



# INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



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

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

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

Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Dr. Md. Sirajul Islam (North South University)	5	0	-	-	-	-	-	-	+ve Hydropower can contribute in flood protection ( Figure SPM 3) / -ve Many dams are located near earthquake zone	ref ch 5.10
Gerrit Hansen (TSU)	5	0	-	-	-	-	-	-	A clarification of terms is vital for chapter 5: Hydropower or HPP is used in general statements that only hold for certain types of HPP (mostly to reservoir type (large) HPP). The terms "small" and "large" hydro are used in several sections, but are not clearly defined in the chapter. The glossary defines large and small (and mini and micro hydro), this should be referenced in the chapter. Even though "large" dam projects (>10 MW) represent by far the largest source of HP energy, "small" and RoR project have a significant share and a vital role particularly in rural areas. The way chapter 5 presents HP is not consistent.	small and rejected as types but glossary to be corrected according to ch 5 -
Switzerland (Swiss Federal Office for the Environment)	5	0	-	-	-	-	-	-	A discussion of the effects of power market liberalization on hydropower should be added (sections 5.4,5.5,5.8); Problem solving does only include problem reduction but does not mention possible adaptation of hydropower generation. Example: Very large dams with often strong negative environmental and social consequences may be replaced by several smaller dams.	first part of comment to be included in 5.4.3. second part will not be included as it is - the second part is addressed in 5.1.3
Gerrit Hansen (TSU)	5	0	-	-	-	-	-	-	as chapter displays severe editorial weaknesses (lack of clear structure, redundant information, not in line with OOA) TSU has prepared a supplementary document called Addendum/TSU Add hereafter [SRREN_Draft2_Review_Hansen_Gerrit_TSUAddendum_Ch5.doc] that suggests an improved structure and has partly moved contents accordingly. Authors/CLAs are kindly requested to consider this document as a working base, without proposed changes being in any way prescriptive or mandatory. Text has not been altered or shortened, as work relating to content should be left to authors (but some parts have been cut). The same document is available in track change mode from the TSU, but has been cleared in the provided version to add readability. For section 5.8, there is a separate document providing guidance for restructuring (SRREN_Draft2_TSU-Review_Schloemer_Steffen_Addendum_Hydro_Cost.doc)	Accepted
United States (U.S. Department of State)	5	0	-	-	-	-	-	-	Chapter 5. Hydropower presents a good overview of hydropower technology, resource potential, and main issues related to hydropower development and operation. A couple of aspects that are currently only briefly mentioned, but deserve to be more prominently covered include: 1. Reservoir management (for the optimization of hydro electricity generation, downstream water uses, irrigation, as well as for environmental management). 2. Hydro cascades (i.e., to maximize utilization of hydro potential in a river basin, the same water is used multiple times for electricity generation going through a series of dams, etc.).	1. will be treated in 5.10 - 2. in 5.3.1
Richard Taylor (International Hydropower Association)	5	0	-	-	-	-	-	-	Comment: Narrative/figures on employment are missing and should be included somewhere in the chapter. A ""key messages"" section should be developed at the end of the chapter (cf. Chapter 2 - Bioenergy).	employment will be addressed i 5.6 (navigant study) -key messages will be presented in ES

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United States (U.S. Department of State)	5	0	-	-	-	-	-	-	Hydropower is too often associated with all bad impacts of large, poorly design projects. The fact is that we now know how to eliminate most of those adverse impacts through better project siting, best practices in project operation, and advanced technologies such as fish-friendly turbines and aerating turbines (e.g., see the IEA Hydropower Annex's Report on Good Practices). These important opportunities to improve the environmental performance of hydropower are not brought out in the SRREN chapters.	impacts are still serious but intent of comment will be addressed see 5.6
Australia (0)	5	0	-	-	-	-	-	-	In Chapter 5 it should make clear that there are limited opportunities in the developed world to introduce new large hydropower systems; and that there are detractors and supporters of large scale hydropower (due to environmental and social impacts). Development opportunities for hydro are very different across countries. For example and in Australia climate change will effect water availability and the country has very limited large-scale opportunities, but greater potential for small scale development. Four other areas should be included: -most of the 'easy' installations have been done; - refurbishment provides some opportunity for more capacity; consideration given to small hydro (mini and micro). Some repetition exists, for example the discussion of hydro as being flexible and allowing nuclear and coal to be used more efficiently.	too general
Ladislau Rybach (Geowatt AG Zurich (company))	5	0	-	-	-	-	-	-	My comments to Chapter 5 of the FOD have been considered, except: The Executive Summary still needs to include numbers about costs.	will be considered when ch 5 is finalized
Peter de Haan (Ernst Basler + Partner AG)	5	0	-	-	-	-	-	-	no comments from Reviewer P de Haan	Accepted
United States (U.S. Department of State)	5	0	-	-	-	-	-	-	Overall, the chapter provides an excellent overview of global hydropower, from the current status, resource and opportunities perspectives. However, the treatment is non-uniform, with some specific areas treated in much greater detail than others. While this is likely reflecting the relative abundance of information available, it makes the reading quite uneven. Given the need to shorten, some of the detail might be removed. The chapter requires significant editing. There are numerous grammatical errors. Examples include 'where' instead of 'were', 'mitigate' instead of 'mitigating', 'mean' instead of 'means', '1700s' instead of '1700s', 'looses' instead of 'loses', incorrect capitalization, missing commas). There are a number of places where references seem called for but are missing. For example, the top of page 9: the statement that 'hydropower has the best conversion efficiency of all know energy sources (~90% water to wire)' should have a reference.	Accepted
Gerrit Hansen (TSU)	5	0	-	-	-	-	-	-	please always convert numbers to EJ/y	ref agreement in mexico to have both when practible

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Gerrit Hansen (TSU)	5	0	-	-	-	-	-	-	please provide all figures in EJ and EJ/y	ref agreement in mexico to have both when practible
United States (U.S. Department of State)	5	0	-	-	-	-	-	-	References: Many references are not complete, and could not be found. Please make sure that a standard reference format is followed. There are a number of places where references seem called for but are missing. For example, the top of page 9: the statement that "hydropower has the best conversion efficiency of all know energy sources (~90% water to wire)" should have a reference. These problems with references are serious because some are flat wrong and others are to inaccessible documents; too many statements that need to be referenced are not.	ref for conversion to be found
Gerrit Hansen (TSU)	5	0	-	-	-	-	-	-	several sections lack scientific references. Please make sure you provide adequate resources to justify your statements, and give peer-reviewed journal articles as references whenever possible.	both scientific and grey refs to be quality assured
QUILES Ernesto J. (Ministerio de Ciencia, Tecnologia e Innovacion Productiva, Universidad Nacional de Salta CONICET)	5	0	-	-	-	-	-	-	The CH5 mentions the qualities and benefits of small hydropower SHP systems. Nevertheless the magnitude that these systems have among the renewable energy development, particularly in developing countries, is not remarked in the document. I think that it would be very important to include in the Chapter 5 an item or sub-chapter specifically addressed to SHP. I have prepared two reports: one summarizing the state of development and progress in each country or region and a second that, taking these data, analyzes a special reports like a First Draft on the importance of the SHP has today and in the future to mitigate the effects of global climate change.	May be discussed as small scale hydro ibut not as "small hydro" based on MW / size categories
Oluf Ulseth (Statkraft AS)	5	0	-	-	-	-	-	-	The IEA Hydropower Implementing Agreement is producing under the leadership of governments of OECD's main hydropower nations information which is undergoing rigorous peer review in form of workshops and consultation periods. The final reports are based on project related research, which is conducted over a period of several years collaboratively by a designated group of experts from governmental agencies, research institutes and the hydropower industry. For chapter 5.6 the IEA studies are the most comprehensive international information source which is actually available with regard to managing social and environmental issues related to hydropower. These reports are based on more than 200 case studies, involving more than 112 experts from 16 countries. Therefore a classification of literature produced under the IEA's Implementing Agreement for Hydropower Technologies and Programmes as grey literature would be highly inappropriate. (See more details in attachment)	ref to this work to be commented in 5.6 - IEA is currently not re as peer rev by the IPCC

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Gerrit Hansen (TSU)	5	0	-	-	-	-	-	-	There is great redundancy and overlap concerning the topics reservoir energy storage, peak load provision and facilitating other sources, namely between the sections 5.5.1, 5.4.3, 5.3.5, 5.5.4, 5.5.5, 5.5.8. TSU suggests to cut the sections 5.3.5 and 5.4.3, and integrate the content of the subsections of 5.5 in one or two subsections, called e.g. "mass energy storage and peak load management", and "interaction with other energy technologies", compare also Addendum provided by TSU	the proposals will be considered under final editing
Norway (Climate and Pollution Agency)	5	0	-	-	-	-	-	-	When one discuss the possibility of hydropower making positive contributions to climate change adaptation efforts and multipurpose benefits, it is important to nuance that these benefits can only be delivered by hydropower projects which have storage capacity	Accepted
United States (U.S. Department of State)	5	4	41	-	-	-	-	-	Add after locks "and replacement of energy dissipation devices and pressurized piping systems".	to be consistent with main text
United States (U.S. Department of State)	5	4	35	-	-	-	-	-	Add after variable speed generation "or superconductors".	to be consistent with main text
United States (U.S. Department of State)	5	4	18	-	-	-	-	-	Add reference for cost of indirect benefits. This is likely to be variable country to country.	to be consistent with main text
United States (U.S. Department of State)	5	4	46	-	-	-	-	-	After energy security insert "and frequency regulation".	freq reg is covered in energy security?
United States (U.S. Department of State)	5	4	27	-	-	-	-	-	At end of paragraph, add " and existing projects as well." That is, new technology can add both energy and environmental benefits at existing projects when they are rehabilitated or equipment is replaced.	unclear meaning
Atle Harby (SINTEF Energy Research)	5	4	35	5	35	-	-	-	erase "(e.g. variable speed generation)	to be consistent with main text
Oluf Ulseth (Statkraft AS)	5	4	1	5	21	-	-	-	Ex. Summary should include a description of the most important barriers against developing new hydropower.	to be consistent with main text
Oluf Ulseth (Statkraft AS)	5	4	-	-	-	-	-	-	Ex. Summary should include an estimate of emissions reduction if the total potential is utilized.	Accepted
Oluf Ulseth (Statkraft AS)	5	4	8	-	-	-	-	-	IHA indicate a technical and economical feasible potential at approx. 9000 TWh pr year and indicate that in Europe and North-America, only 30% is left for potential development. The potential shown in the report is larger and it is questioned if the report is based on only a technical potential, not a technical, environmental and economic potential.	will be considered
United States (U.S. Department of State)	5	4	28	-	-	-	-	-	Insert the word "broad" in from of types and consider changing the reservoir classification to storage because there are other types of storage like natural storage and glaciers.	unclear meaning
United States (U.S. Department of State)	5	4	12	-	-	-	-	-	Pg. 4, L. 12: Mention economically viable capacity here.	to be consistent with main text

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United States (U.S. Department of State)	5	4	41	-	-	-	-	-	Pg. 4, L. 41: Change to "large dams in the world were also built".	to be consistent with main text
Norway (Climate and Pollution Agency)	5	4	38	-	-	-	-	-	RM&U of old power stations is not always cost effective	statement may be modified
Canada (Environment Canada)	5	4	28	4	28	-	-	-	Suggest adding hydrokinetic to list of type of hydropower projects.	Accepted
Oluf Ulseth (Statkraft AS)	5	4	33	-	-	-	-	-	The description of transboundary issues does not reflect the existing conflicts and potential conflicts on water. Reference is made to India - Pakistan, Turkey - Iraq, Middle East,	reflecting existing conflicts not intended
United States (U.S. Department of State)	5	4	25	-	-	-	-	-	The most common way to characterize projects is by capacity, but that is not in the list here.	classification by MW rejected
United States (U.S. Department of State)	5	4	14	-	-	-	-	-	The wording "probably be small" is a questionable statement, especially at local scale and site-specific issues. Qualify.	to be consistent with main text
United States (U.S. Department of State)	5	4	38	4	43	-	-	-	This paragraph missed the opportunity to highlight opportunities for simultaneous energy and environmental benefits in the RM&U process when advanced technologies are adopted.	to be consistent with main text
Gerrit Hansen (TSU)	5	4	8	-	9	ES	-	-	agreed terms for SRREN is "technical potential", capacity potential is not defined	will be considered
Gerrit Hansen (TSU)	5	4	13	-	14	ES	-	-	content and intent of sentence not clear	to be consistent with main text
Gerrit Hansen (TSU)	5	4	45	-	46	ES	-	-	does this statement hold for all forms of HP/Hydropower in general?	to be consistent with main text
Gerrit Hansen (TSU)	5	4	0	-	5	ES	-	-	ES does not follow the agreed structure for technology chapters	the ES will be edited and there will be a consistency check according to changes in the main text
Gerrit Hansen (TSU)	5	4	17	-	-	ES	-	-	in the ES, no quotes/citations should be used (rephrase statement: "according to the world bank").	to be consistent with main text
Gerrit Hansen (TSU)	5	4	28	-	-	ES	-	-	incoherent as the chapter text (fig.5.6 to 5.9) defines four types, including instream technology	Accepted
Gerrit Hansen (TSU)	5	4	4	-	5	ES	-	-	insert "For electricity generation" or else clarify that conversion efficiency relates to electricity generation	the statement will be considered
Gerrit Hansen (TSU)	5	4	25	-	-	ES	-	-	insert "hydraulic" before head	to be consistent with main text
Gerrit Hansen (TSU)	5	4	38	-	-	ES	-	-	please do not use abbreviations in the ES	Accepted
Gerrit Hansen (TSU)	5	4	16	-	24	ES	-	-	reverse section order: place section starting in line 24 (definition of HP project types) before section starting in line 16	to be consistent with main text
Gerrit Hansen (TSU)	5	4	33	-	35	ES	-	-	statement might be perceived as not balanced, as (large) HP projects, dams and deviations can also create tension and conflict amongst neighboring states competing for the same water resource.	to be consistent with main text

