



# INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



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

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Expert Review of the First Order Draft  
Dec 14, 2009 – Feb 8, 2010

### Chapter 5

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<sup>1</sup> see <<<http://ipcc.ch/pdf/ipcc-principles/ipcc-principles-appendix-a.pdf>>>, Section 4.1 and clarification in decision 8 on procedures taken at the 33rd Session of the Panel <<[http://www.ipcc.ch/meetings/session33/ipcc\\_p33\\_decisions\\_taken\\_procedures.pdf](http://www.ipcc.ch/meetings/session33/ipcc_p33_decisions_taken_procedures.pdf)>>

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**Expert Review of First-Order Draft  
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## Special Report on Renewable Energy Sources and Climate Change Mitigation, First Order Draft

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Considerations by the writing team
SCOWCROFT (EURELECTRIC)	5	0	-	-	-	-	-	-	For general comments on IPCC SRREN FOD Chapter 5 Hydropower see ancillary material: SREEN_Draft0_Review_Vahrenholt_Fritz_Material_01.ppt	Accepted
Rybach (Geowatt AG)	5	0	-	-	-	-	-	-	This chapter does not address long-term deployment in the context of carbon mitigation, especially in terms of TPES and hydropower share for the scenario categories I+II, III+IV and V+VI of IPCC AR4.	Is being taken care
Harby (SINTEF Energy Research)	5	5	34	5	34	-	-	-	"erase ""(e.g. variable speed generation)"	research i sgoing on
Vahrenholt (RWE Innogy GmbH)	5	5	10	-	-	-	-	-	"IPCC SRREN FOD: ""The undeveloped capacity ranges from about 70 percent in Europe and North America to 95 percent in Africa..."" RWEI Comment: The undeveloped technically feasible potential for hydropower is traceable, but does not represent the economically feasible hydropower potential which is significantly less, e.g. for Europe and North and Central America it amounts to about 25%. (Source: Hydropower & Dams 2008, pp. 15-17; VGB 2009)."	Accepted
SCOWCROFT (EURELECTRIC)	5	5	10	-	-	-	-	-	"IPCC SRREN FOD: ""The undeveloped capacity ranges from about 70 percent in Europe and North America to 95 percent in Africa..."". Our comment: The undeveloped technically feasible potential for hydropower is traceable, but does not represent the economically feasible hydropower potential which is significantly less, e.g. for Europe and North and Central America it amounts to about 25%. (Source: Hydropower & Dams 2008, pp. 15-17; VGB 2009)."	the ex sum will be edited according to input from th evarious subchapter
Harby (SINTEF Energy Research)	5	5	38	5	38	-	-	-	"please change ""less"" with ""short""	better language
Harby (SINTEF Energy Research)	5	5	35	5	35	-	-	-	"please list more envrionmental issues than ""fish friendly turbines"" as there are much more research on environmental issues "	its just an example
Christophersen (Climate and Pollution Agency)	5	5	13	-	-	-	-	-	"We propose that ""even if"" is changed to ""even though""	Accepted
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	5	3	-	-	-	-	-	Hydropower may also be derived from kinetic energy in flows, not only from potential energy between higher and lower elevations	move word "water": "from the energy of water moving from ---"
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	5	8	-	-	-	-	-	Precise : 14,368 TWh PER YEAR with	Accepted
Gagnon (Hydro-Quebec)	5	5	8	-	-	-	-	-	Suggestion: Based on cumulative site by site assessments, the total world technically feasible potential □	the data is based on referred journal

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de Campos (Petrobras)	5	5	34	5	36	-	-	-	The ongoing research in dam built technics, the enhanced power recovery from ecological flow rate of current hydropower, the mobile water dam development, new topographic also may ensure continuous improvement. (add to current text)	too detailed - will be refelcted in the main text
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	5	-	6	-	Exec. Summary	-	-	I may be wrong, but I did not see any words related to the role of pumped storage hydro in the executive summary. It reflects the fact that section 5.3.1.3 on this topic poorly addresses the issues and opportunities associated to pumped-storage.	Accepted
Taylor (International Hydropower Association (IHA))	5	5	12	5	12	Executive Summary	-	-	"Add ""distribution and magnitude of"" before ""resource potential for hydropower could change due to a changing climate"" and add immediately after "", however the total amount of water in the hydrologic cycle will remain the same"". Reason: There is a widely held misconception that climate change means less water available to harness for hydropower. However, the amount of water in the hydrologic cycle will remain the same as it has always been, it is just the distribution and magnitude that change."	Accepted
Taylor (International Hydropower Association (IHA))	5	5	27	5	27	Executive Summary	-	-	"Delete ""based"" and add ""Whether a hydropower scheme is connected to a grid or not is also a relevant typology"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	accept to delete " based" for the rest see if this is refelcted where typology is discussed
Taylor (International Hydropower Association (IHA))	5	5	16	5	16	Executive Summary	-	-	"Delete ""large"" and replace with ""reservoir"". Reason: All hydropower generates the same technology, irrespective of scale. Relevant technical/scientific differences include how a hydropower scheme stores its water and, perhaps, whether it is connected to a grid or not. Therefore if categorisation is to be used it should be ""reservoir"", ""run-of-river"", ""pumped storage"" and ""off-grid"" (as necessary). Categorisation by ""large"" or ""small"" falls into the trap of policy rather than science. ""Large"" and ""small"" vary widely across regions and countries from 1 to 50 MW reflecting the policy choices of a particular region or country. Additionally, the categorisation by ""large"" or ""small"" fails to encompass real sustainability considerations. For example, ""large"" project socio-environmental impacts must be compared with the cumulative effect of multiple ""small"" projects over a given geography. No other renewable energy technology is categorised in this way. It is fundamental that the debate between ""large"" and ""small"" be recast to accurately reflect the technical/scientific nature of the renewable technologies and highlight the sustainability choices societies must make according to current and future needs."	Accepted

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Taylor (International Hydropower Association (IHA))	5	5	22	5	22	Executive Summary	-	-	"Delete ""large"" and replace with ""reservoir and pumped storage hydro"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	Accepted
Taylor (International Hydropower Association (IHA))	5	5	29	5	29	Executive Summary	-	-	"Delete ""new"" and replace with ""continually advancing"". Reason: sustainability guidelines for hydropower are not new."	Agree - check with text inside chapter
Taylor (International Hydropower Association (IHA))	5	5	15	5	15	Executive Summary	-	-	"Delete ""several"" and replace with ""many"". Reason: There have been more than ""several"" countries where hydropower development has been a catalyst for economic and social development."	Accepted
Taylor (International Hydropower Association (IHA))	5	5	19	5	19	Executive Summary	-	-	"Delete ""Small"" and replace with ""Run-of-River"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	use "small run of river"
Taylor (International Hydropower Association (IHA))	5	5	33	5	33	Executive Summary	-	-	"Delete ""what may"" and replace with ""which can"". Reason: ""can"" better reflects the affirmative nature of international cooperation than ""may""."	Accepted
Taylor (International Hydropower Association (IHA))	5	5	1	6	22	Executive Summary	-	-	Comment: Subject to my suggested edits above, overall the Executive Summary adequately reflects the general state of affairs for hydropower in the world today.	Accepted
SCOWCROFT (EURELECTRIC)	5	6	20	6	22	-	-	-	"IPCC SRREN FOD: ""..., multipurpose hydropower projects may have an enabling role beyond the electricity sector as a financing instrument for reservoirs, helping to secure freshwater availability."" Our comment: We considers it to be fair and economically feasible if for multipurpose hydropower projects each stakeholder bears his own development costs."	adds a new message not intended in ES, covered under 5.8.2
Vahrenholt (RWE Innogy GmbH)	5	6	20	6	22	-	-	-	"IPCC SRREN FOD: ""..., multipurpose hydropower projects may have an enabling role beyond the electricity sector as a financing instrument for reservoirs, helping to secure freshwater availability."" RWEI Comment: RWEI considers it to be fair and economically feasible if for multipurpose hydropower projects each stakeholder bears his own development costs."	adds a new message not intended in ES, covered under 5.8.3

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SCOWCROFT (EURELECTRIC)	5	6	6	6	7	-	-	-	"IPCC SRREN FOD: "...1163 hydropower projects are in the CDM pipeline, □However, very few projects have so far received credits."" Our comment: The complex and extensive procedure as well as the ambitious criteria for a CDM credit to be granted should be mentioned in the report."	Accepted
Vahrenholt (RWE Innogy GmbH)	5	6	6	6	7	-	-	-	"IPCC SRREN FOD: "...1163 hydropower projects are in the CDM pipeline, □However, very few projects have so far received credits."" RWEI Comment: The complex and extensive procedure as well as the ambitious criteria for a CDM credit to be granted should be mentioned in the report."	Accepted
Ulleberg (Institute for Energy Technology)	5	6	1	6	1	-	-	-	"Proposal: Use the word ""variable"" instead of ""intermittent"""	to be defined in cahpter 1
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	6	5	6	7	-	-	-	the numbers could be updated according to the DCM project pipline (UNEP Riso_2010_CDM Project Pipeline), see attached file 01, being available online at: <a href="http://cdmpipeline.org/publications/CDMpipeline.xls">http://cdmpipeline.org/publications/CDMpipeline.xls</a>	Accepted
Verduzco (Chevron Corporation)	5	6	16	6	19	ES	-	-	Rephrase to improve clarity. Line 17 - Why are CHPand sugar cane ethanol long-term options?	comment to wrong chapter
Taylor (International Hydropower Association (IHA))	5	6	11	6	11	Execu tive Sum mary	-	-	"Add ""Conversely, hydropower storage also helps manage flood events in dry and wet regions."" after ""stress"". Reason: Hydropower storage also plays a critical role in flood prevention and mitigation."	Accepted
Taylor (International Hydropower Association (IHA))	5	6	7	6	7	Execu tive Sum mary	-	-	"Add ""In addition, while perceptions of the GHG footprint of hydropower remain extremely low, concensus on how to measure the exact GHG emissions status of reservoir projects is currently uncertain. For this reason most reservoir hydropower is excluded from the CDM. International scientific efforts are currently underway to resolve this issue."" after ""...have so far received credits."" Reason: This is a fuller reflection of the current situation regarding hydropowert and the CDM - UNESCO and IHA are currently undertaking an international project which is well underway to resolving this matter."	will not be reflected as proposed but will be considered in the main text
Louis (EDF Hydro Engineering Centre)	5	7	4	-	6	-	-	-	"delete ""Prior to □ and sawmills etc""."	Sentece is fine but fo rclarification "hydropower" replaced with "the power from water"
Abed (National Research Centre)	5	7	14	-	-	-	-	-	"omit: ""was"""	Accepted
Louis (EDF Hydro Engineering Centre)	5	8	5	-	-	-	-	-	"after ""installed"" add ""capacity"""	Accepted

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SCOWCROFT (EURELECTRIC)	5	8	25	-	-	-	-	-	"IPCC SRREN FOD: ""small hydro >1-100 MW"" Our proposal: Small hydro >1-10 MW, medium hydro >10-100 MW."	ref comm 34 Taylor
Vahrenholt (RWE Innogy GmbH)	5	8	25	-	-	-	-	-	"IPCC SRREN FOD: ""small hydro >1-100 MW"" RWEI Comment: Small hydro >1-10 MW, medium hydro >10-100 MW."	ref comm 34 Taylor
Louis (EDF Hydro Engineering Centre)	5	8	2	-	-	-	-	-	"replace ""Its great"" by ""Their great"""	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	8	-	10	-	-	-	-	"The exemplary illustrations (pictures) given are not identified (e.g. ""Figure"", ""Illustration"", etc. ) and there are no references in the text to the pictures. "	Accepted
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	8	25	-	-	-	-	-	"Threshold of 100 MW separating small and medium hydropower projects might be questioned ; or a reference should be given (from World Bank, from IHA, from ICOLD ?) that supports this classification"	ref comm 34 Taylor
Jara Tirapegui (Endesa Eco S.A.)	5	8	16	8	27	-	-	-	As the author says, the classification varies in each country, but it's not clear the criterion to the classification, or indicate the information source.	ref comm 34 Taylor
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	8	22	-	-	-	-	-	Please use a dot instead of a comma for the given number	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	8	23	-	-	-	-	-	Please use a dot instead of a comma for the given number	Accepted
de Campos (Petrobras)	5	8	8	8	10	-	-	-	The majority of high head hydropower potential had been explored. The remain hydropower potential has low head features. To enhance the electrical power in low head sites ones must construct dam and consequently create larges reservoir.(add to current text)	not true in all countries
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	8	16	8	27	-	-	-	What are comparable and common ranges of size classifications in the literature? Please give a short reference of common classifications or numbers.	ref comm 34 Taylor
Taylor (International Hydropower Association (IHA))	5	8	14	9	12	5.1.2-5.1.2.1	-	-	"Delete entire section and replace with a section based on the following typologies: reservoir, run-of-river, pumped storage and off-grid. Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3"".. In addition Section 5.1.2.1 completely contradicts the latter half of the preceding section."	new text will be proposed for these issues also in accordance to TSU memo from september 03 2009
Jara Tirapegui (Endesa Eco S.A.)	5	8	-	-	-	5.1.2.1	-	-	The figures dont' have reference number	Accepted
Kruger (South African Weather Service)	5	8	27	8	28	5.1.2.1	-	-	The images should be given as figures with proper captions.	Accepted

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Louis (EDF Hydro Engineering Centre)	5	9	5	-	12	-	-	-	Large and small hydro have a role to play in the global community development. Total world hydro capacity amounted to 887 GW in 2009 up from 848.5 in 2008 (source Hydropower & Dams world Atlas 2009). There are currently 172 GW under construction. Large hydro connected to the UHV grid will meet the national and regional energy needs while small hydro will satisfy local community needs, specifically when the area is not connected to the grid. Large hydro will usually rely on international financing and international suppliers while small hydro can in many cases rely on domestic suppliers. Both have been successful in contributing to the development of the areas where they have been built.	ref comm 34 Taylor
de Campos (Petrobras)	5	9	18	9	20	-	-	-	The specific rotation, i.e, the relation between head and discharge determines the type of hydraulic turbine to be used. For instance, Itaipu, a high head hydroelectric is powered by Francis Turbine (correct the text)	topic moved to technology classification
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	9	21	9	25	-	-	-	What are comparable and common ranges of size classifications in the literature? - e.g. head height for dam projects according to the classification of small (<15m) and large dams (>15m) from the International Commission on Large Dams (ICOLD).	ref comm 34 Taylor
Jara Tirapegui (Endesa Eco S.A.)	5	9	-	-	-	5.1.2.2	-	-	The figures dont' have reference number	Accepted
Kruger (South African Weather Service)	5	9	25	9	26	5.1.2.2	-	-	The images should be given as figures with proper captions.	Accepted
Harby (SINTEF Energy Research)	5	9	-	-	-	-	X	-	The photo of Tyssedal power plant does not really show the idea of a high head power plant. A picture including the reservoir at high altitude or a sketch may show this better	will find better picture
Louis (EDF Hydro Engineering Centre)	5	10	14	-	-	-	-	-	"after ""grid"", add ""(fast start capability, flexibility, reliability)""	Accepted
Louis (EDF Hydro Engineering Centre)	5	10	17	-	20	-	-	-	"not relevant with the title of the section ""maturity"", delete"	ref comm 34 Taylor
Jara Tirapegui (Endesa Eco S.A.)	5	10	6	-	-	-	-	-	"Superscript correction in ""m2""	Accepted
Ulleberg (Institute for Energy Technology)	5	10	18	10	20	-	-	-	Energy payback ratio is not directly related to maturity of technology (e.g. fossile fuel based technologies that are mature can have an unfavorable energy payback ratio). Suggestion: Delete the last sentence in this paragraph.	will need to be kept in the introduction under a different heading
de Campos (Petrobras)	5	10	18	-	-	-	-	-	Hydraulic energy (pressure and velocity) is converted into mechanical energy in the turbine and, then, converted into electrical energy in the generator. (correct the text)	Accepted

