "Technical Constrained". Somewhere in the text referring to Table 7.1, it should be noted that all the Technical potentials have at least some limited constraints. 3. In Archer and Jacobson (2005), the "48% average capacity factor" is extremely high and unrealistic for an average value, and I suspect this value is an error or a typo. 4. In WBGU (2004), it is recommended that we change the term "sustainable" to "constrained" in both the Methods and Assumptions column and the Results column. The sustainable potential here is just a form of a constrained potential, which is assumed to be 14% of the technical potential in this study. 5. In WEC (1994) and in Grubb and Meyer (1993), instead of saying "based on an early global wind resource map", it is recommended that we say "based on the global wind resource map by Elliott et al. (1981)". (This reference is already included in the SREEN document.) Otherwise, the reader does not know which early wind resource map was used in these studies.	1. we believe that krewitt has not applied economic screens, as did the studies that he built from, but will verify one final time. 2. it is impossible to impose greater structure on the table because the nature of the contraints imposed in each study vary, making it difficult if not impossible to strictly compare the level of the constraints across studies. Instead, all that can readily be done is to compare the constraints within individual studies. The only obvious exception to that rule is for Lu et al, where the assumptions border on a theoretical potential estimate, and where we prefer to use the limited constraints language even on an absolute basis. We will refer to the glossary terms where possible, but where needed will also note when we are forced to use different study-specific resource potential terms.

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United States (U.S. Department of State)	7	-	-	-	-	-	-	7.1	The variance in technical potential assumptions provides a huge range in both the offshore and land-based wind resource estimates. The authors have discussed this to some extent in 7.2.1 but we recommend bringing a summary of the various parameters and assumptions directly affecting the "technical potential" to the beginning of the section to help explain the large variance of results of table 7.1.	Such text is already provided in the paragraph directly following the table, and is therefore sufficiently prominent. A shorter statement to the same effect is the first sentence of section 7.2.
Finn Gunnar Nielsen (Statoil)	7	-	-	-	-	-	-	7.4	As the baseline for this table is 2002, the relevance may be questioned. Significant development has taken place since then. Further: The table seems to reflect onshore develpment only. For offshore turbines relevant keywords may be: new foundation concepts, including floating, improved reliability/ reduced O&M, improved access systems, reduced top head mass, park optimization etc.	This table is sourced from a published document and it is only relevant for onshore wind. The footnote does describe some improvements since 2002. Text in the previous parapraph will be added to note that a similar study for offshore wind is underway, but not yet completed.
Finn Gunnar Nielsen (Statoil)	7	-	-	-	-	-	-	7.5	Does civil work include foundation?	Yes, it does
United States (U.S. Department of State)	7	-	-	-	-	-	-	7.7	Standardization of units, table 7.7 is listed in GW, EJ is used elsewhere. Use one or the other or list both as reference.	We will seek to add EJ to the table.