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Richard Taylor (International Hydropower Association)	5	4	28	4	28	Executive Summary	-	-	Delete ""run-of-river"" and replace with ""run of river"". Delete ""based"".	Accepted
United States (U.S. Department of State)	5	5	2	-	-	-	-	-	Add a sentence on how conventional hydropower uses synchronous generators while other renewables use induction generators; this makes hydro more valuable than grid stabilization.	to be consistent with main text
United States (U.S. Department of State)	5	5	19	-	-	-	-	-	Add recreation.	to be consistent with main text
Kristie Ebi (Department of Global Ecology)	5	5	-	-	-	-	-	-	p 550, lines 7-21. There needs to be a discussion of the downsides of dams, including ecosystem impacts. Citations need to be added.	to be consistent with main text
United States (U.S. Department of State)	5	5	1	-	-	-	-	-	Pg. 5, L 1: Change to "solar and wave power"	Accepted
United States (U.S. Department of State)	5	5	6	-	-	-	-	-	Pg. 5, L. 6: What is CDM?	ref comm line 44?
Atle Harby (SINTEF Energy Research)	5	5	39	5	39	-	-	-	please change "less" with "short"	to be consistent with main text
Atle Harby (SINTEF Energy Research)	5	5	36	5	36	-	-	-	please list more environmental issues than "fish friendly turbines" as there are much more research on environmental issues	to be consistent with main text
Gerrit Hansen (TSU)	5	5	5	-	6	ES	-	-	context needed for CDM statement	Accepted
Gerrit Hansen (TSU)	5	5	7	-	15	ES	-	-	statement might be perceived as not balanced, as HP can also result in increased competition for water between different stakeholders, e.g. farmers (irrigation) and urban population/industry during dry seasons. This conflict can be exacerbated by future climate and landuse change impacts.	to be consistent with main text
Richard Taylor (International Hydropower Association)	5	5	1	5	1	Executive Summary	-	-	Delete ""and"" and replace with "","". Insert ""and storing the energy of"" after ""regulating"". Delete ""intermittent"" and ""wind, solar and waves"".	to be consistent with main text
Gian-Kasper Plattner (IPCC WGI TSU, University of Bern)	5	6	11	6	13	-	-	-	"The source of hydropower is water moving in the hydrological cycle. The source of hydropower therefore comes from the sun,ζ" -- this statement is unclear and needs to be clarified (Is the source of hydropower water moving or the sun?)	sentences will be reworded (propose to combine the two sentences)
John Twidell (AMSET Centre)	5	6	9	-	-	-	-	-	add sentence 'The technology is available for a wide range scales and locations, and may be associated with energy storage by periodic reverse pumping'. [hydro as pumped storage is important, but lacks a mention in this early introduction]	"and storage" will be added after "generation" line 7
United States (U.S. Department of State)	5	6	5	-	-	-	-	-	Clarify "market." What kinds of markets?	replace market by. -- "status of<the hydropower industry and its role in the energy and emissions markets>"

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Gerrit Hansen (TSU)	5	6	31	6	35	-	-	-	cut whole paragraph	para to be rephrased
Gerrit Hansen (TSU)	5	6	38	-	39	-	-	-	general statement incoherent with statement in 5.3.1.1 ""Installation of small RoR HP is relatively cheap"	comment not understood
United States (U.S. Department of State)	5	6	26	6	30	-	-	-	Hydropower= The "Conversion Factor" multiplied by "flow" multiplied by "head". This explanation talks only of the flow part of the equation -- head is equally important in the Power Equation and it is as important in explaining where hydropower is located. Add that to this discussion, possibly by introducing the Power Equation here.	change start of sentence in line 26 and replace with the power equation
David Clubb (European Environment Agency)	5	6	44	7	4	-	-	-	Incorrect/omission: A discussion of the history of hydro would be incomplete without reference to the first installation, which took place at Cragside, Rothbury, United Kingdom in 1870.	needs to be checked - include capacity in th eldest - if possible (Appleton is known) look also at Aristide Berges 1869 in France
Gian-Kasper Plattner (IPCC WGI TSU, University of Bern)	5	6	11	6	30	-	-	-	Is this lengthy and very basic introductory paragraph really necessary, the whole paragraph is very much textbook style and as such does not provide anything to the assessment. If it's really needed, suggest to at least provide references for quantitative statements.	to be made more concise
John Twidell (AMSET Centre)	5	6	44	-	-	-	-	-	There should be mention of the world's first hydroelectric power plant in 1870 at Lord Armstrong's house, Cragside, in Norhumberland, UK. See <a href="http://en.wikipedia.org/wiki/Cragside">//en.wikipedia.org/wiki/Cragside</a>	needs to be checked
Gian-Kasper Plattner (IPCC WGI TSU, University of Bern)	5	6	31	6	32	5.1.1	-	-	Comment by Simon Allen, Science Officer WGI TSU, University of Bern: Lines 31 - 32. The statement 'Hydropower is both renewable and sustainable' surely only applies if intended from a global perspective. In many regions of the world, hydropower is definitely not sustainable in a changing climate, as noted elsewhere in SRREN. Suggest rewriting - 'From a global perspective (or earth-system perspective) hydropower is both renewable and sustainable.....'	sentence should read: "From the global perspective hydropower is renewable as the resource will not be depleted as long as ---"
Simon Allen (IPCC WGI TSU, University of Bern)	5	6	31	6	32	5.1.1	-	-	Lines 31 - 32. The statement 'Hydropower is both renewable and sustainable' surely only applies if intended from a global perspective. In many regions of the world, hydropower is definitely not sustainable in a changing climate, as noted elsewhere in SRREN. Suggest rewriting - 'From a global perspective (or earth-system perspective) hydropower is both renewable and sustainable.....'	sentence should read: "From the global perspective hydropower is renewable as the resource will not be depleted as long as ---"
Richard Taylor (International Hydropower Association)	5	6	37	6	38	5.1.2	-	-	Delete ""Hydropower, hydraulic power or water power is power that is derived from the force or energy of moving water, which may be harnessed for useful purposes"" and replace with ""Hydropower may be defined as the conversion of the kinetic energy of moving water into mechanical power through a turbine or other device, used directly or to drive a generator to produce electrical power"".	first sentence to be deleted



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Richard Taylor (International Hydropower Association)	5	7	16	7	17	-	-	-	Delete coal and oil fuelled power plants increased. Several hydropower plants involved large dams which submerged land to provide water storage. This has cause great concern for environmental impacts." and replace with ""the number and size of fossil fuel, nuclear as well as hydro power plants increased. Concerns arose around environmental impacts.""	but say: - " concern arose around environmnetal and social ---"
David Clubb (European Environment Agency)	5	7	12	7	13	-	-	-	Incorrect phrasing: Highly subjective; depends on city size, region size or energy intensity. Needs better phrasing	statement is general and not relating to specific areas.
David Clubb (European Environment Agency)	5	7	18	7	18	-	-	-	Incorrect phrasing: This has not just caused concern for environmental impacts; the environmental impact has been significant	is discussed in 5.6
United States (U.S. Department of State)	5	7	6	-	-	-	-	-	Insert "resource" after renewable	sentence ok
David Clubb (European Environment Agency)	5	7	5	7	7	-	-	-	Irrelevant/incorrect phrasing: Does it really matter that single installations have a large output? Remember that these 'single' installations are also made of multiple units. In what way would this be different from (say) a mega-wind farm?	intent is to illustarte the scale of hydro
David Clubb (European Environment Agency)	5	7	9	7	11	-	-	-	Omission: If environmental considerations are discussed here, then negative impacts should be also mentioned (barriers to fish migration, increased flooding in some areas, thermal shock etc)	Environmnetal aspects not adressed here. However sentence deleted and insert a comma and then ", in addition to a wide range of water related services (ref 5.10)."
United States (U.S. Department of State)	5	7	27	-	-	-	-	-	Rather than storage capacity, it would be better to say "use of available storage capacity" or "operation"	not understood
United States (U.S. Department of State)	5	7	1	-	-	-	-	-	Sentence ending in New York - explain how the NY example explains the importance of DC versus AC transmission.	too detailed
United States (U.S. Department of State)	5	7	3	-	-	-	-	-	The reference to USBR here is unclear and incomplete.	to be checked
Richard Taylor (International Hydropower Association)	5	7	6	7	6	5.1.2	-	-	Insert ""on a significant scale -"" after ""produce"".	sentence to end with "on a significant scale " and move figures into paranthesis and give capacities)
Richard Taylor (International Hydropower Association)	5	7	28	7	28	5.1.3	-	-	Delete "" pumping, reversible"" and replace with ""mixed (some pumping), pumped storage"".	Accepted
Richard Taylor (International Hydropower Association)	5	7	29	7	29	5.1.3	-	-	Delete ""intermittent"".	Accepted

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Richard Taylor (International Hydropower Association)	5	7	27	7	27	5.1.3	-	-	Delete ""run-of-river, pond, seasonal, multi-year"" and replace with ""run of river, daily-monthly-yearly"".	but insert storage after yearly
China (China Meteorological Administration)	5	7	23	8	22	5.1.3	-	-	The development of small hydropower has played a very important role in enhancing rural electrification, promoting economic and social development in rural areas, improving production and living conditions for rural population and contributing to energy-saving and emission reduction. Chen Lei, 2009: Developing Small Hydropower Actively with a Focus on People's Well-being Improvement, SHP News, Volume 26, 2009?p3?. "Triangular cooperation mode among the developing countries, developed countries and international organization" initiated by IN-SHP has been recognized by UNDP as "a new tendency in South-South cooperation". It is suggested to create a new special section on Small Hydropower and incorporating the content regarding small hydropower in section 5.1.3, 5.4.5.2, 5.5.3 and 5.7 as a new section, and simply elaborating importance and development tendency in small hydropower, etc. It should also indicate whether the potential and installed capacity in this chapter has included small hydropower or not.	ref to 5.1.3
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	8	20	-	-	-	-	-	'Kaplan and bulb turbines' should be 'Kaplan and Kaplan bulb turbines'	Rejected. Bulb turbine is known commonly as bulb turbine.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	8	45	-	-	-	-	-	'nuclear and thermal power plants' should be 'nuclear and fossil fuel based thermal power plants'	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	8	45	-	-	-	-	-	(nuclear power plants are also thermal power plants)	Accepted
United States (U.S. Department of State)	5	8	35	-	-	-	-	-	Although Hydropower is relatively mature, it still can be significantly improved with R&D and advanced technology. The way this paragraph starts out perpetuates the myth that nothing more needs to be done to hydropower technology.	ref 5.7
David Clubb (European Environment Agency)	5	8	37	8	38	-	-	-	Incorrect phrasing/lack of detail: This sentence needs to be qualified. The huge variation in size has already been described, so a 'one size fits all' description of costs cannot possibly be valid	delete from 37-39
United States (U.S. Department of State)	5	8	17	-	-	-	-	-	Insert "turbine" before the word outlet.	not the turbine but downstream water level
United States (U.S. Department of State)	5	8	20	-	-	-	-	-	Insert after Kaplan ", impeller".	Rejected. Impeller is out of context.

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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
United States (U.S. Department of State)	5	8	37	-	-	-	-	-	Replace 40 with "30-50".	Delete sentence line 36-37 insert "--, with many examples of hydropower plants buildt in the19th century still in operation today .line 39 after Hydropower add "now" and line 40 after response time of - insert "modern". Delet sentence starting in line 42 Hydrpower porvides ---
Canada (Environment Canada)	5	8	17	8	18	-	-	-	Suggest that bracketed text stating head as "the vertical height of water above the turbine" is not an accurate definition and could be removed.	Accepted
United States (U.S. Department of State)	5	8	37	8	42	-	-	-	The statements here are true, but more so for large hydro than small. With advancements in small hydro, we hope to overcome some of the issues with large hydro.	hydro reservoirs regardless of size is adressed
David Clubb (European Environment Agency)	5	8	5	8	6	-	-	-	They can be installed with little effect. However, historically, this has not been the case. There is also a multiplier effect where many small installations on one body of water can severely damage the ecosystems (particularly with regard to fish passage)	sentence to be deleted
United States (U.S. Department of State)	5	8	24	8	33	-	-	-	This discussion and definitions are awkward and should be improved to emphasize that hydropower is part of multipurpose projects rather than the reverse. This is especially important in developed countries like the U.S., where hydropower is not the top priority any more, but rather an addition that is useful.	comment change the meaning of text - a ref to 5.10 should be inserted
United States (U.S. Department of State)	5	8	6	-	-	-	-	-	This statement of lack of impact from small systems is misleading. Impacts can be great if poor locations are chosen (e.g., with sensitive species). Soften or qualify the statement.	sentence to be deleted
United States (U.S. Department of State)	5	8	16	8	22	-	-	-	This would be another useful place to cite the Power Equation that defines how flow and head interact.	the equation will be placed either in 5.1.1 or 5.1.3 depending on the final draft arrangements
United States (U.S. Department of State)	5	8	11	8	15	-	-	-	We should highlight here the importance of basin-scale planning and integrated water resources management.	ref 385/64
Richard Taylor (International Hydropower Association)	5	8	5	8	6	5.1.3	-	-	Delete ""These power systems can be installed in small rivers or streams with little or marginal environmental effect"".	Accepted

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Richard Taylor (International Hydropower Association)	5	8	7	8	15	5.1.3	-	-	Delete lines 7 to 15 and replace with: "Size is not an accurate indicator of a hydropower project's effects. Large scale projects can be constructed with moderate negative impacts, while the cumulative effects of several small scale projects can be more adverse than a larger scale project in the same area. By better planning and management many negative effects can be avoided, reduced or mitigated. Moreover, focussing on a project's negative effects loses sight of the positive effects a project has. These positive and negative effects must be carefully balanced in a sustainability assessment in order to produce a project which achieves optimal economic, environmental and social outcomes. In this light, it more useful to evaluate a hydropower project on its sustainability performance rather than utilising arbitrary scale classifications."	after Size insert "(in MW)" - and also insert after "By better < basinwide> planning" ref to 5.6 for discussion on sustainability
Richard Taylor (International Hydropower Association)	5	8	1	8	1	5.1.3	-	-	Insert ""to assist small scale, often less economic projects and/or off-grid / rural electrification projects"" after ""countries"".	sentence to be modified
Richard Taylor (International Hydropower Association)	5	8	42	8	42	5.1.5	-	-	Insert "", for example, variable renewables such as wind and solar." after ""(IEA-ETP, 2008).	text may be modified
Gerrit Hansen (TSU)	5	9	13	-	-	-	-	-	"not limited" is not precise, as e.g. reported technical potential is about 5 times current installed capacity (cp.5.2.1), please rephrase sentence accordingly.	Accepted
United States (U.S. Department of State)	5	9	78	-	-	-	-	-	Add a short paragraph here about the opportunities that are now available with advanced technologies like fish-friendly and aerating turbines, to make hydro more compatible with the environment and overcome some of the most serious obstacles to new development.	comment not understood, line 78?
United States (U.S. Department of State)	5	9	14	9	17	-	-	-	Barriers also include competing energy sources and relative costs of development, which are in turn affected by energy policies. For example, the low apparent cost of natural gas in the U.S. is impeding new renewable development, like hydropower. This is a false choice if natural gas prices do not include the full cost on the environment, while the regulatory burdens no hydropower are relatively much higher, adding cost that are not incurred by natural gas. This is an important policy issue.	Accepted
Kristin Seyboth (IPCC WG III TSU)	5	9	20	10	21	-	-	-	Delete bullet list, or reduce to a maximum of 1 paragraph. The specific examples of policies do not provide the reader with an understanding of what type of policy design mechanisms have been shown to successfully support hydropower, which is what the reader wants to see here. I.e. the reader misses a clear description of what types of policies have been implemented to address hydro specific barriers outlined in lines 13-19 of this page. See e.g. wind and geothermal sections 7.4.4 and 4.4.4 respectively.	consider reducing if needed