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Louis (EDF Hydro Engineering Centre)	5	10	4	-	6	-	-	-	Idea understood but sentence not clear. Should be rephrased	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	10	6	10	7	-	-	-	The given illustration with the example of Lake Mead and the Hoover Dam do not seem to fit in the rather general classification scheme of dam purposes given in advance and after this paragraph. I suggest using a textbox for this example.	ref comm 34 Taylor
Jara Tirapegui (Endesa Eco S.A.)	5	10	-	-	-	5.1.2.3	-	-	The figures dont' have reference number	Accepted
Kruger (South African Weather Service)	5	10	6	10	7	5.1.2.3	-	-	The image should be given as a figure with a proper caption. Reference should be provided for statements on the right.	Accepted
Taylor (International Hydropower Association (IHA))	5	10	29	10	29	5.2.1	-	-	"Add ""which vary according to time and space"" after ""...energy supply and pricing""."	Accepted
Gagnon (Hydro-Quebec)	5	11	2	-	-	-	-	-	(not MW) 3838 GW	Concept accepted, but value and units corrected to 3877 GW.
de Campos (Petrobras)	5	11	2	-	-	-	-	-	3,838 GW (correct the text)	Concept accepted, but value and units corrected to 3877 GW.
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	11	2	-	-	-	-	-	Correct 3,838 GW (and not MW)	Concept accepted, but value and units corrected to 3877 GW.
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	11	1	-	-	-	-	-	Precise again : 14,368 TWh PER YEAR	Concept accepted, but will be worded "annual generation potential is 14,368 TWh..."
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	11	24	11	25	-	-	-	The 2005 numbers should be counterchecked, updated and referenced to the previously given numbers in Figure 5.1 according to BP (2008).	Listed values in Fig. 5.1 are for 2007, which is not the base year. Figure is included to illustrate growth in generation in world regions.
Christophersen (Climate and Pollution Agency)	5	11	16	-	18	-	-	-	We suggest the following change in the sentence: Most notably Asia and also Latin America have very large potentials, and along with Australasia/Oceania they have great potential hydropower growth factors (450 to almost 800%).	no significant improvemnt
Taylor (International Hydropower Association (IHA))	5	11	16	11	16	5.2.1	-	-	"Add ""However, this must be tempered against economically feasible potentials that vary in time in space, which are themselves subject to the sustainability policy choices given societies make in time and space."" after ""...""tapped out""." Reason: Technical potential is a very coarse measure of potential it must be tempered by the economic and socio-environmental political realities OECD countries face."	Concept accepted, but wording changed slightly to: "However, economically feasible potentials are subject to time dependent economic conditions and the sustainability policy choices given societies make."
Rybach (Geowatt AG)	5	11	24	-	25	-	5.3	-	are there no more recent data than from 2003/2004 available? Or are the changes since then negligible? If so this should be mentioned.	shall be revised



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Louis (EDF Hydro Engineering Centre)	5	12	18	-	20	-	-	-	"delete ""Non traditional □spillways"""	Sentences qualify the potential values provided and inform the reader of other water energy resources like hydro kinetics, water mills whose potential has not been assessed and may offer significant amounts of additional hydropower.
SCOWCROFT (EURELECTRIC)	5	12	8	12	12	-	-	-	"IPCC SRREN FOD: ""It is also noteworthy that the capacity factors are in the range to be expected although the value for Europe (34%) is surprising low perhaps due to the use of one year of data. If this value along with those for Asia (39%) and Australasia/Oceania (37%) are actually representative, it could indicate an opportunity for increased generation through equipment upgrades and operation optimization."" Our proposal: The conclusion that different capacity factors represent different qualities of hydropower operating is considered to be misleading. Different design factors, e.g. multipurpose water supply and the type of power plant (run-of-river, storage, pumped storage) have an essential influence on the capacity factor."	Capacity factor is the ratio of actual generation compared to the ideal generation at nameplate capacity. It is not a measure of actual generation. No conclusion is stated that the "capacity factors represent different quantities of hydropower operating."
Vahrenholt (RWE Innogy GmbH)	5	12	8	12	12	-	-	-	"IPCC SRREN FOD: ""It is also noteworthy that the capacity factors are in the range to be expected although the value for Europe (34%) is surprising low perhaps due to the use of one year of data. If this value along with those for Asia (39%) and Australasia/Oceania (37%) are actually representative, it could indicate an opportunity for increased generation through equipment upgrades and operation optimization."" RWEI Comment: The conclusion that different capacity factors represent different qualities of hydropower operating is considered to be misleading. Different design factors, e.g. multipurpose water supply and the type of power plant (run-of-river, storage, pumped storage) have an essential influence on the capacity factor."	Capacity factor is the ratio of actual generation compared to the ideal generation at nameplate capacity. It is not a measure of actual generation. No conclusion is stated that the "capacity factors represent different quantities of hydropower operating."
Louis (EDF Hydro Engineering Centre)	5	12	21	-	23	-	-	-	"replace by ""produce energy from in-stream technology and constructed waterway resources. Their potential has not been assessed□.rest unchanged"""	Does not correct or add clarity.
Louis (EDF Hydro Engineering Centre)	5	12	4	-	12	-	-	-	delete. Explanation seems too short. Low capacity factor may also result from the fact that hydro in these countries is mostly in the form of peak load facilities	Intent is not to explain in detail, but rather to point out the highlights of the information presented in Fig. 5.3
Abed (National Research Centre)	5	12	24	12	27	-	-	-	omit	conclusions are based on hydropower potential information presented above

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Aelbrecht (Electricite de France - Hydro Engineering Center)	5	12	10	12	12	-	-	-	The capacity factor discrepancy among countries, and in particular low values in Europe, may be explained by the energy mix and the way Hydro is used in combination with other sources of energy. Low values do not automatically indicate opportunity for equipment upgrades and operation optimization. A well optimized Hydro system can have a low capacity factor in a certain power generation mix. Certain projects are designed for peaking energy and then have a voluntary low capacity factor, which enables reduce GHG emissions (refer to Chapter 8)	Statement regarding low capacity factors offers possible implication of these low values. Sentence to be added providing alternate explanation of how hydropower may be used in energy mix.
de Campos (Petrobras)	5	12	10	-	-	-	-	-	The low capacity factor doesn't have to do with low efficiency equipment. The low capacity factor is related to the seasonality of some rivers, for instance, frozen river during the winter time, or due to characteristic of the electric load. (correct the text)	Statement regarding low capacity factors offers a legitimate possible implication of these low values. Sentence regarding equipment capacity selection relative to water availability, which also effects capacity factor will be added.
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	12	-	-	-	-	5.3	-	I agree with TSU remark about colour-coding which is not consistent	Accepted
Louis (EDF Hydro Engineering Centre)	5	13	14	-	-	-	-	-	"delete ""Here impacts on□..discussed"""	Concept accepted. Text will be revised to combine sentences.
Louis (EDF Hydro Engineering Centre)	5	13	16	-	-	-	-	-	"replace by ""□on these sources, with a few additions from papers and"""	Accepted
Ulleberg (Institute for Energy Technology)	5	13	15	13	16	-	-	-	"Which chapter or sub-chapter does the statement ""The information presented here□"" refer too? Please specify."	Accepted
Abed (National Research Centre)	5	13	12	13	17	-	-	-	may be omitted	neccessry to explain
Gagnon (Hydro-Quebec)	5	13	11	-	-	-	-	-	Sedimentation in reservoir will tend to reduce storage services, not necessarily total generation (generation is reduced only in extreme cases) Suggestion: replace 'increasing flood spills and decreasing generation' by 'and decreasing storage services'.	Accepted
Kruger (South African Weather Service)	5	13	20	13	20	5.2.2	-	-	A short description of the different scenarios will be useful.	is decribed in other document
Ulleberg (Institute for Energy Technology)	5	13	-	-	-	-	5.4	-	It is not clear why the time period 2090-2099 is selected.	Accepted
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	14	3	-	-	-	-	-	"add : ""evaporation and snow melt""."	Accepted

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MANNEH (MINISTRY OF FINANCE AND ECONOMIC AFFAIRS)	5	14	24	38	3	-	-	-	Areas that needs to be looked at for possible reduction or shortened.	neccessry to explain
Abed (National Research Centre)	5	14	24	14	28	-	-	-	maybe omitted	neccessry to explain
de Campos (Petrobras)	5	14	13	-	-	-	-	-	Multi-model ensembles approach is not a warranty of reducing uncertainty in mathematical models (add to current text)	Accepted
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	14	-	-	-	5.2.2.2	-	-	Spatial and temporal downscaling issue is surprisingly not mentionned in this section. It is currently considered as one of top priority research needs when one try to derive GCM scenario outputs into hydrological responses and potential river flow regime changes	Accepted
Louis (EDF Hydro Engineering Centre)	5	15	20	-	22	-	-	-	"delete ""In Australia □. plants""."	shall provide a refrence to support the para
Louis (EDF Hydro Engineering Centre)	5	15	26	-	27	-	-	-	sentence not clear.	shall improve para
Kruger (South African Weather Service)	5	15	8	15	8	5.2.2.3.1	-	-	Timelines of projections are necessary in this and subsequent sections.	if information is available
Taylor (International Hydropower Association (IHA))	5	15	19	15	27	5.2.2.3.4	-	-	Comment: I know the text is derived from AR4 but the text on Australia is surprisingly scanty given the extreme water scarcity conditions it faces. Also missing is the El Niñoouthern Oscillation (ENSO) which has quite a strong effect on the weather patterns Australia and New Zealand experience. Finally, a further missing statement is that New Zealand is very dependent on hydropower for its electricity (it's over 60% of its generation).	if information is available
Ulleberg (Institute for Energy Technology)	5	16	37	16	40	-	-	-	"In theory, this statement seems logical. In practice, it might be difficult to transmit hydropower from a ""wet"" to a ""dry"" region (e.g. from tropical to Southern Africa, ref. Figs 5.4 and 5.5). This should be pointed out in the last paragraph."	shall improve para
Louis (EDF Hydro Engineering Centre)	5	16	38	-	40	-	-	-	conclusion seems not in line with what is expressed in the geographical sections before.	para shall be improved to provide more clarity
Ulleberg (Institute for Energy Technology)	5	17	7	17	7	-	-	-	HPP needs to be defined the first time	Hydro power plant shall be defined
Louis (EDF Hydro Engineering Centre)	5	17	13	-	17	-	-	-	"delete ""Some RoR HPP □..water flow"""	shall improve
Harby (SINTEF Energy Research)	5	17	32	17	32	-	-	-	"I am not sure if this example fits to ""Run of River"" as Theun Hinboun Expansion Project includes 100 km2 reservoir"	to remove and place in abos in section 5.6

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Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	17	8	-	-	-	-	-	"Please use consistent abbreviations ("RoR" vs. "ROR" in line 18)"	Accepted
Ulleberg (Institute for Energy Technology)	5	17	27	17	27	-	-	-	"Proposal: Use the word ""variable"" instead of ""intermittent"""	always use variable instead of intermittent
Abed (National Research Centre)	5	17	13	17	17	-	-	-	can be omitted	shall improve
REUTOV (FEDERAL AGENCY FOR SCIENCE AND INNOVATION (RUSSIA))	5	17	19	-	-	-	-	-	replace Run for run	RoR
Ulleberg (Institute for Energy Technology)	5	17	7	17	8	-	-	-	ROR (Run of River) is elsewhere abbreviated to RoR. Need to be consistent throughout chapter	Run of River is abbreviated to RoR
Harby (SINTEF Energy Research)	5	17	32	17	32	-	-	-	The figure 50 mill USD should be shown together with the total budget of the project to show what share goes to mitigation of social and environmental issues.	to remove and place in abos in section 5.6
Louis (EDF Hydro Engineering Centre)	5	17	-	-	-	5.3.1.1	-	-	Should also be mentioned the case of RoR project constructed in the form of cascades along a river valley, often with a reservoir type HPP in the upper reaches of the valley that allows both to benefit from the cumulative capacity of the various powerstations and also from the ability to store the energy and release it when most needed.	shall incorporate
Kruger (South African Weather Service)	5	17	33	17	33	5.3.1.1	-	-	Which oppurtunities are referred to?	to remove and place in abos in section 5.6
Louis (EDF Hydro Engineering Centre)	5	18	11	-	14	-	-	-	"sentence ""For example □ landscape"" is too specific. Delete ?"	landscape word shall be relaced with Topography
Louis (EDF Hydro Engineering Centre)	5	18	20	-	-	-	-	-	Pumped storage plants pump water from a lower reservoir into an upper reservoir □	Accepted
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	18	-	-	-	5.3.1.3	-	-	"The section dedicated to pumped-storage is poorly developed ; the technology would deserve a larger description of its benefits to a generation mix"	shall improve
Kruger (South African Weather Service)	5	18	1	18	3	5.3.1.1	5.6	-	Make figure and photo (a) and (b) and give reference for the photo.	Accepted
Gagnon (Hydro-Quebec)	5	18	-	-	-	-	5.7	-	Photo of Manic 5 is distorted vertically and not to scale	to be corrected
Kruger (South African Weather Service)	5	18	15	18	17	5.3.1.2	5.7	-	Make figure and photo (a) and (b) and give reference for the photo.	Accepted
Ulleberg (Institute for Energy Technology)	5	19	12	19	12	-	-	-	"change ""□ will be determined □"" to ""□ is determined □"""	Accepted
de Campos (Petrobras)	5	19	5	19	6	-	-	-	Hydrokinetic turbine can be used in this case (add to current text)	shall provide additional line

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Kruger (South African Weather Service)	5	19	1	19	3	5.3.1.3	5.8	-	Make figure and photo (a) and (b) and give reference for the photo.	Accepted
Kruger (South African Weather Service)	5	19	7	19	9	5.3.1.4	5.9	-	Make figure and photo (a) and (b) and give reference for the photo.	Accepted
de Campos (Petrobras)	5	20	8	-	-	-	-	-	The inefficiency is due to hydraulic loss in the water circuit (intake, turbine, tail-race), mechanical loss in the turbo-generator group and electrical loss in the generator (correct the text)	shall be improved
de Campos (Petrobras)	5	20	15	20	23	-	-	-	This paragraph point out some ways to increase efficiency. However, these subjects have been studied for years, reaching their maximum level. (remove)	This is the status quo of technology in increasing efficiency
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	20	8	20	8	-	-	-	Without any unit the given rest of the potential energy, given as (100-eta) must be (1-eta). Alternatively it could be written (100%-eta).	Accepted
Rybach (Geowatt AG)	5	20	2	-	-	-	5,16	-	to what do the asterisks refer?	this comment refers to Fig 5.16 whci is on page 28
Ulleberg (Institute for Energy Technology)	5	20	-	-	-	-	5.10	-	Poor quality plot and unclear text/legend	Accepted
Tran (Vietnam Institute of Meteorology, Hydrology and Environment)	5	20	-	-	-	-	5.10	-	Source:.....	Accepted
Kruger (South African Weather Service)	5	20	25	20	25	5.3.2.1	5.10	-	Reference for figure in caption is necessary.	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	21	5	21	6	-	-	-	""Tunnels are used for a number of other purposes□"" --> which purposes?"	Accepted
Jara Tirapegui (Endesa Eco S.A.)	5	21	21	-	-	-	-	-	"Superscript correction in ""m2""	Accepted
Jara Tirapegui (Endesa Eco S.A.)	5	21	19	-	-	-	-	-	"The author says ""For more details, see below"", but it's not clear where they are."	Accepted
Ulleberg (Institute for Energy Technology)	5	22	45	19	45	-	-	-	"Is there a synonym for ""bathymetric""? (if so, maybe put this in parenthesis to help the reader)"	The bathymetric is relating to measurements of the depths of oceans or lakes
REUTOV (FEDERAL AGENCY FOR SCIENCE AND INNOVATION (RUSSIA))	5	22	23	-	-	-	-	-	"misprint: replace ""ads"" for ""adds""	Replace "add" for "ads"
REUTOV (FEDERAL AGENCY FOR SCIENCE AND INNOVATION (RUSSIA))	5	23	17	-	-	-	-	-	"specify the source of information; proper presentation and reference"	Accepted

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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Considerations by the writing team
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	23	2	-	-	-	-	-	"Suppress ""every two years"". This period is very site specific. I would suggest : ""at a pace consistent with sedimentological processes (siltation, erosion) time scale"" or something similar"	Accepted
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	23	36	-	-	-	-	-	remove sediment: do you mean mechanically remove, or flow-driven during flood and flushing, or both ? Should be precised	Accepted
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	23	-	24	-	5.3.3	-	-	"The section dedicated to sedimentation problems should distinguish two kinds of projects : run-of-river schemes, where flushes procedures during floods can be integrated into operation flood management to maintain stable and sustainable siltation rate in the reservoirs ; and storage facility, where floods cannot be positively used to manage and limit siltation rate."	Accepted
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	23	-	24	-	5.3.3	-	-	"The section should also clearly highlight that sedimentation processes can have implications on : safety (increasing flooding risk upstream) ; environment (perturbing morphodynamics and ecological functionalities) ; operation (turbine wear and loss of storage capacity)"	Accepted
Louis (EDF Hydro Engineering Centre)	5	24	21	-	-	-	-	-	""Normally the life of the equipment of a hydroelectric power plant <input type="checkbox"/> ""	check other chapter for how long a HPP lives. ok let's put 50-60 years
Ulleberg (Institute for Energy Technology)	5	24	1	24	2	-	-	-	"Last sentence: ""In this context much research and development work remains <input type="checkbox"/> "". It would be useful with a hint on what kind of research and development is required here. What is the solution?"	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	24	43	22	43	-	-	-	"Please formulate more general/objectively (do not use ""our vulnerability"")."	Accepted
Louis (EDF Hydro Engineering Centre)	5	24	30	-	-	-	-	-	"replace ""today"" by ""in 2009"""	Accepted
Abed (National Research Centre)	5	24	38	24	45	-	-	-	can be omitted	Delete partially
Louis (EDF Hydro Engineering Centre)	5	24	35	-	-	-	-	-	<input type="checkbox"/> components added without <input type="checkbox"/>	Accepted
Louis (EDF Hydro Engineering Centre)	5	24	39	-	40	-	-	-	delete	Accepted
Gagnon (Hydro-Quebec)	5	24	21	-	-	-	-	-	In Canada, the age of plants before refurbishments has been more around 50-60 years. So the typical life of plant can be much higher than 30-35	I will include the modification

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SCOWCROFT (EURELECTRIC)	5	24	21	-	-	-	-	-	IPCC SRREN FOD: Data in contradiction to page 31, e.g. concerning lifespan. Our comment: Replacement - If properly maintained, hydroelectric facilities exceed lifespans of 100 years. Many hydro power plants built at the beginning of the last century are still in operation. If not steadily maintained, a renovation after approx. 30-35 years will be necessary.	I will include the modification
Vahrenholt (RWE Innogy GmbH)	5	24	21	-	-	-	-	-	IPCC SRREN FOD: Data in contradiction to page 31, e.g. concerning lifespan. RWEI comment: Replacement - If properly maintained, hydroelectric facilities exceed lifespans of 100 years. Many hydro power plants built at the beginning of the last century are still in operation. If not steadily maintained, a renovation after approx. 30-35 years will be necessary.	I will include the modification
Abed (National Research Centre)	5	24	3	24	6	-	-	-	may be omitted	This is a key message reference shall be provided
Louis (EDF Hydro Engineering Centre)	5	24	-	-	-	5.3.4	-	-	"In 2004, as part of its follow-up initiative to the World Commission on Dams, the World Bank received a grant from the Swedish International Development Agency (SIDA) to support the Dams Planning and Management Action Plan. Through competitive bidding, the World Bank applied part of the proceeds to entrust EDF with the task of setting up a Framework for Policy and Decision-making on Dam and Hydro Plant Rehabilitation and Uprating (R&U). This Framework proposes a decision-making approach, which is intended to help in defining the adequate scope of such a project and the optimum timing for its implementation. Above and beyond the objective of restoring 'as-new' conditions, the Framework also addresses the potential for actually increasing the performance of existing dams and hydro plants. Such potential for improvement exists in most cases for works which were often designed 20 to 30 years ago, or more, on the basis of the needs and technology prevailing at that time. (Ref HRW Magazine Volume 14, Number 3, July 2006)."	Adding text reflecting this point.
Kruger (South African Weather Service)	5	24	39	24	40	5.3.5	-	-	"Please rephrase sentence - ""timely"" = temporally""?"	Accepted
Louis (EDF Hydro Engineering Centre)	5	25	11	-	13	-	-	-	"delete ""China, □(IEA, 2008)""."	information important and relevant
REUTOV (FEDERAL AGENCY FOR SCIENCE AND INNOVATION (RUSSIA))	5	25	20	-	23	-	-	-	"delete; irrelevant information, not to the point"	Formulation shall be improved as above

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Louis (EDF Hydro Engineering Centre)	5	25	20	-	23	-	-	-	"Replace ""In these countries □ base"" by ""These countries seem to have followed in the footsteps of developed countries, drawing on untapped potential to provide clean and safe energy, in sufficient quantities to guarantee the expansion of a solid industrial base""."	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	25	19	25	20	-	-	-	"The countries mentioned should be described as ""emerging economies"", not as ""developing countries""."	delete "developing" and "major" words
Abed (National Research Centre)	5	25	1	25	4	-	-	-	can be omitted	It's related to storage of water and energy
Louis (EDF Hydro Engineering Centre)	5	25	26	-	31	-	-	-	move the para after line 10.	Accepted
Taylor (International Hydropower Association (IHA))	5	25	23	25	23	5.4.1	-	-	"Add ""Russia is however somewhat of an exception given it developed hydropower and industrialised much earlier than Brazil, China and India, albeit under a non-capitalist economic system. Therefore it faces the twin challenges of developing new hydropower projects and the challenges of maintaining ageing hydropower infrastructure."" after ""...solid industrial base"". Reason: Russia is different in kind from the other BRICs."	Accepted
de Campos (Petrobras)	5	26	9	-	-	-	-	-	"In this case, ""the major boom in"" must replaced to "" the share reduction in electricity generation"""	Accepted
Ulleberg (Institute for Energy Technology)	5	26	-	-	-	-	5.13	-	Poor quality plot and unclear text/legend	Replace the text of legend: "Hydro.." to "Share of Hydro Generation (3121 TWh in 2006)"
Taylor (International Hydropower Association (IHA))	5	26	4	26	4	5.4.1	-	5.2	"Delete ""First"" and replace with ""Top"". Reason: There are other smaller producing countries (e.g. Iceland, New Zealand) which have higher percentage domestic electricity generation from hydro."	Accepted
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	27	16	-	-	-	-	-	"the term ""toe"" has not been defined beforehand (tons of oil equivalent ?)"	Put like a footnote of the chart: * "the term ""toe"tons of oil equivalent
de Campos (Petrobras)	5	27	19	-	-	-	-	-	According to Figure 5.15, Oil accounts for the major share of final consumption (change text)	Although the oil accounts for the major share of final consumption in 2006, electricity increase for a second energy source of final consumption (figure 5.15), in part is due to the increase of electricity generation and consumption in China, principally during the last decade (figure 5.16).
de Campos (Petrobras)	5	27	4	27	14	-	-	-	Change this paragraph for a chart considering the sources of electric energy of each country (China, Canada, Brazil, US and Russia).	I accept the suggestion 255, the paragraph line 4 - 14, is not really necessary. Delete the paragraph.



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REUTOV (FEDERAL AGENCY FOR SCIENCE AND INNOVATION (RUSSIA))	5	27	6	-	9	-	-	-	needs rephrasing, give only facts	I accept the suggestion 255, the paragraph line 4 - 14, is not really necessary. Delete the paragraph.
Kruger (South African Weather Service)	5	27	4	27	14	5.4.2	-	-	This section is not really necessary - to discuss other power sources in such detail.	Delete * and "Key World...", new title of Figuer 5.16.: "Evolution from 1971 to 2006 of World electricity generation by region (TWh). (source: IEA, 2008)."
Ulleberg (Institute for Energy Technology)	5	28	9	28	9	-	-	-	""Low head and fish friendly turbines □"" Low head and fish friendly turbines are described in more detail in subsequent sub-chapters. Sentence can possibly be deleted, to avoid to much repetition. "	Accepted
Abed (National Research Centre)	5	28	11	28	15	-	-	-	omit	It's important, because strengthen the role of the information and planification in technical development. The retrofit is very important too.
Ulleberg (Institute for Energy Technology)	5	28	19	28	20	-	-	-	There are very few water electrolyzers dedicated to hydrogen fuel production for transport (e.g., Reykjavik). Hydro to H2 only makes sense if there is abundance of hydro power in a region and a local goal to use H2 as fuel for transport.	Change lines 19-20 to: "Most recently hydro electricity has also been used in the electrolysis process for hydrogen fuel production, if there is abundance of hydro power in a region and a local goal to use H2 as fuel for transport."
Taylor (International Hydropower Association (IHA))	5	28	22	28	22	5.4.4	-	-	"Add ""The production of peak load energy from hydropower allows the optimization of base load power generation from other less flexible electricity sources such as nuclear and thermal powerplants. By absorbing excess power, pumped-storage plants enable large thermal or nuclear powerplants to operate at optimum output with high efficiency, even if demand is low. This contributes to reducing the GHG emissions from thermal powerplants."" after ""Peak power is expensive"". Reason: Hydro gives ancillary service to all other electricity generation technologies."	Add after: "... Peak power is expensive". "The production of peak load energy from hydropower allows the optimization of base load power generation from other less flexible electricity sources such as nuclear and thermal powerplants. By absorbing excess power, pumped-storage plants enable large thermal or nuclear powerplants to operate at optimum output with high efficiency, even if demand is low. This contributes to reducing the GHG emissions from thermal powerplants."
Taylor (International Hydropower Association (IHA))	5	28	21	28	22	5.4.4	-	-	"Delete ""wind power"" from both lines and replace with ""intermittent renewables (wind, solar pv, concentrating solar power)"". Reason: Wind is not the only intermittent renewable that hydro supports."	Change: "Hydropower can also provide the firming capacity for wind power." to Hydropower can also provide the firming capacity for intermittent renewables (wind, solar pv, concentrating solar power)."

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Taylor (International Hydropower Association (IHA))	5	28	33	28	33	5.4.5	-	-	"Add ""Due to scientific uncertainty regarding the GHG emissions status of reservoirs,"" before ""The CDM Executive Board..."". Reason: This is a clearer statement of the driver behind the power density rule."	Accepted
Dunn (GE Energy)	5	28	28	30	9	5.4.5	-	-	As discussed in expert review meeting, CDM credits should be addressed uniformly, either across technology chapters (where relevant), in policy chapter, or partly in both.	waiting for instructions from TSU
Kruger (South African Weather Service)	5	28	31	28	31	5.4.5	-	-	Explain/define AMS ID and ACM002.	Accepted
Vahrenholt (RWE Innogy GmbH)	5	28	-	-	-	5.4.5	-	-	IPCC SRREN FOD: Joint implementation (JI) is not mentioned. RWEI Comment: RWEI suggests to also mention JI as a further project-based instrument for Emission Certificate generation (possible between two industrialized countries).	Accepted
SCOWCROFT (EURELECTRIC)	5	28	-	-	-	5.4.5	-	-	IPCC SRREN FOD: Joint implementation (JI) is not mentioned. We suggest to also mention JI as a further project-based instrument for Emission Certificate generation (possible between two industrialized countries).	Accepted
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	28	-	-	-	-	5.16	-	Figure 5.16 might be enlarged for better reading	Accepted
Kruger (South African Weather Service)	5	28	2	28	3	5.4.2	5.16	-	"Why * after generation? Is 'Key World Energy Statistics'" part of the reference?"	Delete * and "Key World...", new title of Figure 5.16: "Evolution from 1971 to 2006 of World electricity generation by region (TWh). (source: IEA, 2008)."
Ulleberg (Institute for Energy Technology)	5	29	24	29	24	-	-	-	"Maybe it would be better to use a synonym for ""fungible"" instead. How about simply ""changeable""?"	official word. to be kept as such
Gagnon (Hydro-Quebec)	5	29	2	-	4	-	-	-	"Suggestion to improve the sentence 'The power density rule seems presently to exclude storage hydropower based on assumptions and not on scientific or professional documentation' New wording: This power density rule was established by examining gross emissions from tropical reservoirs. This rule is now obsolete for 2 reasons: firstly, the scientific consensus on the need to define 'net' emissions from reservoirs; second, the huge differences in emissions, depending on climate and many other factors."	Accepted
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	29	3	-	-	-	-	-	Precise : arbitrary assumptions or arbitrary postulates when speaking about classification of storage hydropower based on power density rule (W/m <sup>2</sup> )	Accepted

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Taylor (International Hydropower Association (IHA))	5	29	26	29	26	5.4.5	-	-	"Add ""As a result the European carbon exchanges are likely to admit large hydro CERs in the near future"" after ""...under the EU ETS"". Reason: ECX and greenmarket are about to admit large hydro CERs into their exchanges as a result of EU DNA harmonisation."	Accepted
Louis (EDF Hydro Engineering Centre)	5	30	21	-	22	-	-	-	"delete ""which leads to □ investors"". This idea, albeit true, is not relevant in this para."	Accepted
Louis (EDF Hydro Engineering Centre)	5	30	25	-	-	-	-	-	"not clear what ""multilateral supply agents"" are."	Replace: ""multilateral supply agents"" for ""multilateral investment agencies"
Abed (National Research Centre)	5	30	-	-	-	-	-	-	Figure 5.18 should be redrawn	Edit figure
Harby (SINTEF Energy Research)	5	30	-	-	-	-	5.18	-	The legend for at least four countries missing	Edit legend.
Louis (EDF Hydro Engineering Centre)	5	31	2	-	-	-	-	-	""High front end costs are too often □""	Replace: "High up-front costs are a deterrent for investment." for "High front end costs are too often a deterrent for investment."
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	31	-	32	-	-	-	-	"In addition to the interesting case of France, it would be also interesting to mention the recent evolution of the relicensing process in the US in the years 2000', coming from a Traditional (TLP) to a fully Integrated Licensing Process (ILP), where settlement agreement between stakeholders are shared early in the process to ensure that main environmental and social issues (represented by a variety of stakeholders : state env. conservation Agencies, Associations for river protection, river uses,...) have been integrated and made compatible together, before filing documents into the Administrative process. As a reference, the following document from US-FERC can be mentioned : ""Ideas for implementing and participating into the Integrated Licensing Process (ILP) : tools for Industry, Agencies, Tribes, NGOs, Citizens, and FERC staff"" - FERC, Feb. 2006"	Add in paragraph line 32 page 31, "In France, under the law of 16 October 1919...Similar arrangements may be seen in many countries" ", like in US. The recent evolution of the relicensing process in the US in the years 2000', coming from a Traditional (TLP) to a fully Integrated Licensing Process (ILP), where settlement agreement between stakeholders are shared early in the process to ensure that main environmental and social issues (represented by a variety of stakeholders : state env. conservation Agencies, Associations for river protection, river uses,...) have been integrated and made compatible together, before filing documents into the Administrative process. (FERC, Feb. 2006)"
Louis (EDF Hydro Engineering Centre)	5	31	9	-	12	-	-	-	Interesting issue but nothing to do with financing. Is dealt with further in the document. Can be deleted.	para shall be moved to better location
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	31	13	31	14	-	-	-	This paragraph should be merged with the subsequent paragraph or it needs stronger support (e.g. the role of public-private-partnerships and associated financing options should be discussed resp. references cited).	Merged paragraph line 13 + paragraph line 15.
Taylor (International Hydropower Association (IHA))	5	31	24	32	7	5.4.6.2	-	-	Comment: This section is heavily France focussed. It would be more balanced if a scan of other EU countries was introduced.	New text proposed in coorection 286