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United States (U.S. Department of State)	5	9	38	-	-	-	-	-	In this bullet or in a new bullet here, the IHA Hydropower Sustainability guidelines should be mentioned. They are brought up in this Chapter, but not until much later. These are important policy issues, so belong in this subsection too.	Accepted
Gerrit Hansen (TSU)	5	9	39	-	44	-	-	-	please reconsider if an IHA policy statement does qualify as reference in a scientific report	grey literature but this section is on policy not science
Oluf Ulseth (Statkraft AS)	5	9	6	10	21	1.6	-	-	Policy - The section could promote or point to the use of governmental and regional "Energy Master Plans", establishing goals, direction and type of Energy System to be developed. Establish areas in which development may take place and coordinate energy plans with environmental and protection plans. Plans could also establish the merit order in terms development.	Accepted
Oluf Ulseth (Statkraft AS)	5	9	6	10	21	1.6	-	-	The Policy statement from India is a possible transboundary issue with conflicts towards Pakistan. The report should rather point to the necessity of establishing agreements between involved nations in order to resolve water issues and to able to utilize the resources without compromising neighbouring countries rights and possibilities.	recommendation would be policy prescriptive
Richard Taylor (International Hydropower Association)	5	9	44	9	44	5.1.6	-	-	Delete ""Saili et al."" and replace with ""IHA"".	Accepted
Richard Taylor (International Hydropower Association)	5	9	27	9	27	5.1.6	-	-	Insert ""and Sustainable Development"" after ""Hydropower"".	Accepted
David Clubb (European Environment Agency)	5	10	23	12	25	-	-	-	General comment: This whole section is based on the assumption that technical potential is the most 'useful' baseline. I would contest this. Technical potential excludes economics and environment. Whilst I take the point that economics is rather variable, I would suggest that it could be used as a proxy for the 'environmentally compatible potential' in the absence of any other environmental restrictions, and is therefore more relevant than the technical potential in this context	technical potential is in the OOA
United States (U.S. Department of State)	5	10	25	-	-	-	-	-	Pg. 10, L. 25: Eliminate "probably"	insert after comprehensive "global"
Gerrit Hansen (TSU)	5	10	33	-	-	-	-	-	provide definition of "capacity potential"	Accepted

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Gerrit Hansen (TSU)	5	10	24	-	31	-	-	-	technical feasible potential according to IJHD, 2005 should be compared/discussed with reference to the technical potential definition agreed upon in the OOA (¿ Technical potential: the amount of RE output obtainable by full implementation of demonstrated and likely to develop technologies or practices. No explicit reference to costs, barriers or policies is made but when adopting practical constraints analysts implicitly take into account economic and socio-political considerations.¿) Other studies need to be referenced, namely the AR4 and the DLR/Ecofys study, and results compared. Also, emphasis on the IJHD numbers should be justified.	a single comment that is not reflected in the overall comments on this section
Australia (0)	5	10	-	-	-	5.2.1	-	-	There is an updated Hydropower and Dams Atlas which was published in 2009 and refers to the 2008 calendar year	2005 baseyear
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	11	4	-	-	-	-	-	'Africa has higher potential than either North America or Europe, which is understandable considering the comparative states of development' should be 'Africa has higher potential than both North America and Europe'	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	11	6	-	-	-	-	-	'However, compared¿' should be 'Compared¿'	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	11	14	-	-	-	-	-	Including (some) hydro pumped storage interferes with capacity factors derived from generation and capacity.	pumped storage not included
Canada (Environment Canada)	5	11	17	11	17	-	-	-	Suggest adding units for generation and capacity to formula for accuracy.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	11	5	-	-	-	-	-	The technical potential of hydropower for world regions is not affected by the state of development	will be revisited in acc with glossary definitions
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	11	14	-	-	-	-	-	The worldwide total installed hydropower capacity (746 GW) apparently includes some hydro pumped storage.	lack of references
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	11	14	-	-	-	-	-	We recommend to use pure hydro capacity and generation data, e.g. 723 GW and 3190 TWh respectively.	lack of references
Australia (0)	5	11	-	-	-	-	-	5,2	Updated data for 2008 is available from the IEA	baseyear is 2005
Richard Taylor (International Hydropower Association)	5	11	-	-	-	-	-	5,3	Comment: Suggest the figure be removed - weak data source.	based on our primary data source

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Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	12	7	-	-	-	-	-	'Capacity factor can be indicative of how hydropower is employed in the energy mix (e.g. peaking vs base-load generation)¿' should be 'Capacity factor can be indicative of the type of hydropower used, e.g. run-of-river which is usually base-load generation and reservoir-based hydropower which may also be used for peak load and therefore may have on average a lower capacity factor than run-of-river hydropower...'	unnecessary clarification
Gerrit Hansen (TSU)	5	12	6	-	10	-	-	-	a more precise discussion of regional capacity factors, typical HP capacity factors and low capacity factors in particular could provide valuable information and a base for further discussion of technology potentials. Also, references for estimates of "potential generation increases achievable by equipment upgrades and operation optimization" could be provided, or references inserted to sections that cover these issues (e.g. 5.7, 5.3.4).	Firstpart of comm: rejected , not necessary second part of comment: non referenced data will be given - ref footot nr 7 page 23 current SPM (SOD)
United States (U.S. Department of State)	5	12	34	-	-	-	-	-	Add "frequency and/or magnitude of" in front of "extreme events"	Accepted
United States (U.S. Department of State)	5	12	8	-	-	-	-	-	Add parenthetical to water availability "(e.g., timing of flows, frequency, duration)"	Accepted
United States (U.S. Department of State)	5	12	25	-	-	-	-	-	At end of paragraph, add ", especially when designed and operated with best-available technologies and operating practices." This emphasis is needed throughout to solidify the fact that improvements can be made over existing technologies.	not relevant any more
United States (U.S. Department of State)	5	12	20	-	-	-	-	-	Change "are undoubtedly" to "may eventually become" for reasons stated in previous comment.	Accepted
United States (U.S. Department of State)	5	12	13	-	-	-	-	-	Hydrokinetic technologies have not yet been proven to be economically viable or technically durable, so reference to them should be qualified throughout. They simply are not a proven, commercial-ready technology yet and may not be so for several decades.	Accepted
Canada (Environment Canada)	5	12	11	12	21	-	-	-	Low head hydro potential is not mentioned here along with hydrokinetic as untapped hydro potential that has not yet been assessed. Suggest that text from page 55, lines 7-10 and page 56, lines 18-22 could be moved here as it is more suitable to this section on resource potential.	Accepted
United States (U.S. Department of State)	5	12	22	12	25	-	-	-	On page 12, the paragraph from lines 22-25 would be an appropriate place to note the benefit of hydropower¿s ability to balance variable renewable energy sources.	may be deleted
Kristie Ebi (Department of Global Ecology)	5	12	-	-	-	-	-	-	p 557, lines 40-44. This paragraph can be deleted. It adds no information.	is a guide for the following sub sections where numbering is to be changed
Gerrit Hansen (TSU)	5	12	22	25	-	-	-	-	paragraph has no additional information, but might be perceived as advocacy and should therefore be rephrased or removed.	Accepted

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David Clubb (European Environment Agency)	5	12	26	17	5	-	-	-	Potential omission: I think there's an important point being missed here. The increased variability in flow will cause capital costs (relative to income) to rise, because it is impossible to design a system which captures all extreme flood water to benefit from increased rainfall without massively increasing the capital cost; but a system based on historical flows will almost certainly have a reduced output due to less constant flow. This will tend to increase system cost and reduce economically feasible resource.	see 5.2.2 line 34
Gerrit Hansen (TSU)	5	12	11	-	-	-	-	-	precise definition of what is included in "conventional HP" should be provided	Accepted
Gerrit Hansen (TSU)	5	12	11	-	21	-	-	-	section could be shortened and referenced to later sections (5.7, 5.7.4), reference is missing	ref line 135
United States (U.S. Department of State)	5	12	9	-	-	-	-	-	Sentence beginning "Potential..." is a good example of the poor grammar throughout this chapter -- editing needed throughout.	Accepted
United States (U.S. Department of State)	5	12	7	-	-	-	-	-	The text beginning at " Capacity factor can be indicative ...." and including the sentences that follow until the end of the paragraph, is poorly written and needs to be re-considered. The concept of capacity factor is important and should be explained in more detail especially with respect to the fact that it is highly variable to site and year to year.	capacity factors will be discussed in 5.1.3 - under "by service type"
Norway (Climate and Pollution Agency)	5	12	34	-	35	-	-	-	This also points out the importance of reservoirs as flood and drought control instruments.	will be covered in 5.10, box 5.1
Denis Aelbrecht (EDF)	5	12	26	13	22	5.2.2 and 5.2.3	-	-	The situation of highly snow-melt driven basins would deserve a specific section, as global warming, which is less uncertain than changes in precipitation as the different spatial scales, will affect river flow regimes in these basins with specific features : earlier flow peak due to earlier timing of snow melt ; river temperature which may decrease (!) as volume from cold water from glaciers is increasing (this may be particularly important for deep rivers for which thermal balance with atmosphere takes long time as opposed to shallow ones) ; etc ... These features will have an important role on hydropower and other water resources uses.	Accepted



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Gerrit Hansen (TSU)	5	12	-	17	-	5.2.2-5.2.5	-	-	5.2.2 to 5.2.5 needs to be re-structured. It appears that 5.2.3 - 5.2.5 are actually subsections of 5.2.2, as 5.2.2 content and reference information is related to those following sections. Also, final heading should read "Possible Impact of climate change on resource potential" according to OOA. The following structure is proposed (without change in content), Please compare suggested structure in Addendum provided by TSU. 5.2.2 Impact of climate change on hydropower resource base/hydrological cycle 5.2.2.1 Projected changes in precipitation 5.2.2.2 Projected changes in river flow 5.2.3 Projected effects on regional hydropower potentials 5.2.3.1 Africa 5.2.3.2 Asia 5.2.3.3 Europe 5.2.3.4 Australia and New-Zealand 5.2.3.5 South-America 5.2.3.6 North-America 5.2.4 Possible Impacts of climate change on resource potential (substituting former 5.2.5.7 An assessment of global effect on hydropower resources)	intent of comment to be considered
Gian-Kasper Plattner (IPCC WGI TSU, University of Bern)	5	13	5	13	6	-	-	-	"each considering a plausible scenario for changes in population and economic activity over the 21st century" -- the SRES scenarios do not just include "changes in population and economic activity" but "represent different demographic, social, economic, technological, and environmental developments" (IPCC SRES, SPM).	read as follows : projections where based on four different scenarios each -----
Oluf Ulseth (Statkraft AS)	5	13	23	-	-	2.4	-	-	Changes in precipitation and river flow seem to point to the fact the the intensity will increase. Generally this would require more and larger reservoirs and higher installed capacity in order to maintain flood protection and to utilize the water resources for power generation. This should be included in the chapter.	is addressed in ch 5.10
Oluf Ulseth (Statkraft AS)	5	13	23	-	-	2.4	-	-	Changes in precipitation and river flow seem to point to the fact the the intensity will increase. It should be mentioned that this could be a problem with regards to dam safety.	a short mention to included
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	14	34	-	-	-	-	-	'The electricity supply in the majority of African States is derived from hydro-electric power' should be	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	14	34	-	-	-	-	-	'The electricity supply in the majority of African States is largely based on hydro-electric power'	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.

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United States (U.S. Department of State)	5	14	15	-	-	-	-	-	At end of sentence ending "is built", insert "and operation is modified to account for new hydrology."	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	14	37	-	-	-	-	-	e.g.: Agrawala, S. et al (2003): Development and climate change in Nepal: focus on water resources and	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	14	37	-	-	-	-	-	hydropower. OECD Environment Directorate and Development Co-operation Directorate, Paris, 2003.	Accepted
Gerrit Hansen (TSU)	5	14	5	-	-	-	-	-	insert reference (Fig. 5.5)	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	14	37	-	-	-	-	-	It is recommended to add information on climate change impacts on hydropower in Asia (paragraph 5.2.5.2),	Accepted
Kristie Ebi (Department of Global Ecology)	5	14	-	-	-	-	-	-	p 559, lines 28-32. It is not useful to say a number of studies have been published. It would be better to provide a summary.	summary is given in the para below
United States (U.S. Department of State)	5	14	27	-	-	-	-	-	Whether it is in AR4 or not, the fact is that in addition to direct effects of climate change on hydrology, there will also be indirect and compounding effects on water availability for hydro, especially in heavily developed river basin with high human populations that consume water and modify land use. These issues should be discussed here or elsewhere.	will be considered if references is found
Frederic Louis (EDF Hydro Engineering Centre)	5	14	-	-	-	5.2.5	-	-	Importance given to Australia and North America seems disproportionate compared to the two lines each for Asia and Africa.	Accepted
Denis Aelbrecht (EDF)	5	14	33	14	39	5.2.5.1 and 5.2.5.2	-	-	Africa and Asia would probably deserve a longer and a bit more detailed description of what could be the effects of climate change on hydropower potential in their regions. Africa is one world region where development of hydropower is probably most likely to occur at a high rate, and which in the same time has probably the greatest exposure to climate variability and change effects. Asia already experiences a huge development of hydro. I would for example invite authors to look at papers from China (Lu Jin, and other publications from IWHR or IWRA), Japan (Y. Tachikama), Russia (M. Bolgov), etc ...	Accepted
Richard Taylor (International Hydropower Association)	5	14	38	14	38	5.2.5.2	-	-	Insert ""major"" after ""of"" and before ""hydropower"".	Accepted

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China (China Meteorological Administration)	5	14	39	14	39	5.2.5.2	-	-	Section 5.2.5.2 reaches a conclusion that changes in runoff in Asia could have a significant impact on power output of hydropower-generating countries such as China, India, Iran and Tajikistan, etc. Since the predictions from meteorological and hydrological models for analyzing the climate change on the water resources and hydropower are subject to the simulation approaches, calculation methods and input conditions, in view of such uncertainties and devoid of the references proof (other sections all have the clear references), for avoiding the potential negative impact on hydropower industry, It is suggested to delete the word "significant" and to further clarify the consistency and uncertainties of the prediction method and results in the report, and the studies on projected impacts on hydropower potential should be continued.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	15	2	-	-	-	-	-	It is recommended to add the following literature source for Europe: Lehner, B., G. Czisch, S. Vassolo (2005): The impact of global change on the hydropower potential of Europe: a model-based analysis. Energy Policy 33 (2005), pp 839-855.	added if found relevant
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	15	9	-	-	-	-	-	It is recommended to decrease the text of 5.2.5.4 Australia and New Zealand (as compared to 5.2.5.2 Asia)	text modified if relevant
United States (U.S. Department of State)	5	15	20	15	25	-	-	-	On pg. 15, lines 20-25: the section on South America discusses ENSO effects, glacier retreat and drought issues; a comment regarding the projected impacts of climate change might be appropriate here. Expand, delete or add region specific references to more details.	not doing this for other regions
United States (U.S. Department of State)	5	15	10	15	18	-	-	-	The treatment of New Zealand's hydropower resource on page 15 (lines 10-18) seems more detailed than other treatments, perhaps disproportionately so. Consider collapsing the regional discussions because they don't have enough detail to enhance our understanding of the issues.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	16	21	-	-	-	-	-	'division into political regions...' should be 'division into countries'	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	16	31	-	-	-	-	-	'The somewhat surprising result etc.' should be 'The small changes in hydropower generation by world region in this study tend to obscure the fact that changes in hydropower generation by country may be much larger and that changes by country region may even exceed those on a country level'	Accepted

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United States (U.S. Department of State)	5	16	25	-	-	-	-	-	Although the direct effects of climate change seem to average out to become minimal, the indirect effects and the adaptation impacts of high human populations are likely to be greater than direct effects. For example, changes in water consumption and higher demands for environmental flows to protect stressed ecosystems may be much larger than climatic effects on hydrology (e.g., Atlanta water demands in AL-FL-GA). This needs some discussion so that future regional effects do not sound too neutral.	will consider this if references is to be found
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	16	34	-	-	-	-	-	It is recommended to omit three sentences starting with 'The future expansion of the hydropower'. They imply that global redistribution is a main issue. However, impacts on hydro potential mainly have a regional scale.	Accepted
Gerrit Hansen (TSU)	5	16	34	-	-	-	-	-	reference/referenced section does not exist	wrong chapter numbering
Canada (Environment Canada)	5	16	2	16	4	5.2.5.6	-	-	Please clarify reference source for sentence. References section does not include "IPCC 2007c".	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	17	27	-	-	-	-	-	'characteristics of a variable or intermittent source' should be 'characteristics of a largely variable source'	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	17	30	-	-	-	-	-	'financial resources for mitigation' should be 'financial resources for mitigation of environmental impacts'	comment i stoo narrow
United States (U.S. Department of State)	5	17	15	-	-	-	-	-	After peaking insert "during high demand periods".	redundancy
United States (U.S. Department of State)	5	17	21	-	-	-	-	-	Instead of "(hourly, daily, or weekly)" I suggest "(typically hourly)".	more precise
United States (U.S. Department of State)	5	17	18	-	-	-	-	-	Instead of "short in the small tributaries" should be "small in the short tributaries"	Accepted
United States (U.S. Department of State)	5	17	9	-	-	-	-	-	Replace reservoir based with "storage".	Accepted
United States (U.S. Department of State)	5	17	6	-	-	-	-	-	Somewhere in this section there should be a discussion of the importance of transmission lines connecting hydropower to the grid and their design relative to transmission loses.	out of scope of SRREN
United States (U.S. Department of State)	5	17	20	17	32	-	-	-	The explanation of RoR projects is oversimplified. For example, some are on mainstems of rivers below other large storage projects that regulate flows and provide headwater benefits, raising the capacity factors of the RoR projects substantially. A distinction should be made between headwater or tributary RoR projects (often also diversion projects), and mainsteam RoR projects lower in the watershed.	Accepted
United States (U.S. Department of State)	5	17	15	-	-	-	-	-	The sentence ending with "no storage capacity" is too limited a definition because RoR projects may also be located downstream, on the main stem of rivers below other storage projects.	sentence will be modified

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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Oluf Ulseth (Statkraft AS)	5	17	7	25	4	5.3	-	-	The section seems to be too detailed.	if possible will be shortened
Richard Taylor (International Hydropower Association)	5	17	14	17	18	5.3.1	-	-	Comment: Conflicting statements about run of river in this paragraph need to be reconciled. It would be more accurate to describe run of river as having 'limited' rather than 'no' storage.	Accepted
Richard Taylor (International Hydropower Association)	5	17	9	17	9	5.3.1	-	-	Delete ""based"".	Accepted
Canada (Environment Canada)	5	17	7	17	18	5.3.1	-	-	Suggest referring to hydrokinetic in introductory paragraph on "Types" as it is discussed as one of the types in section 5.3.1.4.	Accepted
Richard Taylor (International Hydropower Association)	5	17	-	-	-	-	5,6	-	Comment: The diagram and picture are not typical representations of run of river. Suggest replacing.	good enough
United States (U.S. Department of State)	5	18	16	-	-	-	-	-	At end of sentence, add "... for load balancing and other ancillary benefits."	Accepted
United States (U.S. Department of State)	5	18	22	-	-	-	-	-	Insert "large-scale" in front of "technologies".	put in before "energy storage"
United States (U.S. Department of State)	5	18	3	-	-	-	-	-	Reconsider this prediction on overall impact, or qualify it with explanation of indirect effects from previous comment.	comment not understood
United States (U.S. Department of State)	5	18	1	-	-	-	-	-	Rename Section 5.3.1.2 "Storage" rather than Reservoir.	more consistent
Gerrit Hansen (TSU)	5	18	30	-	32	-	-	-	sentence not clear	comment not understood
United States (U.S. Department of State)	5	18	2	-	-	-	-	-	The mode of operation of reservoir, or storage, hydropower projects is very important. Energy values and environmental impacts depend on how water is released from the active storage volume of surface reservoirs. These modes of operation should be described: peaking, pulsing, and baseload (with seasonal shift in river discharge).	5.3. to be reduced further - intent in comment will be considered
Richard Taylor (International Hydropower Association)	5	18	-	-	-	-	5,9	-	Comment: The figure on the left looks like a run of river. Suggest replacing. A figure or picture of hydrokinetic would also be useful here.	instream with existing facilities
Gerrit Hansen (TSU)	5	19	25	-	-	-	-	-	formula should have a clear title/number	Accepted
United States (U.S. Department of State)	5	19	17	-	-	-	-	-	It would be more complete to define this as flows outside the minimum and maximum hydraulic capacity of the generating equipment, plus leakage. Flows can be unusable for hydropower if either too high or too low.	Accepted

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Canada (Environment Canada)	5	19	30	19	31	-	-	-	Suggest removing "into kinetic energy and then". This depends on type of turbine - the total "potential" energy does not necessarily transform into kinetic energy before transforming to mechanical energy.	two lines to be deleted
United States (U.S. Department of State)	5	19	25	-	-	-	-	-	This equation doesn't look right, or it is not sufficiently explained. It looks like a power equation defining capacity or HP, unless the C factor is both a fixed capacity factor and the hours in a year. It would be better to break this into two different equations, one that calculates power (MW) and one energy (GWh/yr)	Accepted
United States (U.S. Department of State)	5	19	12	22	30	-	-	-	This section is problematic in a couple of ways: + it seems somewhat redundant with Section 5.7 + it misses the important trend in advanced technologies that substantially improve the environmental performance of hydropower. Move it all to 5.7, combine and/or add the issue of environmental performance?	5.3.2 - 5.3.3 moved to 5.7 and merged if possible
United States (U.S. Department of State)	5	20	16	-	-	-	-	-	A cross reference to the later section discussing CFD would be useful here.	whole section to be moved to 5.7
United States (U.S. Department of State)	5	20	1	20	10	-	-	-	Turbine and generator operation is often not at the Best Efficiency Point (BEP) by design (e.g., to match demand or balance loads, or sell more valuable power), which lowers the realized efficiency of power plants substantially. The discussions throughout this chapter tend to imply that operational efficiencies are always high, or as high as possible -- that is not the case and should be explained more completely.	assumption in comment not found in text
United States (U.S. Department of State)	5	21	3	-	-	-	-	-	After the word hard insert "and soft" and replace the word mainly with "often". It is important to explain that tunneling is increasingly favored as a replacement for surface structures like penstocks.	Accepted
United States (U.S. Department of State)	5	21	0	22	0	-	-	-	The editor note indicated that the chapter is currently longer than desired. One section that could be significantly shortened is the one dealing with tunneling capacity (pg. 21-22). While the information is interesting, the level of detail provided doesn't add a great deal to the overall topic of hydropower, and some of this detail could be eliminated with minimal impact overall. Other construction items, like penstocks, conveyance structures, cofferdams, and associated materials are all important, but not covered in equal detail. Nevertheless there is not room for these details.	paragraphs to be modified
United States (U.S. Department of State)	5	21	10	21	11	-	-	-	These classifications are too broad because other technologies are important like microtunneling alone or in combination with other tunneling methods.	Accepted
Canada (Environment Canada)	5	21	1	22	30	5.3.2.2.	-	-	Suggest section goes into too much detail on a specific technology used in hydropower - it could be reduced to help shorten chapter.	whole section to be moved to 5.7
United States (U.S. Department of State)	5	22	20	-	-	-	-	-	Change item 4 to read "in situ (pre-existing) rock stresses	Accepted

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United States (U.S. Department of State)	5	22	27	22	30	-	-	-	Pg. 22 lines 27-30: does lining reduce leakage? Does this benefit overall efficiency?	good questions but too detailed for the report
Gerrit Hansen (TSU)	5	22	29	-	30	-	-	-	sentence should read "¿unlined high pressure shafts ¿"?	Accepted
United States (U.S. Department of State)	5	22	32	-	-	-	-	-	The statement that "sedimentation is not caused by hydroelectric projects" is not exactly true. Any hydraulic control structures that slow down water flows, even temporarily, will change sediment transport characteristics and change sedimentation patterns. Hydro projects all involve hydraulic control structures of some type to control head and/or flow. The second part of the first sentence, that problems need to be understood and managed is true and should be emphasized rather than the first part. Release patterns from hydro projects may also lead to erosion and new sedimentation in downstream river channels.	should be considered
United States (U.S. Department of State)	5	23	36	-	-	-	-	-	better said as "better management of land use practices in upstream watersheds to reduce erosion and sediment loading."	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.
Norway (Climate and Pollution Agency)	5	23	11	-	-	-	-	-	International Rivers is an interest group which one must be careful to consider as a valuable reference for a scientific document. Therefore the reference in chapter 5 (p.23) to McCully should probably not be quoted in an IPCC report.	Accepted
Oluf Ulseth (Statkraft AS)	5	23	10	23	11	-	-	-	McCully from International Rivers is quoted as a reference in this document. This is an interest group which is living from the controversies it rises. It is questionable if she could be regarded as a valuable reference in such a scientific document. The reference and the related text passage should be deleted.	Accepted
Gerrit Hansen (TSU)	5	23	34	-	-	-	-	-	more recent references should be provided	2005 is recent
United States (U.S. Department of State)	5	23	10	23	12	-	-	-	This would be a good place to tie in the potential indirect effects of climate change, such as the effect that increases in storm intensity or frequency would have on erosion process and sediment loading.	to be mentioned if reference exist
China (China Meteorological Administration)	5	23	32	23	33	5.3.3	-	-	Add ¿for instance, the technology of clear water impounding and muddy flow releasing was innovated and widely used in China¿?Yin Baohe?Construction Technology and Achievement of Yellow River Xiaolangdi Multi-purposed Hydro Project; Development Status and Project Practice of Chinese Dam Technology, Chinese Water Resource Publishing House, 2007, P239-244).	too detailed, total sedimentation section will be reduced
United States (U.S. Department of State)	5	24	22	-	-	-	-	-	After controls insert "(eg. programmable logical controllers).	Accepted
United States (U.S. Department of State)	5	24	23	-	-	-	-	-	Insert after monitoring before etc. "GIS (switchyards?)"	Accepted
United States (U.S. Department of State)	5	24	44	-	-	-	-	-	Instead of "in neither is" should be "is neither".	Accepted