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Ulleberg (Institute for Energy Technology)	5	31	-	-	-	-	5.19	-	More insight is needed on these energy payback calculations (and assumptions). Suggestion: Energy payback calculations for all technologies discussed in the SRREN-report are done using the same method.	copied from a reference paper.
Harby (SINTEF Energy Research)	5	31	-	-	-	-	5.19	-	The scale on the x-axis should be the same in both parts of figure 5.19	copied from a reference paper.
Sims (Massey University)	5	32	25	-	-	-	-	-	"Define or quantify ""short period""	change to " a few minutes"
Louis (EDF Hydro Engineering Centre)	5	32	5	-	-	-	-	-	"delete ""therefore""."	Accepted
Maeda (The Federation of Electric Power Companies, Japan)	5	32	38	32	40	-	-	-	"Open access would not likely to be an incentive for constructing hydro power plants, because of its significant long construction period including assessment on environment."	in deregulated systems construction of hydro plants are influenced with open access to the transmission system philosophy
Sims (Massey University)	5	32	9	-	17	-	-	-	Covered in Chapter 8 - could delete or shorten and cross reference	will be considered
REUTOV (FEDERAL AGENCY FOR SCIENCE AND INNOVATION (RUSSIA))	5	32	9	-	17	-	-	-	needs rephrasing	Accepted
Gagnon (Hydro-Quebec)	5	32	27	-	-	-	-	-	Please replace 'gas plants' by 'gas turbines' (it is the turbine technology that allows quicker response)	Accepted
Sims (Massey University)	5	32	17	-	22	-	-	-	Refer to Chapter 8.	Accepted
Sims (Massey University)	5	32	23	-	-	-	-	-	Suggest delete sub-heading	Accepted
Taylor (International Hydropower Association (IHA))	5	32	11	32	11	5.5	-	-	"Delete ""new"" and replace with ""the scale-up of non-hydro"". Reason: None of the other renewables are recent, it is just their scale-up that is."	"new" has been replaced with "other non-hydro"
Taylor (International Hydropower Association (IHA))	5	32	15	32	22	5.5	-	-	Comment: Heavy focus on wind intermittency here to the neglect of solar pv and concentrating solar power.	emphasis is now placed on entire power system outputs
Louis (EDF Hydro Engineering Centre)	5	32	-	-	-	5.5.2	-	-	Should also mention large industrial customers like aluminum smelters or mines.	aluminum smelters and mines are industries. Can be mentioned as examples for emphasis only
Louis (EDF Hydro Engineering Centre)	5	33	76	-	9	-	-	-	delete.	content relevant
Sims (Massey University)	5	33	15	-	-	-	-	-	Refer to chap 9 and delete Table 5.3	information is relevant shall be deleted if transferred to a X-cutting chapters
Ulleberg (Institute for Energy Technology)	5	33	15	33	24	-	-	-	The first two paragraphs and the first sentence in the third paragraph includes general (and fairly obvious) information on rural electrification, and is not specific for hydro power. Suggestion: Delete this text.	text to go alongwith the tabel no 5.3 to X-cutting chapter if possible

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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Considerations by the writing team
Taylor (International Hydropower Association (IHA))	5	33	5	33	5	5.5.2	-	-	"Delete ""(especially small hydro power)"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	large hydropower plants are always connected to larger grids since the areas immediately around them cannot consume all the energy generated
Taylor (International Hydropower Association (IHA))	5	33	27	33	27	5.5.2	-	-	"Delete ""small"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	may be cahnged to smaller or small scale
Taylor (International Hydropower Association (IHA))	5	33	25	33	25	5.5.2	-	-	"Delete ""small"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	may be changed to small or small scale
Taylor (International Hydropower Association (IHA))	5	33	24	33	24	5.5.2	-	-	"Delete ""small"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	may be changed to smaller
Taylor (International Hydropower Association (IHA))	5	33	28	33	28	5.5.2	-	-	"Delete ""small"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	may be changed to smaller or small scale
Sims (Massey University)	5	33	-	-	-	-	5.20	-	Does this add anything? Suggest delete	relevant , edit figure text exchange isolated with captive
Kruger (South African Weather Service)	5	33	1	33	2	5.5.2	5.20	-	Reference to figure?	Accepted
Sims (Massey University)	5	34	3	-	7	-	-	-	Quote costs or refer to section that does.	Accepted
Taylor (International Hydropower Association (IHA))	5	34	4	34	4	5.5.3	-	-	"Add ""er"" to ""small"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	similar wording will be investigated
Taylor (International Hydropower Association (IHA))	5	34	5	34	-	5.5.3	-	-	"Add ""r"" to ""large"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	similar wording will be investigated
Taylor (International Hydropower Association (IHA))	5	34	6	34	6	5.5.3	-	-	"Add ""r"" to ""large"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	similar wording will be investigated
Taylor (International Hydropower Association (IHA))	5	34	8	34	8	5.5.3	-	-	"Delete ""small hydro are"". Reason: See reason given for ""5, 5, 16, 5, 16"" above nd c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	similar wording will be investigated
Taylor (International Hydropower Association (IHA))	5	34	3	34	3	5.5.3	-	-	"Delete ""Small"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	may be changed to smaller or small scale
Kruger (South African Weather Service)	5	34	1	34	2	5.5.3	-	5.3	Such a table can be included in an introductory chapter, as it has a bearing on all renewables.	information is relevant shall be deleted if transferred to a X-cutting chapters

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Ulleberg (Institute for Energy Technology)	5	35	32	35	32	-	-	-	"Proposal: Use the word ""variable"" instead of ""intermittent"""	meaning may vary between concepts - follow definition in ch 1
REUTOV (FEDERAL AGENCY FOR SCIENCE AND INNOVATION (RUSSIA)) Sims (Massey University)	5	35	17	-	-	-	-	-	compare with page 37 line 29: unification is need - brownouts and blackouts (or brown and blackouts)	consistency will be ensured
Sims (Massey University)	5	35	19	-	23	-	-	-	Hydro can also be base load when high shares. Not clear here.	Accepted
Sims (Massey University)	5	35	24	-	31	-	-	-	Move to section 5.5.5 and integrate.	as above
Abed (National Research Centre)	5	35	24	35	45	-	-	-	omit	edited to make the information flow
Sims (Massey University)	5	35	37	-	39	-	-	-	Repetition	as above
Harby (SINTEF Energy Research)	5	35	37	35	46	-	-	-	This paragraph may be erased or most of it as it is already said before.	edited
Harby (SINTEF Energy Research)	5	35	4	35	46	-	-	-	This section may be shorter as several things are repeated. However, more emphasize should be put on the need for hydropower with a reservoir. Run of river plants may not be able to meet peaking demands!	Accepted
Taylor (International Hydropower Association (IHA))	5	35	1	35	1	5.5.3	-	-	"Delete ""small"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	similar wording will be investigated
Taylor (International Hydropower Association (IHA))	5	35	3	35	3	5.5.3	-	-	"Delete ""small"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	similar wording will be investigated
Harby (SINTEF Energy Research)	5	36	22	36	23	-	-	-	"Please quantify how much CAES can store in stead of writing ""substantial amount"". I doubt it is in the same order of magnitude as pumped hydro."	Accepted
de Campos (Petrobras)	5	36	2	36	3	-	-	-	"This phrase could be rephrased. Maybe this one would be better: ""Hydroelectric generation differs from others types of RE generation by its constant availability"	rephrased differently
Louis (EDF Hydro Engineering Centre)	5	36	22	-	23	-	-	-	CAES can also store energy on an industrial scale, but not as much as pumped storage. Although theoretically promising, CAES technology is not yet much developed around the world. Furthermore, ageing of those facilities is not yet well documented.	will be reflected in text Typical capacities for a CAES system are around 50-300MW and can provide a start-up time of about 9 minutes for an emergency start, and about 12 minutes under normal conditions. The storage period is also the longest due to the fact that its losses are very small. A CAES system can be used to store energy for more than a year.

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SCOWCROFT (EURELECTRIC)	5	36	0	-	-	-	-	-	Compared to all other technologies pumped storage is the most efficient. (Source: VGB 2009).	information used
Vahrenholt (RWE Innogy GmbH)	5	36	-	-	-	-	-	-	Compared to all other technologies pumped storage is the most efficient. (Source: VGB 2009).	ref will be checked
Louis (EDF Hydro Engineering Centre)	5	36	9	-	13	-	-	-	delete sentence.	deleted
Sims (Massey University)	5	36	13	-	14	-	-	-	Delete sentence. Not necessary.	deleted
Abed (National Research Centre)	5	36	27	36	32	-	-	-	omit	Already done above
Abed (National Research Centre)	5	36	2	35	8	-	-	-	omit	information is needed but moved to "Energy Storage section"
Harby (SINTEF Energy Research)	5	36	14	36	16	-	-	-	Pumped storage may also store electricity before it is produced if the upstream pumping reservoir also is used as a traditional reservoir	mixed plant types may be mentioned
de Campos (Petrobras)	5	36	9	-	-	-	-	-	Reservoir based hydropower store potential energy, not kinetic energy. There is no significant water movement in the reservoir (correct the text)	rephrased
Ulleberg (Institute for Energy Technology)	5	36	27	36	32	-	-	-	This information is provided elsewhere in the report. Suggestion: Delete paragraph	Accepted
Ulleberg (Institute for Energy Technology)	5	36	1	36	23	5.5.5	-	-	The need for energy storage depends on many factors, e.g., climate, energy mix (fossil, other RES), power demand (industry, urban or rural), transmission capacity, etc. Suggestion: This theme should be discussed in further detail in Chapter 8.	Accepted
Sims (Massey University)	5	36	-	-	-	5.5.5	5.21	-	Negotiate with Chapter 8 as to what might go where.	remains - ch 8 asked ask to refer to ch 5
Louis (EDF Hydro Engineering Centre)	5	37	12	-	13	-	-	-	"Pumped storage schemes have the same common benefits as conventional hydropower plants: flexibility and reliability. They have also many other benefits which profit to the power system as a whole: their capacity is usually high as compared to conventional schemes, their "fuel" is renewable, they can be used to consume excess energy during off-peak hours. Their use and benefit in the power system depend on the mix of generating plants and the architecture of the transmission system. Pumped storage today represents 5% of the world's installed capacity. Figures vary from 2.4% in the USA to nearly 9% in Japan. It is very difficult to state what should be the optimum value in a power system. It is dependent on the mix of the system, the amount of existing hydro storage facilities and on the architecture of the grid with respect to consumption load centres."	will be incorporated
Sims (Massey University)	5	37	1	-	18	-	-	-	A figure could help the text.	check fig 5.8

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Louis (EDF Hydro Engineering Centre)	5	37	1	-	5	-	-	-	Not only reversible units may be used. Some recent projects such as Kops II in Austria also rely on ternary units (Pelton + pump on the same shaft) or separate turbines and pumps. Pumepd storage is very versatile as it can be adapted in various situations to the geography of the sites and to the needs of the power systems. Is is noteworthy that recent technologies allow those facilities to closely follow up the load curve MW by MW.	Accepted
Abed (National Research Centre)	5	37	14	37	18	-	-	-	omit	deleted
Louis (EDF Hydro Engineering Centre)	5	37	23	-	26	-	-	-	Para not clear. Delete ?	deleted
de Campos (Petrobras)	5	37	42	-	-	-	-	-	The project's final cost per unit of energy produced are reduced... (correct the text)	Accepted
Sims (Massey University)	5	37	-	-	-	5.5.5	-	-	This and other sections very descriptive with no references.	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	38	22	38	22	-	-	-	""□within seconds of demand□"" --> suggestion: ""...within seconds to meet demand...""	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	38	19	38	19	-	-	-	"Add the limitation ""□given sufficient system-wide transmission capacity."" at the end of the sentence. "	Accepted
Louis (EDF Hydro Engineering Centre)	5	38	10	-	11	-	-	-	"Replace by ""Typically, a hydropower plant can operate from a stopped condition to full power in just a few minutes""."	Accepted
Sims (Massey University)	5	38	10	-	11	-	-	-	Delete - repetition.	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	38	12	38	12	-	-	-	Give the table's key findings or message.	Accepted
Louis (EDF Hydro Engineering Centre)	5	38	23	-	24	-	-	-	Is availability the right word ? Generation would be better.	no the same concept
Abed (National Research Centre)	5	38	1	38	3	-	-	-	omit	Accepted
Sims (Massey University)	5	38	21	-	24	-	-	-	Suggest delete - adds nothing.	relevant - lacks refr
Abed (National Research Centre)	5	38	-	-	-	-	-	-	Table 5.4: Notes and NCF remove line extensions	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	38	1	38	3	-	-	-	The conclusions from this section should be drawn after elaborating on the single supply characteristics in subsections 5.5.6.1 to 5.5.6.4.	Accepted
Kruger (South African Weather Service)	5	38	23	38	23	5.5.6.3	-	-	"Put ""However"", before ""In""."	Accepted



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Jara Tirapegui (Endesa Eco S.A.)	5	38	-	-	-	-	-	5.4	"Delet a bracket in the penultimate line: ""Forced Outage Rate ((hours□"""	Accepted
Sims (Massey University)	5	38	12	-	-	-	-	5.4	Meaningless statement. Expand or delete Table 5.4. Title inadequate. Why is NCF not PF?	Accepted
Kruger (South African Weather Service)	5	38	13	38	13	5.5.6.1	-	5.4	"Some explanations of the statistics can be given. The defenitions under ""Notes"" in the table should be part of the caption?"	Accepted
Sims (Massey University)	5	39	26	-	33	-	-	-	Here and elsewhere needs references.	reference to be provided
Tolmasquim (Empresa de Pesquisa Energetica - EPE)	5	39	40	-	-	-	-	-	Itaipu instead of Itapu	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	39	26	39	33	-	-	-	Please give the total number of treaties once and only refer to the percentages as share of this number in the subsequent sentences. This would improve readability.	same as above
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	39	26	39	33	-	-	-	Please give the total number of treaties once and only refer to the percentages as share of this number in the subsequent sentences. This would improve readability.	to be edited
Tolmasquim (Empresa de Pesquisa Energetica - EPE)	5	39	26	39	33	-	-	-	There isn't the reference of the data.	reference to be provided
Taylor (International Hydropower Association (IHA))	5	39	12	39	12	5.5.6.4	-	-	"Add as a new line after line 12 ""The incentivisation of ancillary services in order to facillitate the scaling-up of electricity generation by other renewables and smartgrids is being investigated at the international policy level"". Reason: The incentivisation of ancillary services is being investigated in the climate change negotiations and by IRENA."	Accepted
Kruger (South African Weather Service)	5	39	26	39	26	5.5.7	-	-	What kind of treaties are referred to?	treaties described
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	40	4	40	4	-	-	-	"formulation suggestion: ""Hydropower plants and its reservoirs support power balancing.""	to be edited
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	40	4	40	4	-	-	-	"formulation suggestion: ""Hydropower plants and its reservoirs support power balancing.""	to be edited
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	40	6	40	6	-	-	-	"formulation suggestion: ""□renewables and may have the following characteristics with respect to supporting other renewable energy sources:"" --> this describes the subsequent bullet points better than the current formulation"	to be edited
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	40	6	40	6	-	-	-	"formulation suggestion: ""□renewables and may have the following characteristics with respect to supporting other renewable energy sources:"" --> this describes the subsequent bullet points better than the current formulation"	to be edited

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Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	40	27	40	27	-	-	-	"Introduce abbreviation ""HPP"" earlier in this chapter. "	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	40	27	40	27	-	-	-	"Introduce abbreviation ""HPP"" earlier in this chapter. "	Accepted
Harby (SINTEF Energy Research)	5	40	21	40	22	-	-	-	"The use of ""up and downsides"" is not good. Please change to ""positive and negative impacts"", for example"	Accepted
Sims (Massey University)	5	40	19	-	-	-	-	-	Define biomass - could be landfill gas but not woody biomass in thermal plants as not peaking capable.	bullet to be deleted
Tran (Vietnam Institute of Meteorology, Hydrology and Environment)	5	40	2	40	19	-	-	-	Dissension within the para: should be shortened	to be edited
Sims (Massey University)	5	40	39	-	-	-	-	-	Methane is controversial and needs more discussion and references. Incorporate footnote into text and expand. But also cross reference to section 5.6.3.	Extensively covered under 5.6.3. which is referenced in line 41
Abed (National Research Centre)	5	40	1	40	19	-	-	-	omit	information relevant
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	40	19	40	19	-	-	-	This is not hydropower's support to other renewables, but vice versa.	as above
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	40	19	40	19	-	-	-	This is not hydropower's support to other renewables, but vice versa.	bullet delete
Ulleberg (Institute for Energy Technology)	5	40	20	47	38	5.6.1	-	-	"This section seem a bit long and ""wordy"". Suggestion: Try to make the text in the section more compact."	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	41	-	-	-	-	-	-	"The second footnote contains ""a"", but I cannot find a second phrase, indicating its necessity. "	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	41	-	-	-	-	-	-	"The second footnote contains ""a"", but I cannot find a second phrase, indicating its necessity. "	Accepted
Sims (Massey University)	5	41	21	-	-	-	-	-	adapted	Accepted
Sims (Massey University)	5	41	12	47	38	-	-	-	All descriptive with lack of references throughout.	Accepted
Kruger (South African Weather Service)	5	41	12	47	38	5.6.1	-	-	In this section there is a general shortage of references/examples to back-up the statements made.	Accepted
Abed (National Research Centre)	5	42	11	-	-	-	-	-	"add : "" . "" after catches"	Accepted