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United States (U.S. Department of State)	5	24	1	24	4	-	-	-	Pg. 24, lines 1-4: discuss other environmental issues here, such as how climate change may affect land use patterns with subsequent indirect effects on water quality and quantity.	env issue in 5.6
United States (U.S. Department of State)	5	24	40	-	-	-	-	-	Section 5.3.5 is redundant with previous sections describing project types: move/combine elsewhere.	move to 5.5.5
Gerrit Hansen (TSU)	5	24	3	-	-	-	-	-	sentence not clear	sentence to be clarified, must be supplemented with control of "land use" and remove "land coverage"
United States (U.S. Department of State)	5	24	14	24	17	-	-	-	U.S. DOE has been using a similar approach of new technology development since 1994 when they started the Advanced Hydropower Turbine Systems Program that emphasized simultaneous improvements in energy and environmental performance. Potential references to use for this program are: (1) Cada, G. F., 2001. The development of advanced hydroelectric turbines to improve fish passage survival, Fisheries 26(9)14-23. (2) Odeh, M., 1999. A summary of environmental friendly turbine design concepts. DOE/ID/13741, U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID. Published July 1999. (3) Sale, M.J., G.F. Cada, and D.D. Dauble, 2007. Historical perspective on the U.S. Department of Energy's Hydropower Program. Proceedings of HydroVision 2006, HCI Publications, Kansas City, MO.	refs included
Gerrit Hansen (TSU)	5	25	34	-	39	-	-	-	reference needed for statement on India. Numerical information on this "substantial potential" would be of high value.	information confirmed by the source
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	25	20	-	-	-	-	-	The left column of Table 5.2 apparently includes hydro pumped storage. Please add text for explanation.	not commented by the source
Richard Taylor (International Hydropower Association)	5	25	4	25	4	5.3.5	-	-	Insert: Pumped storage hydro is also playing an increasingly important role in storing the surplus energy generated by variable renewables such as wind and solar, facilitating their integration and optimisation into the grid.	para moved to 5.5.5 - text to be merged
Canada (Environment Canada)	5	25	20	25	20	5.4.1	-	5.2	Suggest that it would make more sense to juxtapose annual generation instead of capacity against percentage of hydro in total electricity generation.	not the objective of this paragraph
Canada (Environment Canada)	5	25	18	25	20	5.4.1	-	5.2	The share of hydro in Canada's total electricity generation was 59% from 2005 to 2007 and 60.4% in 2008. Line 18 and Table 5.2 wrongly mention Canada's hydro share as being 58%, which is not consistent with Chapter 01, section 1.3.3.2., line 5, page 208, where Canada's hydro share is 60%. Source: Statistics Canada: catalogue 57-202-XB Electric Power Generation, Transmission and Generation ( <a href="http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=57-202-X&amp;lang=eng">http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=57-202-X&amp;lang=eng</a> ).	IEA is the agreed source



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Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	26	27	-	-	-	-	-	Please add after '.41%' 'whereas the share of gas-fired power increased from 12.1% in 1973 to 20.1% in 2006'	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	26	15	-	-	-	-	-	Please rephrase the sentence 'Russia is however an exception <sub>ζ</sub> ' accordingly.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	26	17	-	-	-	-	-	The sentence 'It faces the twin challenges <sub>ζ</sub> ' may be omitted as other countries face the same challenges.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	26	12	-	-	-	-	-	The sentence starting with 'In these countries' may be omitted as the content thereof seems to be selfevident.	deleted from line 12-80
China (China Meteorological Administration)	5	26	19	-	-	5.4.1	5,13	-	Hydro generation by P.R.China in the figure is verified as "573.3 TW.h" (Table from Hydropower Generation from 1949-2008 in China, Journal of China's Water Power 2008, China Society for Hydropower Engineering, Chinese Electric Power Publishing House, 2009).	IEA is the agreed source
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	27	8	-	-	-	-	-	'of the 8,084 billion toe <sub>ζ</sub> ' should be 'of the 338,500 EJ <sub>ζ</sub> '	EJ in footnote or in paranthesis
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	27	3	-	-	-	-	-	Two sentences starting with 'Of the world's five <sub>ζ</sub> ' may be omitted as they do not seem to give much insight.	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.
Australia (0)	5	27	7	28	3	5.4.2	-	-	It may be more relevant to discuss hydro's share of electricity generation, rather than total electricity generation from all fuels. This could potentially be put in an overview chapter instead.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	28	14	-	-	-	-	-	'nuclear and thermal power plants' should be 'nuclear and fossil fuel based thermal power plants'	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	28	15	-	-	-	-	-	'thermal or nuclear power plants' should be 'nuclear or fossil fuel based thermal power plants'	Accepted
David Clubb (European Environment Agency)	5	28	16	28	18	-	-	-	Assertion as fact. Hydro can be an excellent or a terrible investment, or anything in between. It depends on many of the factors already discussed. But you cannot make this statement in isolation. You could say that its benefits (with respect to peak generation in particular) enhance its financial position with respect to other renewables or fossil fuels	not the objective of the chapter
United States (U.S. Department of State)	5	28	5	28	18	-	-	-	Before mentioning some specific electricity uses (starting in line 7), it should be first stated that hydropower covers all "regular" uses like general demand.	Accepted

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David Clubb (European Environment Agency)	5	28	14	28	15	-	-	-	False assertion. The use of hydro does not mean that thermal and nuclear plants operate at high efficiency. Their efficiencies are generally of the order 35-40%. What it does mean is that less efficient peak generator use is minimised.	delete "at optimum output" and replace high with higher
David Clubb (European Environment Agency)	5	28	27	28	27	-	-	-	Incorrect: use of units	unit is correct
United States (U.S. Department of State)	5	28	19	-	-	-	-	-	Insert "operating reserves," before voltage regulation.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	28	9	-	-	-	-	-	Please add after '..for transport' 'or as a propellant for rockets used in spacecraft'	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	28	1	-	-	-	-	-	Please omit Figure 5.16 as it does not appear to provide additional information compared to Figure 5.1, p. 7.	Accepted
United States (U.S. Department of State)	5	28	23	28	31	-	-	-	Strongly agree with this paragraph.	Accepted
United States (U.S. Department of State)	5	28	12	-	-	-	-	-	The statement that "peak power is expensive" is problematic. Peak power is very valuable, therefore its price is high in competitive electricity markets. It can be expensive to produce, but where natural gas is plentiful, it can also be relatively cheap, cheaper than hydropower. A more detailed explanation is needed here.	Accepted
Australia (0)	5	28	-	-	-	5.4.4	-	-	CDM and JI should be discussed in the context of the Kyoto Protocol - This section is very unclear.	in 24 add after implementation"under the Kyoto Protocol
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	30	24	-	-	-	-	-	'contrary to thermal and gas/oil/coal options' should be 'contrary to fossil fuel based thermal power options'	Accepted
United States (U.S. Department of State)	5	30	40	-	-	-	-	-	Instead of "challenged" it should be "challenging".	Accepted
Gerrit Hansen (TSU)	5	30	18	-	38	-	-	-	paragraph has little additional information, and lacks sources. Could be removed without loss of information (compare also Add provided by TSU)	paragraph is important re environmental and social issues
United States (U.S. Department of State)	5	30	31	30	34	-	-	-	Pg 30, lines 31-34: difficult to understand the phrasing of this single-sentence paragraph.	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.
Gerrit Hansen (TSU)	5	30	2	-	4	-	-	-	referenced sections not clear/consistent, should be 5.6.2 in both cases?	Accepted
Richard Taylor (International Hydropower Association)	5	30	18	30	19	5.4.5	-	-	Delete ""represents physical action and impacts, with inevitable"" and replace with ""involves"". Delete ""the"" after ""minimize"" and before ""environmental"".	Accepted

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Frederic Louis (EDF Hydro Engineering Centre)	5	30	-	-	-	5.4.5.1	-	-	The energy payback ration has noting to do with financing. It is a very interesting subject and should be treated under a specific heading.	energy payback ratio to be moved to 5.6 only for hydro and add energy payback time
Brazil (Ministry of Science and Technology)	5	31	34	31	34	-	-	-	Brazil, one of the world's leading hydropower producers, has also created incentives to stimulate the implementation of ""Small Hydro-power Plants - PCH"", term referred to units under 30 MW in the country ( applicable to other renewables too) : 50 % deduction on electric power distribution tax (TUSD) - Ref: Resolução ANEEL n° 281/1999 < <a href="http://www.aneel.gov.br/cedoc/bres1999281.pdf">http://www.aneel.gov.br/cedoc/bres1999281.pdf</a> >	Accepted
David Clubb (European Environment Agency)	5	31	15	32	6	-	-	-	Irrelevant: There is no logic for choosing France as the example for administrative process. In fact, the processes vary so much from country to country that a more reasonable submission would be to give examples of the sort of thing that are required for permissions (environmental considerations) and leave it at that.	keep example and reduce volume - take in discussion on small and large discrimination as barrier - section 5.4.5.2
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	5	31	24	32	6	-	-	-	Paragraph considered to be too country specific - nevertheless the example describes one of the obstacles in the licensing process.	keep example and reduce volume
United States (U.S. Department of State)	5	31	14	-	-	-	-	-	ROI, expectation for short periods to achieve ROI, and uncertainty imposed by long planning and regulatory processes are all issues that constitute financing challenges to hydropower. Explain.	Accepted
Gerrit Hansen (TSU)	5	31	23	32	6	-	-	-	this paragraph is too detailed and still doesn't make very clear whar the most important point is: entire paragraph should be deleted or summed in a short sentence cutting to the case	keep example and reduce volume
China (China Meteorological Administration)	5	31	15	32	6	5.4.5.2	-	-	Comparing with the hydropower technology application and prospect, Chapter 5 seldom mentions the country's hydropower policy and regulation, which often play the important role in promoting the sustainable development of hydropower and better responses to climate change. It is suggested to give a proper description of the mainstream law, regulation and policy in this chapter, for example incorporating the hydropower concession laws and FIT by Europe in one table and giving a simple introduction. Please incorporate the content regarding small hydros from this section into that new special section on Small Hydropower after 5.1.3.	new section on small hydro is not required
Canada (Environment Canada)	5	31	15	32	6	5.4.5.2	-	-	Suggest explaining what "Administrative and Licensing" generally means - particular aspects are mentioned, but big picture is not described.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	32	27	-	-	-	-	-	'the optimum thermal efficiency state when the emission per unit output is minimum' should be 'the optimum thermal efficiency'. Optimal thermal efficiency is mainly an economic issue taking into account the economic penalty due to lack of efficiency of part-load generation. Environmental emissions are a secondary issue.	disagree with statement

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Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	32	26	-	-	-	-	-	'Thermal power plants (coal, gas or liquid fuel)...' should be 'Thermal power plants (based on nuclear power, coal, gas or liquid fuel)...'	as mentioned before
United States (U.S. Department of State)	5	32	7	32	22	-	-	-	Paragraph should clearly state that there are no problems in integrating hydropower plants into the system. Moreover, it may help with the integration of other renewable energy sources.  Spell out RES (renewable energy source).	Accepted
David Clubb (European Environment Agency)	5	32	23	32	30	-	-	-	Repetition. This is correct but has already been stated before several times. Those previous times should be eliminated (except possibly for the summary)	needs editing
Gerrit Hansen (TSU)	5	32	38	-	40	-	-	-	sentence is not clear	sentence will be modified
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	32	26	-	-	-	-	-		Comment incomplete.
Richard Taylor (International Hydropower Association)	5	32	20	32	20	5.5	-	-	Insert ""In addition, pumped storage hydro provides for the storage of surplus energy generated by variable renewables such as wind and solar, enabling greater penetration into the grid and facilitating integration and optimisation.""	Accepted
David Clubb (European Environment Agency)	5	33	9	33	11	-	-	-	Assertion as fact. Not all hydro power plants (including captive) are a good investment opportunity. This is then confirmed in the next sentence. Highly inconsistent.	delete line 9-11
David Clubb (European Environment Agency)	5	33	16	33	27	-	-	-	Duplication of content from Chapter 3 (page 60 and 61)	relevant to ch 5 - could be shortened
Gerrit Hansen (TSU)	5	33	30	-	34	-	-	-	if reference could be improved, that would be very helpful. Also, consider including this information in section 5.4.2 regional deployment/development	Accepted
Gerrit Hansen (TSU)	5	33	9	-	10	-	-	-	please rephrase sentence, it is not a scientific statement	delete line 9-11
Richard Taylor (International Hydropower Association)	5	33	26	33	26	5.5.3	-	-	Add ""scale"" after ""small"" and before ""hydro"".	Accepted
Richard Taylor (International Hydropower Association)	5	33	29	33	29	5.5.3	-	-	Add ""scale"" after ""Small"" and before ""hydro"".	Accepted
David Clubb (European Environment Agency)	5	34	5	34	7	-	-	-	Ambiguity: I understand what the writier is driving at here, but the unclear use of language leaves the meaning ambiguous. If there are 'cost benefits' to small systems, why are large systems more cost-effective? Or is this the case? What is the key message you are trying to provide here....is it related to externalities?	comment to be considered

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David Clubb (European Environment Agency)	5	34	3	34	4	-	-	-	Incorrect phrasing/omission: '¿ can offer considerable financial benefits to the individual as well as the community.' What individual? How likely is it that individuals in the developing world will be able to afford to install hydro systems alone?	find reference
David Clubb (European Environment Agency)	5	34	4	34	5	-	-	-	Unspecified statement: 'even though the scale of small hydro capital cost may not be comparable to large hydropower ¿' In what way is the scale comparable or not comparable? This sentence does not provide any information as it is written	Accepted
China (China Meteorological Administration)	5	34	3	34	20	5.5.3	-	-	And please incorporate the content regarding small hydropower of this section in a new special section on Small Hydropower after 5.1.3.	no new section on "small scale" hydro
Brazil (Ministry of Science and Technology)	5	35	33	35	33	-	-	-	An important remark at this stage is the excellent seasonal complementarity of hydro power with wind energy in Brazil, i.e the dry season (lower water level in reservoirs) registers higher occurrences of wind than during the rainy period (Ref: GWEC - Global Wind Report 2009). Besides that, it is quite significant the seasonal complementarity of hydro power with electricity produced out of sugar cane bagasse: the harvesting season (May - November), when this bio-energy is produced, coincides with the dry period in the country (Ref:Castro, Nivalde Jose, "" Inserção da bioeletricidade na matriz de geração de eletricidade"" , Forum Gesel de Política Energética:programa de bioeletricidade 2011-2020 , 26th February, 2010, Rio, < <a href="http://www.nuca.ie.ufrj.br/gesel/">http://www.nuca.ie.ufrj.br/gesel/</a> >)	to be included in 5.5.8
Gerrit Hansen (TSU)	5	35	8	-	9	-	-	-	cut sentence here, as lack of flexibility of thermal plants is discussed elsewhere	edit
David Clubb (European Environment Agency)	5	35	34	35	34	-	-	-	Incorrect phrasing: Suggested rephrasing: from 'loosely termed as' to 'considered as'	Accepted
David Clubb (European Environment Agency)	5	35	42	35	43	-	-	-	Incorrect. Compressed air is not 'mechanical energy' (which is not really a correct definition anyway); it is potential energy. A moving flywheel possesses kinetic energy (again, mechanical energy is not really a suitable term)	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.
David Clubb (European Environment Agency)	5	35	40	35	40	-	-	-	Incorrect. Electricity can be stored directly in any size capacitor.	not relevant
United States (U.S. Department of State)	5	35	21	-	-	-	-	-	Pg. 35, L. 21: Change to as it needs virtually no "ramp-up" time	Accepted
Gerrit Hansen (TSU)	5	35	2	-	7	-	-	-	reference missing, the statement on advanced countries could be challenged (e.g. in northern europe, air conditioning is not very common, nor needed), colloquial style is irritating, whole paragraph might be shortened and rephrased expressing the fact, that electricity demands vary depending on several conditions	reduce content - important to show what peaking is about