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Abed (National Research Centre)	5	42	6	-	-	-	-	-	"add: ""."" after 2004)"	Accepted
Harby (SINTEF Energy Research)	5	42	35	42	35	-	-	-	"Replace ""volume"" with ""magnitude"""	Accepted
Harby (SINTEF Energy Research)	5	42	13	42	13	-	-	-	"The text is biased mentioning ""but in many cases has a positive effect on downstream areas"". It is widely known that most cases has negative effects downstream, but there are also some positive. These should be balanced."	Accepted
de Campos (Petrobras)	5	42	11	-	-	-	-	-	In hydropower peaking cases the death of fish is an important issue to be assessed at the environmental impact assessment (add to current text)	Accepted
de Campos (Petrobras)	5	42	17	42	30	-	-	-	Manage the work force in the end of the construction must be an important social issue to be considered in the assessments (add to current text)	Accepted
Sims (Massey University)	5	42	17	-	27	-	-	-	Refer to Chapter 9	It should e the other way around. Ch.9 should refer to the more detailed analysis provided in Ch.5
Harby (SINTEF Energy Research)	5	42	3	42	3	-	-	-	The example from Orkla only includes 3 years of unregulated data from before regulation, and may not be representative	This statement is also supported by the subsequent reference (line 6)
Taylor (International Hydropower Association (IHA))	5	42	17	42	27	5.6.1	-	-	Comment: For balance, this paragraph needs to talk about the impacts of resettlement, etc. with the creation of larger-scale reservoirs and/or refer to section 5.6.1.7.	Accepted
Harby (SINTEF Energy Research)	5	43	11	43	11	-	-	-	"The sentence ""Generally, reservoirs are good habitat for fish."" should be changed to ""Generally, reservoirs may be good habitat for fish."" There are many examples on both enhanced and decreased habitat conditions. "	Accepted
Gagnon (Hydro-Quebec)	5	44	18	-	33	-	-	-	If possible, it would be worthwhile to give a more complete picture of where there are no or little sedimentation problems (not just Norway and Canada). Otherwise, the issue may appear more important than it is really.	Accepted
Harby (SINTEF Energy Research)	5	44	6	44	6	-	-	-	Please give reference to successful re-oxygenation of reservoirs? Is this possible in large scales (large reservoirs) as well?	Authors will further investigate if fre can e found otherwise will be deleted
Harby (SINTEF Energy Research)	5	44	2	44	2	-	-	-	The formation of methane is not only something that happens in the first years after impoundment. Methane may be created as long as there are lack of oxygen which may be an on-going process for the life-span of the reservoir.	Accepted

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Aelbrecht (Electricite de France - Hydro Engineering Center)	5	44	-	-	-	5.6.1.4	-	-	"Distinction of projects behavior with respect to sedimentation problem must be made between run-of-river projects on one hand and storage reservoirs on the other hand. The formers are characterized by some possibility of using flow in the upstream pond to erode and transport sediment downstream (particularlry during floods) ; the latters do not have the same possibility, and specific solution must be considered"	Accepted
Kruger (South African Weather Service)	5	44	17	44	33	5.6.1.4	-	-	Sedimentation is not caused by HPP as such, it is one of the challenges of HPP projects. Therefore not an environmental impact.	In many cases the creation of a reservoir associated with the HPP has an impact on the sediment transit
Harby (SINTEF Energy Research)	5	45	5	45	5	-	-	-	"Suggested to change the word ""minimize"" with ""reduce"". Please include that this mainly is possible in low-head power plants."	Accepted
Aelbrecht (Electricite de France - Hydro Engineering Center)	5	45	-	-	-	5.6.1.6	-	-	"This section should highlight that solutions for upstream fish migration are now pretty well managed : a variety of solutions have been studied and tested since about 30 years and have shown acceptable to high efficiency ; the downstream fish migration issue is significantly more difficult to adress ; important research efforts are undertaken in some countries, especially for adresssing the cas of eels migration, while salmonids downstream migration is progressively well managed. Fish-Friendly turbines (VLH from MJ2Tech ; Alden concept ; Alstom and Voith MGR concepts) also appear as highly potential valuable win-win solutions to both respond to fish protection and energy optimization. "	Accepted
Gagnon (Hydro-Quebec)	5	46	30	-	-	-	-	-	The issue of mercury in reservoir may need a small paragraph of its own. It should include a reference on the fact that the mercury on Northern soils is basically mercury that was previously emitted by smelters and coal fired power plants. It is mainly this mercury that is contaminating reservoirs.	Accepted
Taylor (International Hydropower Association (IHA))	5	46	5	46	5	5.6.1.8	-	-	"Delete ""large"" and replace with ""reservoir"". Reason: See reason given for ""5, 5, 16, 5, 16"" above and c.f. comment for ""9, 55, 1, 55, 11, 9.6.3""."	Accepted
Taylor (International Hydropower Association (IHA))	5	47	39	44	39	5.6.2	-	-	Comment: I strongly support this crisp statement of the fundamental issues underlying the assessment and management of hydropower project impacts.	Accepted
Harby (SINTEF Energy Research)	5	49	42	49	44	-	-	-	"All freshwater systems also bury some carbon in the sediments (see Cole et al, 2007. Plumbing the Global Carbon Cycle: Integrating Inland Waters into the Terrestrial Carbon Budget. Ecosystems DOI: 10.1007/s10021-006-9013-8)."	Accepted

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Harby (SINTEF Energy Research)	5	49	41	49	41	-	-	-	"Please give how many countries the experts represent in stead of the phrase ""all over the world""."	Accepted
SCOWCROFT (EURELECTRIC)	5	49	0	-	-	-	-	-	The value of 15 gCO <sub>2</sub> eq/kWh can be confirmed by research work of VGB. (Source: VGB 2009).	Accepted
Vahrenholt (RWE Innogy GmbH)	5	49	-	-	-	-	-	-	The value of 15 gCO <sub>2</sub> eq/kWh can be confirmed by research work of VGB. (Source: VGB 2009).	Accepted
Taylor (International Hydropower Association (IHA))	5	49	18	49	21	5.6.3	-	-	Suggested edits: It should be commented that these emissions are not considered to be important for the whole life cycle of the reservoir. Also, it should be added that emissions associated with land use change (including deforestation, agricultural practices, and urbanisation) have to be approached with care, as they are not always a direct consequence of the dam construction.	Accepted
Harby (SINTEF Energy Research)	5	50	11	50	11	-	-	-	"Erase the word ""riparian"". The inflow from the terrestrial ecosystem includes more than the riparian zone"	Accepted
Harby (SINTEF Energy Research)	5	50	11	50	11	-	-	-	"It is unprecise to write ""abstract carbon inflow"". The more precise operation is to consider the effect of carbon inflow from the terrestrial ecosystem on the net GHG emission before and after impoundment."	Accepted
Harby (SINTEF Energy Research)	5	50	11	50	12	-	-	-	"Please rewrite the mixing of carbon inflow from the terrestrial ecosystem and ""other human activitites"". The inflow from the terrestrial ecosystem may be both natural and related to human activities, please distinguish."	Accepted
Harby (SINTEF Energy Research)	5	50	10	50	10	-	-	-	The terrestrial ecosystem located in the area before impoundment must of course also be included in the net emission calculation, as well as the wetlands, rivers and lakes.	Accepted
Harby (SINTEF Energy Research)	5	50	1	50	3	-	-	-	This is only for CO <sub>2</sub> , not for methane or all GHG!	Accepted

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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Considerations by the writing team
Taylor (International Hydropower Association (IHA))	5	50	19	50	28	5.6.3	-	-	"Comment: The sentence ""CH4 transferred through diffusive fluxes from the bottom to the water surface of the reservoir may undergo oxidation, that is to say transformed in CO2, in the water column nearby the oxicle9 when methanotrophic bacteria are present"" should be moved further to the end of the paragraph. Suggestion: the paragraph should read like ""For most of the studied reservoirs, two GHG pathways from the reservoir to the atmosphere have been studied (Figure 5.23): ebullition and diffusive fluxes from the surface of the reservoir. In addition, studies at Petit-Saut, Samuel and Balbina have investigated GHG emissions downstream of the dam (degassing just downstream of the dam and diffusive fluxes along the river course downstream of the dam). CH4 transferred through diffusive fluxes from the bottom to the water surface of the reservoir may undergo oxidation, that is to say transformed in CO2, in the water column nearby the oxicle9 when methanotrophic bacteria are present. Regarding N2O, Gu□n et al. (2008b) have identified several possible pathways for N2O emissions: emissions could occur via diffusive flux, degassing and possibly through macrophytes but this last pathway has never been quantified neither in boreal or tropical environment""	Accepted
Taylor (International Hydropower Association (IHA))	5	50	14	50	15	5.6.3	-	-	"Comment: The sentence ""The nitrous oxide (N2O) could be also an issue in some cases and more particularly in tropical areas or in reservoirs with large drawdown zones"" gives the impression that the main driver for N2O emissions is the location of the reservoir in ""tropical areas"".  Suggestion: to change the order of the drivers in the sentece. The sentence should be ""The nitrous oxide (N2O) could be also an issue in some cases and more particularly in reservoirs with large drawdown zones or in tropical areas""."	Accepted
Taylor (International Hydropower Association (IHA))	5	50	30	51	2	5.6.3	-	-	"There are two different titles for figure 5.23: ""Evolution of the E&S process, adopted from UNEP (2007)"" and ""Carbon dioxide and methane pathways in freshwater reservoir with an anoxic hypolimnion ((IJHD, 2 2005); Guerin et al. 2007; Guerin et al 2008b)"". The correct title should be: ""Carbon dioxide and methane pathways in freshwater reservoir with an anoxic hypolimnion (UNESCO/IHA, 2008)""."	exact ref will be checked
Tolmasquim (Empresa de Pesquisa Energetica - EPE)	5	51	-	-	-	-	-	-	"Foot note: Write ""Itumbiara"" instead of ""Itumbira"" and ""Sarvalho"" instead of ""Carvalho""."	Accepted

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Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	51	-	-	-	-	-	-	"I suggest to use a different time schedule than ""□first semester 2010""."	idem
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	51	-	-	-	-	-	-	"I suggest to use a different time schedule than ""□first semester 2010""."	No more precise information at this stage
Jara Tirapegui (Endesa Eco S.A.)	5	51	13	-	-	-	-	-	"Indicate ""OM"" meaning"	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	51	13	51	13	-	-	-	"Introduce the abbreviation ""OM"" to the reader, which is also used in Fig. 5.23."	Accepted
Harby (SINTEF Energy Research)	5	51	28	51	28	-	-	-	"Please include ""or by internal processes in the reservoir"" after the word ""watershed"". In many cases, primary production and internal processes in the reservoir are the main contribution to the GHG flux (uptake and emission)."	Accepted
Harby (SINTEF Energy Research)	5	51	5	51	5	-	-	-	"Plese write ""flux"" in stead of ""emissions"". It is not sure what direction the flux will be, i.e. its better to use flux than emission/uptake."	Accepted
Jara Tirapegui (Endesa Eco S.A.)	5	51	8	-	-	-	-	-	"Subscript correction in ""CO2"" and ""CH4"""	Accepted
Harby (SINTEF Energy Research)	5	51	1	51	2	-	-	-	Something missing in the first phrase?	ref comment Taylor 67
Harby (SINTEF Energy Research)	5	51	15	51	21	-	-	-	The sentence only gives information that measurements have been done without giving the estimates of gross emissions. Please include what the measurements show, i.e. in some cases high gross GHG emissions.	Accepted
Harby (SINTEF Energy Research)	5	51	12	52	7	-	-	-	This paragraph may be shortened and more balanced. Please also include estimates of net emissions.	Lack of peered review refernces for net estimates
Ulleberg (Institute for Energy Technology)	5	51	13	51	13	-	-	-	Where is OM defined?	Accepted

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Taylor (International Hydropower Association (IHA))	5	51	11	51	11	5.6.3	-	-	"A paragraph on GHG emissions in boreal and temperate regions should be included, after table 5.5., and before the paragraph starting on line 12. Suggestion: ""Gross emissions measurements in boreal and temperate regions from Canada, Finland, Iceland, Norway, Sweden and USA imply that highly variable results can be obtained for CO2 emissions, so that reservoirs can act as sinks, but also can present significant CO2 emissions. Significant CH4 emissions were not observed in these studies (under boreal/temperate conditions, significant CH4 emissions are expected only for reservoirs with large drawdown zones and high organic and nutrient inflows)."	Accepted
Taylor (International Hydropower Association (IHA))	5	51	9	51	9	5.6.3	-	-	"The correct refernce should be ""UNESCO/IHA, 2008"" (instead of ""UNESCO-RED, 2008"")"	Accepted



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Taylor (International Hydropower Association (IHA))	5	51	3	51	7	5.6.3	-	-	<p>"The paragraph refers only to gross emissions investigated in boreal and temperate regions, and refer to Table 5.5 as summarising ""boreal/temperate regions from Canada, Finland, Iceland, Norway, Sweden and USA"". However, gross emissions have also been measured under tropical (and sub-tropical) conditions, and Table 5.5 includes data from tropical conditions. Also, the footnote 11 (reported to ""temperate"" present a series of references from studies in tropical regions). Suggestion: ""Still, for the time being, only a limited amount of studies appraising the net emissions from freshwater reservoirs (i.e. excluding unrelated anthropogenic sources and pre-existing natural emissions) is available, whereas gross emissions have been investigated in boreal<sup>10</sup>, temperate<sup>11</sup> and tropical/subtropical<sup>12</sup> regions. Gross emissions measurements in are summarized in Table 5.5. below."".</p> <p>Footnotes:  <sup>10</sup> Rudd 1993; Duchemin et al., 1995; Kelly et al. 1997; Huttunen et al. 2002; Tremblay et al. 2005  <sup>11</sup> Therrien et al. 2005; Soumis et al. 2004; Casper et al. 2000  <sup>12</sup> Keller and Stallard 1994; Rosa and Scheaffer 1994; Galy-Lacaux et al. 1997; Galy-Lacaux et al. 1999; Fearnside 1995; Fearnside 1997; Fearnside 2001; Fearnside 2002; Delmas et al. 2001; Rosa et al. 2003; Abril et al. 2005; Sikar et al. 2005; Santos et al. 2006; Guerin et al. 2008; Kemenes et al. 2007</p> <p>Observe that all subsequent footnotes have to be renumbered.                      Also observe that the reference to ""gross emissions measurements in boreal/temperate regions from Canada, Finland, Iceland, Norway, Sweden and USA"" was eliminated (see comment for line 11)</p> <p>"</p>	Accepted
Ulleberg (Institute for Energy Technology)	5	51	-	-	-	-	-	5.5	Strange units (mmol per m2 per day). Would it be possible to convert to kg per m2 day or per year? It would also be interesting to relate these emission to typical energy output per year, e.g. kg CO2/year per kWh/year, i.e., kg CO2/kWh	Commonly used units. Depends on the reservoir characteristics, not the Power plant. Therefore the relation to energy output must be computed on a case by case basis
SCOWCROFT (EURELECTRIC)	5	52	38	-	-	-	-	-	"IPCC SRREN FOD: ""□due to sediments□"" Our proposal: ""...due to corrosion or cavitation□"""	Accepted
Vahrenholt (RWE Innogy GmbH)	5	52	38	-	-	-	-	-	"IPCC SRREN FOD: ""□due to sediments□"" RWEI comment: ""...due to corrosion or cavitation□"""	Accepted