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David Clubb (European Environment Agency)	5	35	1	35	25	-	-	-	Repetition. This issue has been covered multiple times within this chapter.	edit to check if this is the main paragraph where this is discussed
Canada (Environment Canada)	5	35	1	37	15	-	-	-	Same idea is repeating. Could be shortened to help reduce size of chapter 5.	edit to check if this is the main paragraph where this is discussed
Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	5	35	43	36	3	-	5.21	-	CAES with yet only two plants installed worldwide is considered to be presented too prominent. As an alternative to figure 5.21 we propose to present results from VGB-Studie 2009 (Fig. 2 in the attached reference SRREN_Draft2_Review_Vahrenholt (Prof. Dr.)_Fritz_Material_01.pdf).	but will be considered
Gerrit Hansen (TSU)	5	36	4	37	15	-	-	-	check for redundancy with section 5.3.1.2	Accepted
United States (U.S. Department of State)	5	36	31	36	33	-	-	-	I suggest the last sentence as follows: It is dependent on the plant mix of the system, the amount of existing hydro storage facilities, the amount of variable energy sources (e.g., wind and solar), system load characteristics, grid topology, and spatial distribution of power plants and load centers.	sentence referred to will be deleted
David Clubb (European Environment Agency)	5	36	30	36	31	-	-	-	Irrelevant: do we really need to consider the 'optimum' value of pumped storage in a system is?	sentence deleted
United States (U.S. Department of State)	5	36	30	-	-	-	-	-	Pg. 36, L. 30: Eliminate "very" These throw-away words do not add to the document.	sentence deleted
David Clubb (European Environment Agency)	5	36	18	36	20	-	-	-	Query: 'pumped storage projects are often constructed in conjunction with large base-load generating stations such as nuclear and coal-fired power stations'. Is this really true? What reference can you cite for this; what examples are there? How 'often' is 'often'? I have never heard of a conventional thermal station construction being accompanied by a hydro storage project.	refs to be included
Frederic Louis (EDF Hydro Engineering Centre)	5	36	29	-	30	-	-	-	Reference is made to the world's total electric capacity.	to be clarified and ref given
Richard Taylor (International Hydropower Association)	5	36	-	-	-	-	5,21	-	Comment: The logarithmic scale is misleading. An alternative figure can be sourced by IHA after comments on the SRREN SOD close (post 23 August 2010).	find new figure
David Clubb (European Environment Agency)	5	37	30	37	35	-	-	-	Contradiction/clarification: Does this paragraph not contradict some statements which were made earlier about small hydro (page 34)? Clarification of both or either is merited	shorten and comment to be considered
David Clubb (European Environment Agency)	5	37	6	37	10	-	-	-	Duplication; this is almost the same point as was made about peak capacity, and should be covered in the same place	Accepted
United States (U.S. Department of State)	5	37	44	-	-	-	-	-	I suggest the following sentence "The hydropower plants have lower Equivalent Forced Outage Rate (EFOR), relative to other energy technologies".	Accepted
Canada (Environment Canada)	5	37	30	37	35	-	-	-	Ideas do not flow and are not really relevant to the heading "Supply characteristics". Suggest deleting to shorten.	shorten

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United States (U.S. Department of State)	5	37	43	-	-	-	-	-	Instead of "l" should be "in"	Accepted
David Clubb (European Environment Agency)	5	37	21	37	29	-	-	-	Misleading. Machine availability is not the most relevant metric for power plant; the correct one should be capacity factor (which is also rather good for hydropower)	to be edited
United States (U.S. Department of State)	5	37	11	37	14	-	-	-	Pg. 37, lines 11-14; opportunity to introduce the concept of larger load-balancing areas.	not in context here
Canada (Environment Canada)	5	37	17	35	20	-	-	-	Same text was used in Page 32 from line 8 to line 11	to be deleted here
Gerrit Hansen (TSU)	5	37	17	-	20	-	-	-	Same wording as first sentence in 5.5, sentence could be cut	to be deleted here
Canada (Environment Canada)	5	37	45	37	45	-	-	-	Suggest explaining the meaning of the Equivalent Forced Outage Factor (EFOR) for non-expert readers (e.g., EFOR is a measure of the unavailability of a generating unit of a power plant).	if EFOR is needed
United States (U.S. Department of State)	5	38	15	-	-	-	-	-	Instead of "support the transmission" I suggest "support the generation and transmission"	Accepted
United States (U.S. Department of State)	5	38	10	-	-	-	-	-	Pg. 38, L. 10: Eliminate "extremely"	to be modified
United States (U.S. Department of State)	5	38	15	-	-	-	-	-	Pg. 38, L. 15: Ancillary Service is necessary...	Accepted
United States (U.S. Department of State)	5	38	3	38	8	-	-	-	Pg. 38, lines 3-8: poorly phrased. Clarify but do not expand, rather cross-reference to Chapter 8 where these issues are discussed in detail.	check to see if ch 5 is the authority
Richard Taylor (International Hydropower Association)	5	38	11	38	11	5.5.6.3	-	-	Delete ""dams"" and replace with ""reservoirs"".	Accepted
Canada (Environment Canada)	5	38	1	38	1	-	-	5.4	Suggest that units (%) be given for PLF, AF, EOF, FOR and EFOR. Please also check definition of FOR - should it be: hours of forced outage/(hours of forced outage + hours of service) ?	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	39	46	-	-	-	-	-	'such as wind and sun' should be 'such as wind and solar energy'.	Accepted
United States (U.S. Department of State)	5	39	5	-	-	-	-	-	Delete "(unit commitments)"	Accepted
David Clubb (European Environment Agency)	5	39	43	40	16	-	-	-	Duplication: these points are covered in other areas	duplicatoins will be removed , 5.5.8 will be merged with 5.5.5 that will be renamed to "support and integration with other renewables2

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United States (U.S. Department of State)	5	39	26	-	-	-	-	-	Pg 39 line 26: 124 of 145 treaties: which treaties?	wording to be checked and refs given
Gerrit Hansen (TSU)	5	39	9	-	11	-	-	-	style unsuitable for this report, should be deleted.	Accepted
Canada (Environment Canada)	5	39	26	39	33	5.5.7	-	-	Suggest that paragraph needs a short introduction that discusses the use of treaties for the management of transboundary waters. Currently it jumps abruptly into a list of treaties without describing their purpose or why they are needed.	Accepted
United States (U.S. Department of State)	5	40	25	-	-	-	-	-	Better wording would be "each hydropower plant is uniquely designed to fit the site-specific characteristics..."	Accepted
United States (U.S. Department of State)	5	40	29	-	-	-	-	-	change "anticipate" to "predict"	Accepted
United States (U.S. Department of State)	5	40	37	-	-	-	-	-	Change "emit" to "have significant net emissions of..."	The purpose of the sentence is to draw attention on the fact that methane (CH4) emissions are the key issue. Net emissions of CH4 and other GHG are addressed in section 5.6.3
United States (U.S. Department of State)	5	40	1	-	-	-	-	-	correct wording "and regulator to other..."  Also, in bullets below or elsewhere, it should be noted that the additional ramping up and down that would accompany balancing of intermittent renewables would have some adverse effects. Such load balancing would push operations off BEP, increase inefficiencies at the hydropower plant, and increase long-term wear on machinery, increasing O&M costs at the hydropower plants.	second part of comment will be considered
Gerrit Hansen (TSU)	5	40	37	-	-	-	-	-	footnote is not relevant, rather introduce reference to 5.6.3	Accepted
Gerrit Hansen (TSU)	5	40	41	-	42	-	-	-	giving a 1992 reference for a statement that refers to "the past decades" is confusing. Either insert more recent reference, or change content accordingly "¿between the 50ies and the beginning of the 90ies project planning evolved".	Accepted
Atle Harby (SINTEF Energy Research)	5	40	36	40	39	-	-	-	I suggest to change the order of the phrases "In some cases, reservoirs absorb more GHG than they emit" with the following phrase.	Accepted
Kristie Ebi (Department of Global Ecology)	5	40	-	-	-	-	-	-	p 585, lines 18-24. This section is on environmental and social impacts, but this does not discuss the possible (and experienced) negative impacts.	Agreed, l 22-24, social issues are not only related to benefit sharing. Need to mention relocation, downstream impacts, etc...
United States (U.S. Department of State)	5	40	34	-	-	-	-	-	Pg. 40, L. 34: Replace creates no atmospheric to "creates very low atmospheric"	or "very few"?
Atle Harby (SINTEF Energy Research)	5	40	37	40	37	-	-	-	Please change "methane (CH4)" to "GHG"	The purpose of the sentence is to draw attention on the fact that methane (CH4) emissions are the key issue



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Fritz Vahrenholt (Prof. Dr.) (RWE Innogy GmbH)	5	40	15	-	-	-	-	-	Point considered not to be consistent with heading.	delete
United States (U.S. Department of State)	5	40	21	-	-	-	-	-	Replace "shows" with "may also have", because the environmental footprint may not be significant at all sites.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	40	11	-	-	-	-	-	The sentence 'Pumped storage and reservoir based...' may be omitted as it is a reiteration of preceding text.	Accepted
Richard Taylor (International Hydropower Association)	5	40	3	40	15	5.5.8	-	-	Comment: Misses a point that pumped storage provides for the storage of surplus energy generated by variable renewables such as wind and solar, enabling greater penetration into the grid and facilitating integration and optimisation.	para to be merged with 5.5.5
United States (U.S. Department of State)	5	41	22	-	-	-	-	-	clarify that the term "Ramsar" comes from  The Convention on Wetlands of International Importance, called the Ramsar Convention	Accepted
Gerrit Hansen (TSU)	5	41	2	-	-	-	-	-	consider to cut footnote	This notion of external stakeholder is better clarified through examples, as given in the footnote
United States (U.S. Department of State)	5	41	27	-	-	-	-	-	insert "may" between "dams" and "represent". Not all sites have migratory fish problems. Also, this subsection is especially in need of editing to correct improper wording and grammar in several places.	Accepted
Oluf Ulseth (Statkraft AS)	5	42	40	46	36	-	-	-	In terms of quoted references, there seems to be a mismatch between IEA 2000 and the WCD. Please check with the responsible working group. As main contributing author to section 5.6 it is my understanding that the following quotes (WCD, 2000) are erroneous insertions and should be deleted: p.42 line 43, page 43 line 41.	References to WCD for the 2 mentioned issues are relevant. However (IEA, 2000b) will be added as another reference for the same 2 issues
United States (U.S. Department of State)	5	42	24	-	-	-	-	-	Pg. 42, L. 24: Change to "A hydropower plant often"	Accepted
United States (U.S. Department of State)	5	42	42	-	-	-	-	-	Pg. 42, L. 42: Change to "modified with reservoir storage".	Accepted
Oluf Ulseth (Statkraft AS)	5	42	40	-	-	-	-	-	Regarding TSU comment: Might it be relevant to clarify explicitly that the sections 5.6.1.1 to 5.6.1.11 are based on information gathered through the IEA studies unless a specific other reference is quoted for pages 42 to 49?	Accepted
Atle Harby (SINTEF Energy Research)	5	42	1	42	7	-	-	-	The example from Orkla only includes 3 years of unregulated data from before regulation, and may not be representative. This example should not be used	Accepted
United States (U.S. Department of State)	5	42	42	42	47	-	-	-	The issue with flow regulation is less the presence of a reservoir than it is the use of the active storage capacity in the reservoir. This should be explained.	The current wording seems clear enough with the following remark

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Oluf Ulseth (Statkraft AS)	5	42	38	-	-	-	-	-	The quote of the hydro-specific IEA studies is incomplete. It should read (2000 a,b,c and 2006). This IEA 2006 reference is referring to a missing one in the reference section (see comment no 38 (II))	Not clear. Contact will be established with the reviewer for clarification. Reference "c" does not exist in the reference list
Norway (Climate and Pollution Agency)	5	42	-	-	-	5.6.1.1	-	-	WCD seems to have been given too much emphasis in the hydropower section. It looks like a mixing up between information originally coming from IEA references.	See comments 464/30
United States (U.S. Department of State)	5	43	28	-	-	-	-	-	change end of first sentence to "some species of fish". reservoirs are not good habitat for riverine species.	Accepted
United States (U.S. Department of State)	5	43	15	-	-	-	-	-	Pg. 43, L. 15: change wording to "can prevent loss"	Accepted
United States (U.S. Department of State)	5	43	16	-	-	-	-	-	Pg. 43, L. 16: change wording to "be the release of controlled floods in critical periods and building weirs".	Accepted
United States (U.S. Department of State)	5	43	29	-	-	-	-	-	Pg. 43, L. 29: remove period	Accepted
United States (U.S. Department of State)	5	43	35	43	36	-	-	-	Pg. 43, L. 35-36: reservoirs (as long as this...species), to	Accepted
United States (U.S. Department of State)	5	43	18	-	-	-	-	-	Section 5.6.1.2 would be better titled "Habitat Alteration"	"Habitat alteration through adm creation"
United States (U.S. Department of State)	5	43	10	-	-	-	-	-	The term "minimum flow" is out of date. today, we talk more of "environmental flow regime" that has many elements of a natural or semi-natural annual hydrograph, including intra-annual seasonality and inter-annual variability, and serving multiple needs from fish habitat protection to fluvial geomorphology.  It would be useful to add a paragraph at the end of this section that describes how the impacts of flow alteration can be mitigated by designing environmental flow requirements that are consistent with local aquatic ecosystems. There are good examples where this has been done successfully. For example see Skagid River project that is discussed in the world commission on dams report.	However "minimum flow" will be replaced by "downstream flow regime" which encompasses environmental and socio-economic impacts and benefits. Skagid river project does not seem to be referred in WCD report (see report index). Further investigation on this project will be done when drafting the final draft report
United States (U.S. Department of State)	5	43	1	-	-	-	-	-	the term "out-leveling" is unclear. define or find a more common term.	propose : "smoothing"
United States (U.S. Department of State)	5	43	19	43	27	-	-	-	This paragraph needs editing is misleading. The impacts from reservoir creation include what is described but also may involve changes in the downstream aquatic ecosystem, depending on how reservoir storage is used to alter the natural flow regime. Both the inundation effects of the reservoir and the flow alteration effects of reservoir operation need to be acknowledged.	Accepted
United States (U.S. Department of State)	5	44	18	44	19	-	-	-	Pg. 44, L. 18 and 19: Put "especially in warm climates" at the end of the sentence.	Accepted

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United States (U.S. Department of State)	5	44	20	-	-	-	-	-	Pg. 44, L. 20: Change to "oxygen also will help to".	Accepted
United States (U.S. Department of State)	5	44	36	-	-	-	-	-	Pg. 44, L. 36: Change wording to "tends to affect (i)".	Accepted
United States (U.S. Department of State)	5	44	38	-	-	-	-	-	Pg. 44, L. 38: Change wording to "like the Himalayas, however, the sediment load may significantly".	Accepted
United States (U.S. Department of State)	5	44	44	-	-	-	-	-	Pg. 44, L. 44: change wording to "The former are characterized by the ability to use flow in".	Accepted
United States (U.S. Department of State)	5	44	46	-	-	-	-	-	Pg. 44, L. 46: change wording to "do not have this option, and".	Accepted
United States (U.S. Department of State)	5	44	6	-	-	-	-	-	Pg. 44, L. 6: Change to "reduce high water temperature".	Accepted
Gerrit Hansen (TSU)	5	44	25	-	28	-	-	-	sentence not clear	Sentence seems clear.
Atle Harby (SINTEF Energy Research)	5	44	22	44	23	-	-	-	Still missing after FOD: Please give reference to successful re-oxygenation of reservoirs? Is this possible in large scales (large reservoirs) as well?	Reference to reservoirs will be suppressed
Atle Harby (SINTEF Energy Research)	5	44	18	44	19	-	-	-	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.	add "in particular in the first years..."
Gerrit Hansen (TSU)	5	44	4	-	6	5.6.1.3	-	-	is the Weser region densely populated and the water quality bad considering international standards/situation? 1400 t/yr refers to ?	It is indeed a densely populated area (Bremen and Bremerhaven). Several studies can be found on the internet dealing with water quality issues on Weser river (salinity caused by industry, etc). 1,400t refers to the yearly collection of floating debris.
United States (U.S. Department of State)	5	45	14	-	-	-	-	-	Add "buffer strips to mitigation measures".	Accepted
Gerrit Hansen (TSU)	5	45	29	-	33	-	-	-	list is not clear, effects and causes are mixed	propose " the most serious causes of ecological effects..." and suppress the last bullet point
United States (U.S. Department of State)	5	45	1	-	-	-	-	-	Pg. 45, L. 1: Change to "and the feasibility of".	Accepted
United States (U.S. Department of State)	5	45	11	-	-	-	-	-	Pg. 45, L. 11: change wording to "flush sediment, conveyance systems".	Accepted
United States (U.S. Department of State)	5	45	1	45	2	-	-	-	Pg. 45, L. 2: change wording to "HPP, the type an volume of sediments is usually studied".	Accepted

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United States (U.S. Department of State)	5	45	1	45	33	-	-	-	This whole discussion does not clarify that these impacts are all dependent on the specific project design and operation, and not applicable to all hydro projects (e.g., small ROR projects without reservoirs). Presence of reservoirs may be related more to non-hydro purposes of the project, and the impacts of storage should not be fully assigned to the hydropower part of the project. More differentiation is needed.	Comment is too general. The site specific aspects of hydropower projects is clearly addressed in introduction of this section 5.6 (page 40, line 25 to 28)
United States (U.S. Department of State)	5	46	10	-	-	-	-	-	change "are now pretty well managed" to "are now widely available"	Accepted
United States (U.S. Department of State)	5	46	34	-	-	-	-	-	change "sensitive" to "controversial"	Resettlement is a sensitive issue, and may attract criticism when it is needed. However it is not systematically controversial.
United States (U.S. Department of State)	5	46	33	-	-	-	-	-	Pg 46, line 33: examples might be helpful here.	The number of hydropower projects without resettlement is huge (most of them) including large scale projects. Therefore no reason to quote one example rather than many others.
China (China Meteorological Administration)	5	46	35	46	36	5.6.1.7	-	-	Add ¿Regulations on Large and Medium-sized Hydropower Engineering Land Requisition Compensation and Resettlement (Order No.471 by State Council of China, 2006), which has gradually reduced the consequent problems and considerably improved the conditions of the affected residents¿ (China Society for Hydropower Engineering, Hydropower of China Over 60 Years, Chinese Electric Power Publishing House, 2009, P42).	The proposed reference is a specific Chinese context. document defining the compensations for resettlers. Such policies exist in many countries. The current references are description of the issue, and not compensation policies.
Kristie Ebi (Department of Global Ecology)	5	47	-	-	-	-	-	-	p 591, lines 39-41. There are a number of publications in Africa on increases in malaria mortality following the installation of microdams. Please check whether dams/reservoirs are associated with river blindness, as river blindness is usually associated with moving water. The sentence needs to be reframed to note that achieving water security and promoting health are not mutually exclusive. Both can be achieved with sufficient planning, involving all relevant sectors.	No data / reference on the first remark. OK on the second, propose "fever, and needs to be taken into account when designing and constructing reservoirs for supply security, which is one of the most pressing needs in these regions"
United States (U.S. Department of State)	5	47	43	-	-	-	-	-	Pg. 47, L. 43: change wording to "liberation of mercury".	Accepted
United States (U.S. Department of State)	5	47	44	47	47	-	-	-	Pg. 47, L. 44-47: I do not think that this sentence is relevant to the topic drop discussion of mercury unless it is directly related to hydropower.	Accepted
Kristie Ebi (Department of Global Ecology)	5	48	-	-	-	-	-	-	p 592, lines 3-4. This sentence should include not just health care, but also public health.	Public health is already mentioned in the previous sentence
United States (U.S. Department of State)	5	48	10	48	11	-	-	-	Pg. 48, L. 10-11: Also, increased access.	remark not clear. Is that the right place?

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United States (U.S. Department of State)	5	48	15	-	-	-	-	-	Pg. 48, L. 15: (e.g.STD) should be considered.	Accepted
United States (U.S. Department of State)	5	48	34	-	-	-	-	-	Pg. 48, L. 34: Change to "beauty, to incorporate".	Accepted
United States (U.S. Department of State)	5	48	36	-	-	-	-	-	Pg. 48, L. 36: Remove comma	Accepted
United States (U.S. Department of State)	5	50	32	50	33	-	-	-	Pg. 50, L. 32-33: (IEA, 2000b). In the case of hydropower production, there is...	Accepted
United States (U.S. Department of State)	5	50	36	50	37	-	-	-	Pg. 50, L. 36-37: Change to "equipment (diesel engines). These data <sub>z</sub> "	Accepted
Gerrit Hansen (TSU)	5	50	30	-	31	-	-	-	please specify that is ment by "climate change indicator (IPCC - 100 years), or give reference	Accepted
Gerrit Hansen (TSU)	5	50	38	-	39	-	-	-	sentence is not clear, please rephrase, e.g. "these emissions are not considered relevant/significant compared to life-cylce EMISSIONS of the reservoir?" and give reference for this statement	Reference (IHA, 2010: "UNESCO/IHA, 2008: Assessment of the GHG status of freshwater reservoirs - scoping paper. Working Group on Greenhouse Gas Status of Freshwater Reservoirs. International Hydrological Programme, p. 28. IHA/GHG-WG/3")
Richard Taylor (International Hydropower Association)	5	50	19	50	19	5.6.2	-	-	Delete multi-stakeholder"" and replace with ""cross-sector"".	Accepted
Richard Taylor (International Hydropower Association)	5	50	23	50	26	5.6.2	-	-	Delete whole paragraph. Comment: It makes no sense and adds no value to prior discussion in the section.	Accepted
Richard Taylor (International Hydropower Association)	5	50	20	50	20	5.6.2	-	-	Insert "", WWF, the Nature Conservancy and IHA"" after ""World Bank"".	Accepted
Gian-Kasper Plattner (IPCC WGI TSU, University of Bern)	5	51	34	51	36	-	-	-	"reservoirs with large drawdown zones" -- this is unclear...what is meant by "drawdown zones"? Drawdown of what? Please explain.	This word is well defined and well known by all scientists but may be defined in a footnote for the time being
Gerrit Hansen (TSU)	5	51	27	-	28	-	-	-	"the cause of which <sub>z</sub> " sentence not clear	Accepted
Norway (Climate and Pollution Agency)	5	51	7	-	11	-	-	-	It is not clear if the numbers on emissions include all of the LCA stages. In any case it would be of interest to include the numbers that are solely connected to possible net reservoir emission.	Numbers of emissions include all of the LCA stages. Not possible to split between "net" and "gross" emissions

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United States (U.S. Department of State)	5	51	33	-	-	-	-	-	Pg. 51, L. 33: Remove one period	Accepted
United States (U.S. Department of State)	5	51	34	-	-	-	-	-	Pg. 51, L. 34: Change to "GHG Emissions produces".	sentence ok as it is
United States (U.S. Department of State)	5	51	35	-	-	-	-	-	Pg. 51, L. 35: Change to "an issue in reservoirs".	N <sub>2</sub> O can also occur in otehr places than reservoirs
United States (U.S. Department of State)	5	51	37	-	-	-	-	-	Pg. 51, L. 37: Change to "boreal environments would emit".	Accepted
United States (U.S. Department of State)	5	51	41	-	-	-	-	-	Pg. 51, L. 41: Ebullition should be explained.	Accepted
United States (U.S. Department of State)	5	51	43	-	-	-	-	-	Pg. 51, L. 43: Change to "of the dams ( ".	Accepted
Atle Harby (SINTEF Energy Research)	5	51	24	51	33	-	-	-	This paragraph is missing one important factor when a reservoir is created: Internal processes like primary production and decay within the reservoir may be more important than external factors. This may lead to both uptake and emissions of GHG and is site specific and variable	It is not the subject of this paragraph. Internal processes are covered p 53 line 16 and line 21
Richard Taylor (International Hydropower Association)	5	51	4	51	4	5.6.3	-	-	Add ""Experience indicates that decommissioning is not likely to be encountered within the typical time horizon of most hydropower facilities (100 years)"".	No Reference It is arguable whether 100 years is indeed the "typical time horizon for most hydropower facilities"
Richard Taylor (International Hydropower Association)	5	51	23	51	23	5.6.3	-	-	Delete ""even"".	Accepted
Atle Harby (SINTEF Energy Research)	5	52	20	52	21	-	-	-	I strongly disagree with the word "Significant". Some CH4 emissions are found in boreal/temperate conditions and they are significant but small. I suggest to use: "I some cases small CH4 emissions where observed in these studies...."	Accepted
Richard Taylor (International Hydropower Association)	5	52	16	52	16	5.6.3	-	-	Delete ""(UNESCO-RED, 2008)"" and replace with correct reference ""(UNESCO/IHA, 2008)"". Full reference: UNESCO/IHA, 2008: Assessment of the GHG status of freshwater reservoirs - scoping paper. Working Group on Greenhouse Gas Status of Freshwater Reservoirs. International Hydrological Programme, p. 28. IHA/GHG-WG/3	Accepted

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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Richard Taylor (International Hydropower Association)	5	52	-	-	-	-	5,23	-	Delete ""(Guerin et al., 2008)"" and replace with the correct reference ""(UNESCO/IHA, 2010)"". Full reference: UNESCO/IHA, 2010: GHG Measurement Guidelines for Freshwater Reservoirs, IHA, London, p. 12.	Indeed this figure appears in the quoted 2010 reference, but was published before by Guerin in 2004 (Guerin, F., G Abril, S Richard and R Delmas, Carbon Dioxide and Methane Cycling in the Petit-Saut Hydroelectric Reservoir (French Guiana), 4th International Symposium Environmental Geochemistry in Tropical Countries, Buzios, Brazil, 25-29 October 2004)
Richard Taylor (International Hydropower Association)	5	52	-	-	-	-	-	5,5	Insert ""(UNESCO/IHA, 2008)"". Full reference: UNESCO/IHA, 2008: Assessment of the GHG status of freshwater reservoirs - scoping paper. Working Group on Greenhouse Gas Status of Freshwater Reservoirs. International Hydrological Programme, p. 28. IHA/GHG-WG/3	Accepted
Norway (Climate and Pollution Agency)	5	53	10	-	-	-	-	-	"High" in relations to the "gross emissions" is in this context not necessarily the right wording.	corrected to significant
Atle Harby (SINTEF Energy Research)	5	53	3	53	7	-	-	-	OM may also come from primary production or other biological processes within the reservoir.	Accepted
Richard Taylor (International Hydropower Association)	5	53	28	53	28	5.6.3	-	-	Delete ""(UNESCO-RED, 2008)"" and replace with correct reference ""(UNESCO/IHA, 2008)"". Full reference: UNESCO/IHA, 2008: Assessment of the GHG status of freshwater reservoirs - scoping paper. Working Group on Greenhouse Gas Status of Freshwater Reservoirs. International Hydrological Programme, p. 28. IHA/GHG-WG/3	Accepted
Richard Taylor (International Hydropower Association)	5	53	36	53	36	5.6.3	-	-	Delete ""will present a measurement specification guidance in July 2010"" and replace with ""published 'GHG Measurement Guidelines for Freshwater Reservoirs' in 2010 (UNESCO/IHA, 2010)"". Full reference: UNESCO/IHA, 2010: GHG Measurement Guidelines for Freshwater Reservoirs, IHA, London.	Accepted
Richard Taylor (International Hydropower Association)	5	53	5	53	5	5.6.3	-	-	Insert ""In new reservoirs,"" before ""OM"".	Accepted
United States (U.S. Department of State)	5	54	24	-	-	-	-	-	Add "may have limited ranges of efficient operations" in describing older turbines.	unnecessary
United States (U.S. Department of State)	5	54	28	-	-	-	-	-	Add to end of paragraph a sentence saying that there will be significant opportunities for net environmental benefits with advanced technology when modernization happens.	Accepted