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Harby (SINTEF Energy Research)	5	52	2	52	2	-	-	-	"Please write ""2-4"" in stead of ""initial"", which should be according to Tremblay et al."	Accepted
Sims (Massey University)	5	52	40	-	-	-	-	-	"Quantify ""most"" and why 30 years?"	"Most" and 30 years is used because this is the findings in the report
Taylor (International Hydropower Association (IHA))	5	52	14	52	14	5.6.3	-	-	"Add ""The UNESCO/IHA project aims to deliver measurement specification guidance to enable standardised measurement and calculation worldwide, a database of results and characteristics of the measurement specification guidance being applied to a representatvie set of reservoirs worldwide, building predictive modelling tools to assess the GHG status of unmonitored reservoirs and new reservoir sites, and guidance on mitigation for vulnerable sites."" after ""... knowledge gaps."" Reason: The deliverables of the UNESCO/IHA project are germane to the dicussion in this section."	Accepted
Ulleberg (Institute for Energy Technology)	5	52	15	52	33	5.64	-	-	"The terminology ""Multiplier effect"" is somewhat relatet to the term ""multi-purpose project"", referred to elsewhere in the chapter. Maybe not necessary to introduce this term and discuss again, as the message has come across elsewhere in the chapter?"	No relation to multipurpose projects. Multiplier is defined line 25
SCOWCROFT (EURELECTRIC)	5	52	0	-	-	5.7	-	-	Technology improvements corresponds to research and development acitivites during the last decades.	meaning 5.6
Vahrenholt (RWE Innogy GmbH)	5	52	-	-	-	5.7	-	-	Technology improvements corresponds to research and development acitivites during the last decades.	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	53	34	53	34	-	-	-	"I propose to replace ""□with respect□"" by ""□in comparison to□""."	Accepted
Harby (SINTEF Energy Research)	5	53	45	53	45	-	-	-	"Include the word ""low-head"" in front of ""hydraulic""."	Accepted
SCOWCROFT (EURELECTRIC)	5	53	44	-	-	-	-	-	Mainly used on US market. European Projects with fish-friendly turbines like Wehrkraftwerk RADAG (new built) Rheinfelden/ENBW/GER (new built) and Eglisau/Axpo/CH (refurbishment).	as above
Vahrenholt (RWE Innogy GmbH)	5	53	44	-	-	-	-	-	Mainly used on US market. European Projects with fish-friendly turbines like Wehrkraftwerk RADAG (new built) Rheinfelden/ENBW/GER (new built) and Eglisau/Axpo/CH (refurbishment).	will be rewritten
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	54	18	54	26	-	-	-	"Has the study (being mentioned in line 26 ) been the basis for FERC's ""policy statement""? If so, I suggest to change the order of the paragraphs."	Accepted

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Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	54	31	54	33	-	-	-	The paragraph's last sentence contains information that has been given a few lines earlier. Please reconsider the sentence's necessity.	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	55	42	55	43	-	-	-	""where only those projects that were considered economically and environmentally feasible have been included."" --> this contradicts to chapter 5.2.1, stating that the technically feasible potential has been chosen because what is economically feasible depends on variable energy supply and pricing (p. 10, lines 27-29)."	will be coordinated between 5.2.1 and 5.8.1
Sims (Massey University)	5	56	28	-	29	-	-	-	kW not KW	Accepted
Rybach (Geowatt AG)	5	56	-	-	-	-	-	-	Presumably the costs are given US\$, not €. .	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	56	9	56	20	-	-	-	This differentiation should be given in section 5.2.1 to clearly show what section 5.2.1 refers to.	5.2.1 only technical potential
de Campos (Petrobras)	5	56	8	-	-	-	-	-	What does this energy cost comprise? What has investment analysis method used to determine the energy cost?	will be investigated
de Campos (Petrobras)	5	56	22	-	-	-	-	-	What is the domain of this function ? (cost x ?)	comment unclear
Ulleberg (Institute for Energy Technology)	5	56	-	-	-	-	-	5.6	Nice table. Units must be given in USD (2005).	the raw figure from the reference
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	57	7	57	7	-	-	-	""according to"" instead of ""in""	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	57	4	57	4	-	-	-	""Development cost of hydropower also DEPEND (not ""cost"" on licensing, ""	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	57	10	57	10	-	-	-	"doubled meaning (""price trend of the prices"")"	one "price" eliminated
Louis (EDF Hydro Engineering Centre)	5	57	16	-	-	-	-	-	"Most of the equipment is today manufactured in ""developing countries"" like China, Brazil, but also India, Russia, Argentina. Most western manufacturers have facilities in China and Brazil."	I will arrange
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	57	15	57	15	-	-	-	"replace ""projects"" by ""equipment""; my suggestion: ""follow global prices for these components""	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	57	16	57	16	-	-	-	"use plural ""most of the machinery used in hydropower projects is ""	Accepted

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Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	57	8	57	9	-	-	-	Please check the formulation of this sentence (greater costs in comparison to?)	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	57	8	57	12	-	-	-	This paragraph needs some support (references, case studies, figures, etc.)	I will put reference or case studies.
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	57	17	57	18	-	-	-	This sentence better fits in a concluding paragraph to this section.	I will move it to the end like a conclusion.
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	57	6	57	6	-	-	-	Use the present not the past tense for citing papers.	Accepted
Ulleberg (Institute for Energy Technology)	5	57	-	-	-	-	5.24	-	What is the purpose of showing this figure? The figure only shows that the cost of a hydropower project is between 250 and 5000 USD/kW. That is not very helpful information. Figure 5.25 is much more useful. Suggestion: Delete Figure 5.24.	5.24 gives unit cost 5.25 do not
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	58	28	58	28	-	-	-	""..each purpose will carry out□"" --> check tenses"	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	58	4	58	4	-	-	-	""□projects as given in figure 5.26.""	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	58	24	58	24	-	-	-	""□serving multi purposes□""	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	58	6	58	6	-	-	-	"Introduce ""E&M"" as abbreviation."	E&M = electromechanical
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	58	2	58	3	-	-	-	"my suggestion: ""□it is possible to identify a trend.""	I will identify the trend by a formula and improve the figure + appropriate reference.
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	58	12	58	12	-	-	-	"Please avoid generalizations like ""□have to be more expensive□"" as there might be exceptions. Instead I suggest to use ""□show the tendency/are generally□"" , etc"	"are generally"
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	58	3	58	3	-	-	-	use present tense	Accepted
Kruger (South African Weather Service)	5	58	6	58	7	5.8.1	5.26	-	Figure should be cleaned up. Reference is necessary in the caption.	I will clean up the figure. + the appropriate reference.

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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Considerations by the writing team
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	59	18	59	18	-	-	-	" ""The Government of India□""	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	59	14	59	19	-	-	-	Are there any conclusions from the cited studies in this paragraph?	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	59	25	59	25	-	-	-	Please give some additional information on the forecast scenarios. What is the range of generation in numbers in 2100? What are the author's best estimates based on? What are the scenarios' assumptions (high, medium, low scenario)?	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	59	5	59	7	-	-	-	Please reformulate the paragraph's first sentence. Its message is not clear to me.	Accepted
Tolmasquim (Empresa de Pesquisa Energetica - EPE)	5	59	-	-	-	-	5.27	-	In the legend: Author's best estimate. Who is the author of the scenario?	reference shall be given by Anund K
Ulleberg (Institute for Energy Technology)	5	59	-	-	-	-	5.27	-	Reference? Details on assumptions and forecasting method should be described.	reference shall be given by Anund K
Kruger (South African Weather Service)	5	59	26	59	27	5.9.1	5.27	-	The forecast scenarios should be briefly explained.	As per Oxford accord this section is bening rearranged/added/edited
Takeuchi (Advanced Industrial Science and Technology)	5	60	-	62	-	-	-	-	Please unite together these figures into one figure to reduce pages.	regional wise depoyment is required as it varies a lot
Ulleberg (Institute for Energy Technology)	5	60	4	61	11	5.9.1.1	-	-	Figures 5.27 - 5.32 could be combined in one figure to save space.	regional wise depoyment is required as it varies a lot
Ulleberg (Institute for Energy Technology)	5	60	-	-	-	-	5.28	-	Reference? Details on assumptions and forecasting method should be described.	shall be explained
Kruger (South African Weather Service)	5	60	12	60	13	5.9.1.1	5.28	-	The forecast scenarios should be briefly explained.	shall be explained
Ulleberg (Institute for Energy Technology)	5	60	-	-	-	-	5.29	-	Reference? Details on assumptions and forecasting method should be described.	shall be explained
Kruger (South African Weather Service)	5	60	19	60	20	5.9.1.1	5.29	-	The forecast scenarios should be briefly explained.	shall be explained
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	61	14	62	3	-	-	-	I understand that (WBCSD, 2009) as a reference to the sentence on p. 61, lines 13-14. If so, there should not be a point at the end of the sentence.	shall be explained
Sims (Massey University)	5	61	-	-	-	-	5.30	-	Combine with Fig 5.31 and 5.32 or at least use same scale for y-axis.	not feasible
Ulleberg (Institute for Energy Technology)	5	61	-	-	-	-	5.30	-	Reference? Details on assumptions and forecasting method should be described.	shall be explained

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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Considerations by the writing team
Kruger (South African Weather Service)	5	61	4	61	5	5.9.1.1	5.30	-	The forecast scenarios should be briefly explained.	shall be explained
Ulleberg (Institute for Energy Technology)	5	61	-	-	-	-	5.31	-	Reference? Details on assumptions and forecasting method should be described.	shall be explained
Kruger (South African Weather Service)	5	61	15	61	16	5.9.1.1	5.31	-	The forecast scenarios should be briefly explained.	shall be explained
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	62	22	63	3	-	-	-	I suggest to put the text-box at the end of this section.	Accepted
Tran (Vietnam Institute of Meteorology, Hydrology and Environment)	5	62	22	-	-	-	-	-	Why use Box here, I haven't seen it in other chapters, needs consistency	Accepted
Kruger (South African Weather Service)	5	62	22	63	3	5.10.1	-	-	Should there be reference made in the text to the boxes?	Accepted
Ulleberg (Institute for Energy Technology)	5	62	-	-	-	-	5.32	-	Reference? Details on assumptions and forecasting method should be described.	5.9 needs re-writing in accordance with the Oxford Accord
Kruger (South African Weather Service)	5	62	1	62	2	5.9.1.1	5.32	-	The forecast scenarios should be briefly explained.	shall be explained
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	63	23	63	27	-	-	-	The introductory sentence needs to be linked to the quotation given in lines 25 to 27.	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	63	23	63	27	-	-	-	The introductory sentence needs to be linked to the quotation given in lines 25 to 27.	Accepted
Tolmasquim (Empresa de Pesquisa Energetica - EPE)	5	64	13	65	32	-	-	-	"There isn't reference of Box 5.3 and 5.4 in the text and it isn't related only to the item ""Multi-purpose use of reservoirs"". Maybe it could be in the item 5.10.1 The need for climate-driven water management."	Accepted
Sims (Massey University)	5	64	-	-	-	-	-	-	Boxes not referred to in text	Accepted
Tran (Vietnam Institute of Meteorology, Hydrology and Environment)	5	64	4	-	-	-	-	-	Why use Box here, I haven't seen it in other chapters, needs consistency	Accepted
Tran (Vietnam Institute of Meteorology, Hydrology and Environment)	5	64	13	-	-	-	-	-	Why use Box here, I haven't seen it in other chapters, needs consistency	Accepted
Ulleberg (Institute for Energy Technology)	5	64	13	65	7	Box 5.3	-	-	Is this box really needed? The information presented is of a very general and abstract nature, and repeats information presented elsewhere in the chapter. Suggestion: Delete Box 5.3.	Accepted

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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Considerations by the writing team
Tran (Vietnam Institute of Meteorology, Hydrology and Environment)	5	65	9	-	-	-	-	-	Why use Box here, I haven't seen it in other chapters, needs consistency	Accepted
Ulleberg (Institute for Energy Technology)	5	65	9	65	32	Box 5.4	-	-	Is this box really needed? The information presented is of a very general and abstract nature, and repeats information presented elsewhere in the chapter. Suggestion: Delete Box 5.4.	Accepted
Ulleberg (Institute for Energy Technology)	5	-	-	-	-	-	-	-	"One main message in the chapter is that hydroelectric projects must be viewed as ""multipurpose projects"" (power, fresh water supply, river transport, flood control, etc.). This message comes across very clearly, and is maybe repeated too many times."	Message appears to be repeated but is given in different context
Ulleberg (Institute for Energy Technology)	5	-	-	-	-	-	-	-	"The description of other RES as being ""intermittent"" should be changed throughout, as this gives the reader the association of an unreliable energy source. Instead, the word ""variable"" should be used to describe other RES."	as per agreed TSU guidelines from X cutting
Taylor (International Hydropower Association (IHA))	5	-	-	-	-	-	-	-	Comment: Chapter 5 could be shortened by 5-6 pages without compromising scope or quality of content. There is duplication and repetition some of which I have indicated below.	Shall be attempted. But shall have additional details on section 5.9
Branche (Electricite de France (EDF))	5	-	-	-	-	-	-	-	Do not discriminate large vs. small hydro in this chapter (it is only a political decision for this distinction as there is no one definition across the region and world regarding the size limit). Hundreds of small hydro power plants generating the same energy amount than a large one, may have more significant impacts (both environmental and social). Furthermore large hydro may be developed in a sustainable way, and may provide positive impacts.	Accepted
Vahrenholt (RWE Innogy GmbH)	5	-	-	-	-	-	-	-	For general comments con IPCC SRREN FOD Chapter 5 Hydropower see ancillary material: SREEN_Draft0_Review_Vahrenholt_Fritz_Material_01.ppt	Accepted
Ulleberg (Institute for Energy Technology)	5	-	-	-	-	-	-	-	In general, a well-written and easy to read chapter, which gives a good description of the hydroelectric potential in the various regions and climate zones around the world, and the challenges to reach the maximum feasible potential.	Accepted
Ulleberg (Institute for Energy Technology)	5	-	-	-	-	-	-	-	Maybe a bit but a bit too much text and repetition on some topics, such as types/classifications of systems (5.3.1 and 5.1.2) and hydroelectric potentials (5.2, 5.4, and 5.9). More detailed comments below.	Accepted
de Haan (Ernst Basler + Partner AG)	5	-	-	-	-	-	-	-	No comments from this expert to chapter 5 hydro	No action required

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Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	5.1.3	-	-	Should give a reference to chapter 5.3, which gives further information on technologies.	introductory section will be rewritten
Harby (SINTEF Energy Research)	5	-	-	-	-	5.10	-	-	It may be worth to mention that some of the reservoirs with reported large gross GHG emissions are multi-purpose reservoirs. Hydropower use may decrease the GHG footprint of reservoirs used for water supply	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	5.10.2	-	-	Boxes 5.2. to 5.4 should be better linked to the chapter. They follow each other without any further explanation how they are related to this chapter.	Accepted



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SCOWCROFT (EURELECTRIC)	5	-	-	-	-	5.3.3	-	-	<p>"This chapter is considered to be too detailed and the statements do not apply for all situations. RWEL therefore suggests to replace it by: As water and fish, also sediments are an integral part of almost any streaming river. However, sediment content strongly varies depending on the type of river from almost none to a high ratio. Sediment ratio is influenced by surrounding land use and vegetation coverage as well as by riverbed material condition and geology. Sediment may be essential for a river system for downstream erosion protection and river delta establishment. Any reservoir acts as a sediment trap. Thus, sedimentation or settling of solids occurs in all basins in the world. The World Commission on Dams (WCD Report, ICOLD 2004) states that up to 1% of worldwide reservoir storage volume is lost due to sedimentation. This exceeds actual new build rate of storage volume, leading to an overall decrease of storage potential (White, 2005). A World Bank study (Mahmood, 1987) comes to similar conclusions. A lot of case studies (HARZA,1999) and literature are also dealing with the problem (Graf, 1971). At the same time, river systems suffer from erosion damages downstream of reservoirs due to a lack of sediments. In many regions, an effective way to reduce sedimentation is a better land use and increased vegetation coverage, e.g. by avoiding clear cutting and a change towards sustainable forestry. Multipurpose reservoirs itself provide irrigation water for enlarging agriculture, increasing vegetation and limiting soil runoff. The Revised Universal Soil Loss Equation (RUSLE) is a method that is widely utilized to estimate soil erosion from a particular parcel of land. In general, the GIS (Geographical Information System) model includes its calibration and using satellite images to determine the vegetation coverage for the entire area. The amount of sediment carried into a reservoir is at its highest during high rainfall and floods. Increases in average annual precipitation of only 10 percent can double the volume of sediment load of rivers (Patric, 2001). However, even an optimized land use will not eliminate sedimentation in reservoirs completely. A reduced storage volume will lead to: 1) a lower flood protection by the reservoir 2) a decreased irrigation water &amp; energy storage capacity 3) a limited operational range of the hydro power plant 4) a shortened reservoir lifetime. Several concepts for sediment control at intake and removal of sediment from reservoirs and settling basin have been developed and practiced. A number of authors (Mahmood, 1987; Morris et al., 1997; ICOLD, 1999; Palmieri et al., 2003; White, 2005) have reported measures to mitigate the sedimentation problems. These measures can be generalised as measures to reduce sediment load to the reservoirs, remove sediment from the storage reservoirs, design and operate hydraulic machineries of hydropower plant aiming to resist effect of sediment passing through them. A method conducted in recent decades to rinse out the sediment in an artificial flood in reservoirs equipped with a bottom outlet lead to ecological damages in downstream regions. However, new technologies as passing on the incoming sediment across the power plant can avoid these disadvantages very cost-effective and with ecological advantages (Hewicker, 2009). Alternative strategies deal with additional sediment traps, such as large settling basins and sluices: Hewicker, 2009: Eliminating Sediment Problems Cheap, Easy, and Permanently, Waterpower '09 Conference, Spokane 2009).</p>	as above

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Vahrenholt (RWE Innogy GmbH)	5	-	-	-	-	5.3.3	-	-	<p>"This chapter is considered to be too detailed and the statements do not apply for all situations. RWEI therefore suggests to replace it by: As water and fish, also sediments are an integral part of almost any streaming river. However, sediment content strongly varies depending on the type of river from almost none to a high ratio. Sediment ratio is influenced by surrounding land use and vegetation coverage as well as by riverbed material condition and geology. Sediment may be essential for a river system for downstream erosion protection and river delta establishment. Any reservoir acts as a sediment trap. Thus, sedimentation or settling of solids occurs in all basins in the world. The World Commission on Dams (WCD Report, ICOLD 2004) states that up to 1% of worldwide reservoir storage volume is lost due to sedimentation. This exceeds actual new build rate of storage volume, leading to an overall decrease of storage potential (White, 2005). A World Bank study (Mahmood, 1987) comes to similar conclusions. A lot of case studies (HARZA, 1999) and literature are also dealing with the problem (Graf, 1971). At the same time, river systems suffer from erosion damages downstream of reservoirs due to a lack of sediments. In many regions, an effective way to reduce sedimentation is a better land use and increased vegetation coverage, e.g. by avoiding clear cutting and a change towards sustainable forestry. Multipurpose reservoirs itself provide irrigation water for enlarging agriculture, increasing vegetation and limiting soil runoff. The Revised Universal Soil Loss Equation (RUSLE) is a method that is widely utilized to estimate soil erosion from a particular parcel of land. In general, the GIS (Geographical Information System) model includes its calibration and using satellite images to determine the vegetation coverage for the entire area. The amount of sediment carried into a reservoir is at its highest during high rainfall and floods. Increases in average annual precipitation of only 10 percent can double the volume of sediment load of rivers (Patric, 2001). However, even an optimized land use will not eliminate sedimentation in reservoirs completely. A reduced storage volume will lead to: 1) a lower flood protection by the reservoir 2) a decreased irrigation water &amp; energy storage capacity 3) a limited operational range of the hydro power plant 4) a shortened reservoir lifetime. Several concepts for sediment control at intake and removal of sediment from reservoirs and settling basin have been developed and practiced. A number of authors (Mahmood, 1987; Morris et al., 1997; ICOLD, 1999; Palmieri et al., 2003; White, 2005) have reported measures to mitigate the sedimentation problems. These measures can be generalised as measures to reduce sediment load to the reservoirs, remove sediment from the storage reservoirs, design and operate hydraulic machineries of hydropower plant aiming to resist effect of sediment passing through them. A method conducted in recent decades to rinse out the sediment in an artificial flood in reservoirs equipped with a bottom outlet lead to ecological damages in downstream regions. However, new technologies as passing on the incoming sediment across the power plant can avoid these disadvantages very cost-effective and with ecological advantages (Hewicker, 2009). Alternative strategies deal with additional sediment traps, such as large settling basins and sand traps. Source: Hewicker, 2009: Eliminating Sediment Problems Cheap, Easy, and Permanently, Waterpower '09 Conference, Spokane 2009).</p>	to detailed but will be considered

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de Campos (Petrobras)	5	-	-	-	-	5.3.4	-	-	Repowering an old hydroelectric can bring all the benefits listed in this section, but ones must be careful whenever enhancing hydroelectric power through increasing its head (dam). This can increase the flood area of the reservoir. (add to current text)	obvious
de Campos (Petrobras)	5	-	-	-	-	5.4.1	-	-	The main reason for hydropower development in a country is an existence of natural resource, i.e. hydropower potential (add to current text)	Confuse with the chapter.
Taylor (International Hydropower Association (IHA))	5	-	-	-	-	5.4.4	-	-	Comment: Sections 5.4.4, 5.5, 5.5.1, 5.5.4, 5.5.5, 5.5.6, 5.5.6.3 and 5.5.8 repeat each other in different words. These sections needs to be rationalised.	Could be founded 5.4.4 (new paragraph in correction 264, and 265) with section 5.5.
de Campos (Petrobras)	5	-	-	-	-	5.4.6.1	-	-	The considerable risk of a Large Hydroelectric investment leads to a high capital cost which implies in decreasing importance of future revenue when considering a Discounted Cash Flow. So, governments must fund the major projects (add to current text)	major projects are not allways funded exclusively by goverments
de Campos (Petrobras)	5	-	-	-	-	5.4.6.2	-	-	The environmental licence also is na important issue. (add to current text)	Add in line 7 pg. 32 " Similar arrangements may be seen in many countries" + "The environmental licence also is na important issue." + correction 286.
Taylor (International Hydropower Association (IHA))	5	-	-	-	-	5.5	-	-	Comment: Sections 5.4.4, 5.5, 5.5.1, 5.5.4, 5.5.5, 5.5.6, 5.5.6.3 and 5.5.8 repeat each other in different words. These sections needs to be rationalised.	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	5.5.1	-	-	"This section should be integrated into section 5.5.4. If this is not an option, I suggest that section 5.5.1 is followed by section 5.5.4 ("Hydropower peaking") as the texts are strongly related."	Accepted
Taylor (International Hydropower Association (IHA))	5	-	-	-	-	5.5.1	-	-	Comment: Sections 5.4.4, 5.5, 5.5.1, 5.5.4, 5.5.5, 5.5.6, 5.5.6.3 and 5.5.8 repeat each other in different words. These sections needs to be rationalised.	Accepted
de Campos (Petrobras)	5	-	-	-	-	5.5.1	-	-	In this case, the hydroelectric must be rewarded for availability insted of energy draws. Otherwise, it would be not economically feasible. (add to current text)	Accepted
Taylor (International Hydropower Association (IHA))	5	-	-	-	-	5.5.4	-	-	Comment: Sections 5.4.4, 5.5, 5.5.1, 5.5.4, 5.5.5, 5.5.6, 5.5.6.3 and 5.5.8 repeat each other in different words. These sections needs to be rationalised.	Accepted
Taylor (International Hydropower Association (IHA))	5	-	-	-	-	5.5.5	-	-	Comment: Sections 5.4.4, 5.5, 5.5.1, 5.5.4, 5.5.5, 5.5.6, 5.5.6.3 and 5.5.8 repeat each other in different words. These sections needs to be rationalised.	Accepted
Taylor (International Hydropower Association (IHA))	5	-	-	-	-	5.5.6	-	-	Comment: Sections 5.4.4, 5.5, 5.5.1, 5.5.4, 5.5.5, 5.5.6, 5.5.6.3 and 5.5.8 repeat each other in different words. These sections needs to be rationalised.	Accepted

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de Campos (Petrobras)	5	-	-	-	-	5.5.6.2	-	-	Other importante issue is the national security. Dams can be a target for terrorist attack (add to current text)	this goes for everything
Taylor (International Hydropower Association (IHA))	5	-	-	-	-	5.5.6.3	-	-	Comment: Sections 5.4.4, 5.5, 5.5.1, 5.5.4, 5.5.5, 5.5.6, 5.5.6.3 and 5.5.8 repeat each other in different words. These sections needs to be rationalised.	Accepted
de Campos (Petrobras)	5	-	-	-	-	5.5.7	-	-	A chart showing the treatis would be usefull	will increase content too much
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	5.5.8	-	-	"I suggest to rename this chapter: ""Interaction with other renewable energy sources"""	not allowed
de Campos (Petrobras)	5	-	-	-	-	5.5.8	-	-	"This section could be sun up in one phrase : ""Hydropower plants with reservoirs work as energy storage and regulator to the other renewable energy sources. This information is repeated throughout the section (remove section)"	it is an important point which needs to be dealt with i nmore detail
Taylor (International Hydropower Association (IHA))	5	-	-	-	-	5.5.8	-	-	Comment: Sections 5.4.4, 5.5, 5.5.1, 5.5.4, 5.5.5, 5.5.6, 5.5.6.3 and 5.5.8 repeat each other in different words. These sections needs to be rationalised.	Accepted
Harby (SINTEF Energy Research)	5	-	-	-	-	5.6	-	-	"In general this first part of ""Environmental and social impacts"" is missing to describe the major problem: Creating a reservoir in a river basin leads to a drastic land-use change which again results in displacement of people, total "	Accepted
Harby (SINTEF Energy Research)	5	-	-	-	-	5.6	-	-	"Introducing a dam or a weir is a migration barrier in the system; one of the most common and important environmental impact. This should also be mentioned in the introduction."	Accepted

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Bevanger (Norwegian Institute for Nature Research (NINA))	5	-	-	-	-	5.6	-	-	<p>"The chapter should comment on possible impacts of hydro-power development on terrestrial fauna and flora. Although existing literature related to ecological effects of river regulations on wildlife is extensive, the knowledge is mainly restricted to and based on EIA studies. A restricted number of long-term studies have been carried out enabling predictions of species-specific effects of hydropower development on mammals and birds. In general four types of environmental disturbances are singled out; i.e. habitat changes, geological and climatic changes, direct mortality and increased human use of the area. Most predictions are, however, very general and only able to focus on type of change, without quantifying the short- and long-term effects. Thus, it is generally realized that the current knowledge cannot provide a basis for precise predictions. Climatic conditions, including seasonality and precipitation, human activities (e.g. forestry and agricultural practices) together with topography and geological conditions are major important factors to modify possible effects of hydropower development. The impacts are highly species-, site-, seasonal -and construction-specific."</p> <p>The most serious ecological effects of hydropower development to wildlife is in general</p> <ul style="list-style-type: none"> <li>o permanent loss of habitat through inundation</li> <li>o loss of flooding</li> <li>o fluctuating water levels (and habitat change)</li> <li>o aspects of landscape ecology and secondary effects</li> </ul> <p>A submerged area loses all terrestrial animals, and many animals will be drowned and expelled when a new reservoir is filled up. Increased aquatic production caused by nutrient leakage from the inundated soil immediately after damming, have been observed to affect both invertebrates and vertebrates positively for some time, i.e. until the soil nutrients have been washed out. An increase in aquatic birds associated with this 'damming effect' in the reservoir has been observed.</p>	First sentence accepted -but a text on this has to be developed
El-Hinnawi (National Research Centre)	5	-	-	-	-	5.6	-	-	<p>"The section contains general statements not supported by quantitative data or examples. The environmental impacts should be divided into physical aspects; biological impacts; geochemical and bio-geochemical impacts; and socio-economic aspects both in the reservoir area and downstream. The impacts of power transmission lines should also be discussed."</p>	There are many ways of classifying impacts. A choice had to be made. Power transmission line impact is a cross-cutting issue for almost all electricity generation technologies

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Harby (SINTEF Energy Research)	5	-	-	-	-	5.6	-	-	(cont. from above) environmental impacts. I am quite sure that the credibility of the chapter would be improved if both positive and negative examples could be shown.	Accepted
Harby (SINTEF Energy Research)	5	-	-	-	-	5.6	-	-	(cont.) change of an ecosystem (from riverine and terrestrial to stagnant/lentic water)change of ecosystem (from riverine and terrestrial to stagnant/lentic water), treat to bio-diversity, habitat loss, etc.	Accepted

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Bevanger (Norwegian Institute for Nature Research (NINA))	5	-	-	-	-	5.6	-	-	<p>A submerged area loses all terrestrial animals, and many animals will be drowned and dispelled when a new reservoir is filled up. Increased aquatic production caused by nutrient leakage from the inundated soil immediately after damming, have been observed to affect both invertebrates and vertebrates positively for some time, i.e. until the soil nutrients have been washed out. An increase in aquatic birds associated with this 'damming effect' in the reservoir has been observed.</p> <p>A prevalent downstream impact of a reservoir is the out-levelling of water discharge over the year; commonly combined with weekly or daily regulations. From a wildlife point of view it is the habitat changes following from this change in water flow regime that might cause concern. The habitat change is mostly a result of the effect which unflooded/flooded shorelines create regarding vegetation growth. The riparian habitats might be completely changed with respect to vegetation, i.e. species and community structure which in turn affect the mammalian and bird fauna.</p> <p>Frequent fluctuations of the water level downstream a hydropower reservoir and a tailrace area might create problems both for mammals and birds. Sudden water release could drown animals and wash nests of waterfowls away. Little is known on how the corridor function of a river system is affected by changed water regimes and a reservoir construction. It is, however, recognized that both birds and mammals can be affected. Moreover, secondary effects of road construction and opening up to pristine habitats will obviously affect the fauna. Minor research activities have focused these aspects.</p> <p>Secondary effects of hydro-power development are the power transmission, and the impact of the over-head wires and power-line corridors. Power lines are known to kill birds both through collisions and electrocution. Even reptiles and mammals are known to be electrocuted. The barrier effect of power-line corridors, pipelines and artificial lakes is another problem to be considered.</p> <p>In short, the probably most dramatic ecological effects of hydropower generation, apart from the inundation of land areas, are the changed seasonal variations in water flow and water level, as the seasonal hydrological dynamics in a river system is the main driver of the ecological processes of such an ecosystem.</p>	the general idea is accepted but a new text needs to be developed

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de Campos (Petrobras)	5	-	-	-	-	5.6	-	-	Some hydropower are build far from the major cities. During its construction, which can take several years, new cities are created to suport the project. If not well previewed in the environmental impact assessment, when the construction is over this cities loose their economy and become a social problem (add to current text)	Accepted
Harby (SINTEF Energy Research)	5	-	-	-	-	5.6	-	-	This section gives several examples on environmental impacts which makes it easier for the reader to understand the subject and I support this idea. However, the examples are not balanced and they mainly show only positive	Accepted
Harby (SINTEF Energy Research)	5	-	-	-	-	5.6.1.2	-	-	This section is more balanced and gives a better overview of positive and negative impacts, including mitigation. However, the fact that dams/reservoirs introduce migration barriers is missing	Accepted
de Campos (Petrobras)	5	-	-	-	-	5.6.1.4	-	-	The type and volume of sediment must be thorough studied before the project start (add to current text)	The Report cannot be prescriptive. The comment will be dealt with using a different wording
Harby (SINTEF Energy Research)	5	-	-	-	-	5.6.1.5	-	-	Reduced biological diversity are closely related to the loss of habitats and special biotopes. This should be mentioned here as well as the impacts on endagered species that need special habitats.	Accepted
de Campos (Petrobras)	5	-	-	-	-	5.6.1.7	-	-	Even though good resettlement policies have been developed, this issue is always an oportunity to political group appears. So, this phase of the project will be always delayed due to negotiations. (add to current text)	May happen, but not in all cases
de Campos (Petrobras)	5	-	-	-	-	5.6.2	-	-	Guidelines and regulations are the key tools to manage environmental and social impacts, but the regulation can make hydropower projects impracticable. So, a trade off is need whenever writting a regulation (a.c.c)	Accepted
Taylor (International Hydropower Association (IHA))	5	-	-	-	-	5.6.3	-	-	"Comment: The section on GHG emissions is basically accurate; however, given the limited coverage of other challenges addressed in this chapter, the size of the GHG section appears to be disproportionate."	GHG emissions from reservoirs is a complex issue, whilst a key one in an IPCC report



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Taylor (International Hydropower Association (IHA))	5	-	-	-	-	5.6.3	-	-	<p>"IPCC (2006). IPCC Guidelines for National Greenhouse Gas Inventories. Volume 4: Agriculture, Forestry and Other Land Use. Chapter 7: Wetlands.</p> <p>Keller M. and R.F. Stallard (1994) Methane emissions by bubbling from Gatun Lake, Panama. J. Geophys. Res. 99, 8307-83 19.</p> <p>Kelly C.A., J.W. Rudd and others (1997) Increases in fluxes of greenhouse gases and methyl mercury following flooding of an experimental reservoir. Env. Sci. Technol. 31: 1334-1344.</p> <p>Kemenes, A., B.R. Forsberg, and J.M. Melack (2007) Methane release below a tropical hydroelectric dam. Geophys. Res. Let. 34: L12809, doi:10.1029/2007GL029479.</p> <p>Rosa, L.P. and R. Schaeffer (1994) Greenhouse gas emissions from hydroelectric reservoirs. Ambio 23: 164-165.</p> <p>Rosa L. P., M.A.dos Santos, B. Matvienko, E. Sikar, R.S.M. Lourenç and C.F. Menezes (2003). Biogenic gas production from major Amazon reservoirs, Brazil. Hydrol. Process. 17: 1443- 1450.</p> <p>Rudd, J.W.M., R. Harris, C.A. Kelly and R.E. Hecky (1993) Are hydroelectric reservoirs significant sources of greenhouse gases? Ambio 22: 246-248.</p> <p>Santos, M.A. dos, L.P. Rosa, B. Sikar, E. Sikar and E. D. dos Santos (2006) Gross greenhouse gas emissions from hydro-power reservoir compared to thermo-power plants. Energy Policy 34: 481-488.</p> <p>Sikar, E., M.A. Santos, B. Matvienko, M.B. Silva, C.H. Rocha, E. Santos, A.P. Bentes Junior and L. P. Rosa (2005) Greenhouse gases and initial findings on the carbon circulation in two reservoirs and their watersheds. Verh. Internat. Verein.Limnol. 29: 573-576.</p> <p>Soumis, N., E. Duchemin, R. Canuel and M. Lucotte (2004) Greenhouse gas emissions from reservoirs of the western United States. Global Biogeochem. Cycles 18: doi: 10. 1029/2003GB002 197.</p> <p>Therrien, J., A. Tremblay and R. Jacques (2005) CO2 emissions from semi-arid reservoirs and natural aquatic ecosystems. Pages 233-250. In Tremblay, A., L. Varfalvy, C. Roehm and M. Garneau (eds.). Greenhouse Gas Emissions: Fluxes and Processes, Hydroelectric Reservoirs and Natural Environments. Environmental Science Series, Springer, New York.</p> <p>Tremblay, L. Varfalvy, C. Roehm and M. Garneau, (eds.) (2005) Greenhouse Gas Emissions: Fluxes and Processes, Hydroelectric Reservoirs and Natural Environments. Environmental Science Series, Springer, New York, 732 pages.</p> <p>UNESCO/IHA; April 2008. Scoping Paper: Assessment of the GHG Status of Freshwater Reservoirs; 28p. IHP/GHG-WG/3.</p> <p>Plus: Lisstrom et al., 1984 Frenzel et al., 1990"</p>	Accepted

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Taylor (International Hydropower Association (IHA))	5	-	-	-	-	5.6.3	-	-	<p>"The following references are present in section 5.6.3, but are missing in the references section:</p> <p>Abril, G., F. Guin, S. Richard, R. Delmas, C. Galy-Lacaux, P. Gosse, A. Tremblay, L. Varfalvy, M. A. dos Santos and B. Matvienko (2005) Carbon dioxide and methane emissions and the carbon budget of a 10-years old tropical reservoir (Petit-Saut, French Guiana). <i>Global Biogeochem. Cycles</i> 19: GB 4007, doi:10.1029/2005GB002457.</p> <p>Casper, P., S.C. Maberly, G.H. Hall and P.J. Finlay (2000) Fluxes of methane and carbon dioxide from a small productive lake to the atmosphere. <i>Biogeochemistry</i> 49: 1-19.</p> <p>Delmas R., C. Galy-Lacaux and S. Richard (2001) Emissions of greenhouse gases from the tropical hydroelectric reservoir of Petit Saut (French Guiana) compared with emissions from thermal alternatives. <i>Global Biogeochem. Cycles</i>, 15: 993-1003.</p> <p>Duchemin, E., M. Lucotte, R. Camuel and A. Chamberland (1995) Production of the greenhouse gases CH4 and CO2 by hydroelectric reservoirs in the boreal region, <i>Global Biogeochem. Cycles</i> 9: 529-540.</p> <p>Fearnside, P.M. (1995). Hydroelectric dams in the Brazilian Amazonas as sources of 'greenhouse' gases. <i>Environmental Conservation</i> 22: 7-19.</p> <p>Fearnside, P.M. (1997). Greenhouse-gas emissions from Amazonas hydroelectric reservoirs: the example of Brazil's Tucuruí dam as compared to fuel alternatives. <i>Environmental Conservation</i> 24: 64-75.</p> <p>Fearnside, P.M. (2001). Environmental impacts of Brazil's Tucuruí dam: Unlearned lessons for hydroelectric development in Amazonia. <i>Environmental Management</i> 27: 377-396.</p> <p>Fearnside, P.M. (2002). Greenhouse gas emissions from hydroelectric reservoir (Brazil's Tucuruí dam) and the energy policy implications. <i>Water, Air, and Soil Pollution</i> 133: 69-96.</p> <p>Galy-Lacaux, C., R. Delmas, C. Jambert, J. F. Dumestre, L. Labroue, S. Richard, and P. Gosse (1997) Gaseous emissions and oxygen consumption in hydroelectric dams: A case study in French Guiana. <i>Global Biogeochem. Cycles</i> 11: 471-483.</p> <p>Galy-Lacaux, C., R. Delmas, G. Kouadio, S. Richard, and P. Gosse (1999) Long term greenhouse gas emission from a hydroelectric reservoir in tropical forest regions. <i>Global Biogeochem. Cycles</i> 13: 503-517.</p> <p>Guin F., G. Abril, D. Serre, C. Delon, S. Richard, R. Delmas, A. Tremblay and L. Varfalvy (2007) Gas transfer velocities of CO2 and CH4 in a tropical reservoir and its river downstream, <i>J. Mar. Syst.</i> 66: 161-172.</p> <p>Guin F., Abril G., Tremblay A. and Delmas R. (2008) Nitrous oxide emissions from tropical hydroelectric reservoirs. <i>Geophysical Research Letters</i> 35, doi:10.1029/2007GL033057.</p> <p>Huttunen, J.T., T.S. Vuori, M. Heikkinen, S. Hellsten, H. Nykänen, O. Meriläinen, R. Uusitalo (2009) Fluxes of CH4, CO2, and N2O in hydroelectric reservoirs Lokka and Porttipahta in the northern boreal zone. <i>Journal of Great Lakes Research</i> 35: 17-24.</p>	Accepted

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Harby (SINTEF Energy Research)	5	-	-	-	-	5.6.3	-	-	I suggest to split LCA and GHG emissions into two separate chapters	Both are sstrongly linked
SCOWCROFT (EURELECTRIC)	5	-	-	-	-	5.6.3	-	-	This chapter is considered to be too detailed and overrepresented.	GHG emissions from reservoirs is a complex issue, whilst a key one in an IPCC report
Vahrenholt (RWE Innogy GmbH)	5	-	-	-	-	5.6.3	-	-	This chapter is considered to be too detailed and overrepresented.	GHG emissions from reservoirs is a complex issue, whilst a key one in an IPCC report
Harby (SINTEF Energy Research)	5	-	-	-	-	5.6.3	-	-	This section needs revision, especially page 51 to give a clearer and more balanced picture of the GHG issue.	This comment is too general. However this section will be improved in the SOD
de Campos (Petrobras)	5	-	-	-	-	5.7	-	-	Mobile Water Dam has been studied for Small Hydro Power Aplication. This technology can mitigate some environmental impacts. (add to current text)	too much detail
de Campos (Petrobras)	5	-	-	-	-	5.7	-	-	New turbines projects with CFD (Computational Fluid Dynamic) otimization can keep high efficiency in broad range of operational points (add to current text)	Accepted
de Campos (Petrobras)	5	-	-	-	-	5.7	-	-	Nowadays the Low and Very Low head turbine are the main issue of research and development center of hydro turbines around the world. The Madeira River Hydropower Complex will be equipped with 104 Low Head Kaplan Turbine. (add to current text)	Will be added if proper referces can be found
de Campos (Petrobras)	5	-	-	-	-	5.7	-	-	Some artificial intelligency techniques, such as neural network, genetic algorithm and fuzzy logic, have been used to optimized the operation and reduce the cost of maintenance of the equipments (add to current text)	Will be added if proper referces can be found
SCOWCROFT (EURELECTRIC)	5	-	-	-	-	5.7.2	-	-	Matrix technology already established (e.g. VATech).	Accepted
Vahrenholt (RWE Innogy GmbH)	5	-	-	-	-	5.7.2	-	-	Matrix technology already established (e.g. VATech).	Accepted
de Campos (Petrobras)	5	-	-	-	-	5.7.4	-	-	Hydrokinetic turbine has low energy density. One can't compare the hydrokinetc potencial with a traditional hydropower potential because its low density energy production. Hydrokinetc turbine should be used in isolated systems. (add to current text)	First sentence ok. Rest will be rejected
SCOWCROFT (EURELECTRIC)	5	-	-	-	-	5.7.4	-	-	Joint venture RWE Innogy and Voith Hydro for development activities already established.	may be seen as advertizing
Vahrenholt (RWE Innogy GmbH)	5	-	-	-	-	5.7.4	-	-	Joint venture RWE Innogy and Voith Hydro for development activities already established.	same as above

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SCOWCROFT (EURELECTRIC)	5	-	-	-	-	5.7.5	-	-	"Replace by a more general paragraph: 5.7.5 New materials: Major wearing effects on hydropower equipment are corrosion, cavitation damages and abrasion. An intensified use of suitable proven materials such as stainless steel and the invention of new developments as coatings limit the wear on equipment and extend gear lifespan. Improvements in material development have been performed for almost any plant component. Examples are: a) penstocks made of fibreglass becoming more important b) better corrosion protection systems for hydromechanical equipment c) better understanding of electrochemical corrosion leading to a suitable material combination; d) trash rack systems with plastic slide rails. Modern turbine design using 3D-flow-simulation provides not only better efficiencies in energy conversion by improved shape of turbine runner and guide/stay vanes. It also leads to a decrease of cavitation damages at high head power plants and to reduced abrasion effects when dealing with heavy sediment loaded propulsion water. Other inventions concern e.g. improved self lubricating bearings with lower damage potential and the invention of electrical servo motors instead of hydraulic ones."	Will be incorporated together with present text, rewritten

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Vahrenholt (RWE Innogy GmbH)	5	-	-	-	-	5.7.5	-	-	"Replace by a more general paragraph: 5.7.5 New materials: Major wearing effects on hydropower equipment are corrosion, cavitation damages and abrasion. An intensified use of suitable proven materials such as stainless steel and the invention of new developments as coatings limit the wear on equipment and extend gear lifespan. Improvements in material development have been performed for almost any plant component. Examples are: a) penstocks made of fibreglass becoming more important in case of possible base/peak load investigations becoming more important in case of possible base/peak load investigations becoming more important in case of possible base/peak load investigations; b) better corrosion protection systems for hydromechanical equipment becoming more important in case of possible base/peak load investigations; c) better understanding of electrochemical corrosion leading to a suitable material combination; d) trash rack systems with plastic slide rails. Modern turbine design using 3D-flow-simulation provides not only better efficiencies in energy conversion by improved shape of turbine runner and guide/stay vanes. It also leads to a decrease of cavitation damages at high head power plants and to reduced abrasion effects when dealing with heavy sediment loaded propulsion water. Other inventions concern e.g. improved self lubricating bearings with lower damage potential and the invention of electrical servo motors instead of hydraulic ones."	Will be incorporated together with present text, rewritten
SCOWCROFT (EURELECTRIC)	5	-	-	-	-	5.7.5	-	-	Is becoming more important in case of possible base/peak load investigations.	Accepted as a general comment to the text.
Vahrenholt (RWE Innogy GmbH)	5	-	-	-	-	5.7.5	-	-	Is becoming more important in case of possible base/peak load investigations.	Accepted as a general comment to the text.
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	5.9.1	-	-	Please give an introductory sentence to this section before referring to fig. 5.27.	As per Oxford accord this section is being rearranged/added/edited
de Campos (Petrobras)	5	-	-	-	-	5.9.1	-	-	What is the reference of this forecast scenarios? What does high scenario means? What does low scenario means?	shall be explained
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	5.9.1.1	-	-	This subsection should be integrated in section 5.9.1 as no further subsection to this section exists. Moreover, this section strongly needs more background information on the presented figures, the underlying assumptions (costs, emission scenarios, prices, electricity demand, etc.). Furthermore, references for all the presented figures are missing.	shall be explained

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Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	-	5.17	-	Numbers could be updated as commented above (see comment in line 1) as of 01/01/2010.	shall be taken care
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	-	5.18	-	Matching numbers and categories (i.e. countries) is not possible. Please reformat the figure.	shall be taken care
de Campos (Petrobras)	5	-	-	-	-	-	5.24	-	Unit Cost is related to energy cost. In this case, \$/KW is Specific Cost	unit cost is consistent with reference
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	-	5.25	-	Reference missing. I suggest to insert this figure below line 7.	ok
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	-	5.26	-	Cut the upper part of the illustration, that shows the figure's title in the original referende. Moreover, the reference is missing.	Accepted
Pálvölgyi (Budapest University of Technology and Economics)	5	-	-	-	-	-	5.28.	-	"It would be useful to separate the hydropower generation in EU (EU-27) and ""Eurasia"". Eurasia is not a widely used geographic category (i.e. where is Kazakhstan; Russia's far east..)"	not necessary
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	-	5.31	-	This figure need to be presented in the section where it is referred to (section 5.9.1.1).	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	-	5.32	-	This figure need to be presented in the section where it is referred to (section 5.9.1.1).	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	-	-	5.2	"What is ""Installed capacity based on Production""? Do you mean ""Operating capacity""? "	only "installed capacity"
de Campos (Petrobras)	5	-	-	-	-	-	-	5.2	Change Title: Major Countries Hydropower Producers....	Accepted
Hirschhausen von (Workgroup for Economic and Infrastructure Policy)	5	-	-	-	-	-	-	5.3	The third and fourth columns are not necessary as the total population (column 1) as well as the electrification rate (column 6) are given.	shall be deleted. But it was from a refrence
de Campos (Petrobras)	5	-	-	-	-	-	-	5.4	the table must be fully revised. There are inconsistency in the index.	Accepted
Harby (SINTEF Energy Research)	5	-	-	-	-	-	-	5.5	Please replace table with more updated values, and please use rather g/m d than mmol.	updated values are not peer reviewed