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United States (U.S. Department of State)	5	54	41	-	-	-	-	-	Check the Hall et al. 2003 reference -- there should be two of them, one with resource data and one with construction costs. Both should be cited but correctly. This is also an issue elsewhere. 1) Hall, et al. 2004 ¿ best for estimates of undeveloped resources, the final in a series; use this to replace some of the Hall et al. 2003 references in the second draft. Hall, D.G., S.J. Cherry, K.S. Reeves, R.D. Lee, G.R. Carroll, G.L. Sommers, and K.L. Verdin, 2004. Water Resources of the United States, with emphasis on low head/low power resources. DOE/ID-11111, U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID. Published April 2004. 2) Hall et al. 2003 ¿ best for economic data, but only has data for U.S. development. Hall, D.G., R.T. Hunt, K.S. Reeves, and G.R. Carroll, 2003. Estimation of economic parameters of the U.S. hydropower resources. INEEL/EXT-03-00662, U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID. Published June 2003.	reference to be checked
United States (U.S. Department of State)	5	54	22	-	-	-	-	-	Pg. 54, L. 22: change wording to "turbines, with up to 96% efficiency, are now close to the theoretical limit". Text should also note that turbines do not always operate at their best efficiency point (BEP). Explain to the reader that there is still room for improvement because of this.	text will be improved
Gerrit Hansen (TSU)	5	54	21	27	-	-	-	-	please reconcile with current 5.3.2.1	5.3.2. may be moved to 5.7 and 5.3.5 to 5.10 and 5.3.3 goes to 5.6
Gerrit Hansen (TSU)	5	54	29	-	30	-	-	-	please state if this cost estimate holds for all projects types and sizes, else specify more clearly.	needs to substantiated
United States (U.S. Department of State)	5	54	21	-	-	-	-	-	Section starts out too positive, allowing the reader to infer that technology development is complete. It should make clear from the beginning that significant advances are possible in both energy efficiency and environmental performance, and that such advances are underway, though not all at the stage of commercial readiness.	text will be modified according to comment
Richard Taylor (International Hydropower Association)	5	54	17	54	17	5.6.4	-	-	Insert ""scale"" after ""large"" and before ""hydro"".	Accepted
Gerrit Hansen (TSU)	5	55	3	-	6	-	-	-	does application of CFD refer to all HPP, or particularly to low head installations (as is suggested by context)	this is about turbines
United States (U.S. Department of State)	5	55	17	-	-	-	-	-	Instead of "an important" I suggest "some".	Accepted



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Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	55	11	-	-	-	-	-	It is recommended to skip the paragraph on small hydropower (SHP) potential of Norway. The source of the SHP potential of 7 TWh (<10 MW) is not substantiated. What is more, in 2001 ESHA estimated the additional SHP generation at 5.75 TWh (1190 MW) in 2015 and the remaining SHP potential at approximately 15 TWh (3100 MW): ESHA (2001): BlueAGE - Blue Energy for a Green Europe. ESHA, Belgium, 2001, pp 15 and 28. (Strategic study for the development of Small Hydro Power in the European Union) ( <a href="http://www.esha.be/fileadmin/esha_files/documents/publications/publications/BlueAGE.pdf">http://www.esha.be/fileadmin/esha_files/documents/publications/publications/BlueAGE.pdf</a> )	but comment will be considered
Gerrit Hansen (TSU)	5	55	7	-	10	-	-	-	quality of data used for HP potential estimates is critically discussed here for the first time. It might be of value for the reader if this discussion was extended (sources, examples, quantification) and referenced also in section 5.2.	this and next para could be combined to address needs for specific applications
Gerrit Hansen (TSU)	5	55	11	-	14	-	-	-	the relation between low head hydro potential and small scale hydro is not clear.	no relation between them
China (China Meteorological Administration)	5	55	11	55	12	5.7	-	-	Please incorporate the content regarding small hydropower from this section in a new special section on Small Hydropower after 5.1.3.	no new section on "small scale" hydro
Canada (Environment Canada)	5	55	9	55	10	5.7	-	-	The potential of 5,000 MW of low head hydro is overestimated and confusing as it does not mention if it is about technical or economic potential or the timeframe. The study "Emerging Hydropower Technologies R&D in Canada: A Strategy for 2007-2011" published by the Hydraulic Energy Group of the CanMET Energy Technology Centre - Ottawa, Natural Resources Canada, in 2007, (available at: <a href="http://canmetenergy-canmetenergie.nrcan-mcan.gc.ca/fichier.php/codectec/En/2009_Hydro_01/PDF+++Final-Engl_HERD_Strategy_2007_2011.pdf">http://canmetenergy-canmetenergie.nrcan-mcan.gc.ca/fichier.php/codectec/En/2009_Hydro_01/PDF+++Final-Engl_HERD_Strategy_2007_2011.pdf</a> ) mentions on page 5 that only 15% of the current identified small hydro potential of 15,000 MW would be "strong candidate for development under current socio-economic conditions and with existing state-of-the-art technologies". While this report cited a 2005 Hatch Acres study for 4,000 MW small hydro technical potential in Ontario (page 5), it should be noted that (1) the Ontario Power Authority's Supply Mix Advice (part 3, section 6) mentions only 1,447 MW of small hydro sites that could be developed under current economic conditions and existing public policy guidelines, and (2) this potential was already included in the first estimation of 15% of the 15,000 MW. The CanMET study concludes that small hydro potential in Canada is largely unknown.	information to be incorporated in text - use "small scale hydro"
Canada (Environment Canada)	5	55	37	56	22	5.7.4	-	-	It is understood that hydro projects with head under 2m or even 3m are not viable. Suggest that the reason that they are not viable be stated (i.e., due to significant civil cost and larger electromechanical equipment required for very low head and high flow).	ultra low head may be viable - example given in fig 5.9 where head is 2 m and project viable

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Canada (Environment Canada)	5	55	37	56	22	5.7.4	-	-	This section would be more appropriately titled "Low-head and Very Low-head" - hydrokinetic is misleading. Commonly used terms: Project with 15m or less head is defined as Low-Head, and subset of that is project with head 3m or less is defined as Very Low-Head. Then, anything with not static head or zero head, just using in-stream flow/current would be Hydrokinetic. Suggest renaming Section 5.7.4 as Low head and very low-head, and adding a separate section or subset of section 5.7.4 on Hydrokinetic that is specific to river application (not to be confused with tidal current application as they are quite different). Suggest also adding illustrations for low-head and for hydrokinetic.	hydrkinetic is velocity head based
United States (U.S. Department of State)	5	56	23	-	-	-	-	-	add to this section the emergence of superconducting generators as an example of how new material can be integrated into hydropower technology to improve performance.	Accepted
United States (U.S. Department of State)	5	56	20	-	-	-	-	-	Pg. 56, L. 20: change to "therefore likely that the hydropower".	Accepted
United States (U.S. Department of State)	5	56	34	-	-	-	-	-	Pg. 56, L. 34: Change to "runners and other".	Rejected. Suggestion does not make thing clear.
United States (U.S. Department of State)	5	56	36	56	38	-	-	-	Pg. 56, L. 36-38: The sentence beginning with "Erosive wear..." is out of context. Remove.	but will be considered and suggest reducing paragraph
United States (U.S. Department of State)	5	56	41	-	-	-	-	-	Pg. 56, L. 41: Change to "especially fine silts and clays".	Accepted
Gerrit Hansen (TSU)	5	56	12	-	-	-	-	-	please reference the original study/data this statement is based on	this i sa policy statement but - source for statment should be investigated if possible
David Clubb (European Environment Agency)	5	57	9	57	17	-	-	-	Duplication: There is an earlier comprehensive section about tunneling	Accepted
United States (U.S. Department of State)	5	57	0	-	-	-	-	-	Pg. 57: the information on tunneling technologies can reside here, perhaps expanding the existing text just a bit to include some of the detail currently on pages 21-22.	Accepted
United States (U.S. Department of State)	5	57	37	-	-	-	-	-	This is not properly cited, it should be: DOE Hydropower Annual Report Sale, M.J., T.L. Acker, M.S. Bevelhimer, G.F. Cada, T. Carlson, D.D. Dauble, D.G. Hall, B.T. Smith, and F. Sotiropoulos, 2006. DOE Hydropower Program Annual Report for FY 2005-2006. ORNL/TM-2006/97, Oak Ridge National Laboratory, Oak Ridge, TN. Published July 2006.	check out appropriate ref
China (China Meteorological Administration)	5	57	29	57	30	5.7.7	-	-	Add ¿China has been a major country for the innovation in roller compacted concrete dam construction technology¿, and ¿ranked the top place in roller compacted concrete dam type, quantity and integrated construction technology internationally¿ (China Society for Hydropower Engineering, Hydropower of China Over 60 Years, Chinese Electric Power Publishing House, 2009, P22).	may be put in a box if space allows

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China (China Meteorological Administration)	5	57	34	57	34	5.7.8	-	-	Add ¿ for instance, Qingjiang Cascade Operation and Mangement Center of China may dispatch every cascade station based on the principle of the integrated optimization and effectiveness maximization¿ (China Society for Hydropower Engineering, Hydropower of China Over 60 Years, Chinese Electric Power Publishing House, 2009, P25).	too many details - space rstrictions
United States (U.S. Department of State)	5	58	16	-	-	-	-	-	Insert "levelized" before the "energy cost in US cents per kWh".	check if levelized
United States (U.S. Department of State)	5	58	21	-	-	-	-	-	Instead of Future cost I suggest "Future levelized cost".	check if levelized
Gerrit Hansen (TSU)	5	58	23	-	23	-	-	-	sentence is not clear: does this mean that all following information in "large hydro" only? And what is considered large hydro? Please specifiy more clearly	large scale! Comment to be considered
United States (U.S. Department of State)	5	59	15	60	7	-	-	-	Pg. 59-Pg. 60, L. 15: This discussion seems to be an outline put together before the first draft was written. It is not appropriate here, remove and summarize the relevant points.	Accepted
Robert Pietzcker (PIK)	5	59	1	59	7	-	-	-	please calculate a weighted average cost in \$/W as well as a 25-75%range (again weighted with capacity)	data is only reported
David Clubb (European Environment Agency)	5	59	16	59	20	-	-	-	Update: 2010 version available	will be considered
Richard Taylor (International Hydropower Association)	5	59	-	-	-	-	5,24	-	Delete: Cost curve incorrect.	figure to be checked
Gerrit Hansen (TSU)	5	60	22	-	23	-	-	-	as in table 5.7. full load hours are given, you might include this value here along with to the percent assumption as a courtesy to the reader	comment to be considered - table 5.7 be reflected as text in th eparagraph
United States (U.S. Department of State)	5	60	17	-	-	-	-	-	Define Load Factor	will be replace by capacity factor
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	60	16	-	-	-	-	-	It is recommended to substitute 'intermittent or variable¿' for 'intermittent¿'	variable should replace intermittent in total chapter
Gerrit Hansen (TSU)	5	60	16	-	-	-	-	-	please use the term "variable" instead of "intermittent" as agreed in OOA	Accepted
Gerrit Hansen (TSU)	5	60	26	-	-	-	-	-	sentence should read "Greenpeace/EREC and Krewitt et al."?	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.

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Canada (Environment Canada)	5	60	21	60	21	5.8.1.	-	-	It is stated on this line that Canada's hydro load factor is 42%. Canada's annual average capacity factor for hydro electricity generation in the 10-year period from 1999-2008 was 57%, with a high of 60% (in years with good hydro resources) and a low of 54% (in years with reduced hydro resources). As an example, Hydro-Quebec's mostly large and very large hydro power portfolio averages capacity factors of 65%. Source: Statistics Canada: catalogue 57-202-XB Electric Power Generation, Transmission and Generation ( <a href="http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=57-202-X&amp;lang=eng">http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=57-202-X&amp;lang=eng</a> ), and catalogue 57-206 Electric Power Generating Stations ( <a href="http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=57-206-X&amp;lang=eng">http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=57-206-X&amp;lang=eng</a> ).	IEA is the source
Canada (Environment Canada)	5	60	22	60	22	5.8.1.	-	-	It is suggested that a load factor of 45% be used for future hydro developments. This load factor is too low for large hydro facilities, but it may be appropriate for small hydro and run-of-river plants of less than 50 MW or high-head hydro of over 50 MW. As such, it is recommended that the report distinguish between large and small hydro developments when using average capacity factors.	based on global data
Richard Taylor (International Hydropower Association)	5	60	-	-	-	-	5,25	-	Delete: Cost curve incorrect.	figure to be checked
Gerrit Hansen (TSU)	5	60	4	-	5	-	5.25	-	If high values represent "outliers" e.g. single very expensive projects, you may consider to use dots instead of a line in Fig. 5.25. Cutting a number (over 6000 US\$) which is explicitly referenced in the text should be avoided.	figure to be checked
Gerrit Hansen (TSU)	5	61	21	-	22	-	-	-	How is "assumed economic potential" derived and defined? The number (8000 to 9000 TWh/ year) does not appear anywhere else in the text, and needs to be referenced.	source is from IJHD 2005 - figures in fig 5.30 - where also sources is given - economic potential is now in glossary
United States (U.S. Department of State)	5	61	1	-	-	-	-	-	Instead of "Lifetime" use "economic lifetime".	Accepted
United States (U.S. Department of State)	5	61	10	-	-	-	-	-	Pg. 61, L. 10: change to "but acceptable for small hydro. It is also important to incorporate salvage value at the conclusion of the economic analysis period for an HPP".	second part rejected - may already have been incorporated
United States (U.S. Department of State)	5	61	28	-	-	-	-	-	Pg. 61, L. 28: 5.25. Change to "It will be assumed that projects.."	Accepted
United States (U.S. Department of State)	5	61	30	-	-	-	-	-	Pg. 61, L. 30: Change to "will be developed".	Accepted
United States (U.S. Department of State)	5	61	30	61	33	-	-	-	Pg. 61, L. 30-33: These sentences, "Very expensive...other alternatives." seem to be off the topic, confusing and misleading. We suggest it be re-written or removed.	will be edited

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Gerrit Hansen (TSU)	5	61	30	-	32	-	-	-	please rephrase sentence (colloquial and unprecise), and include a reference to the "barriers" sections of this report.	Accepted
Gerrit Hansen (TSU)	5	61	18	-	19	-	-	-	Text states 6 and 10 % as opposed to 3, 7 and 10 % in the table.	Accepted
United States (U.S. Department of State)	5	61	38	61	39	-	-	-	This units of \$/KwH are probably wrong - do you mean \$/kw? These units should be consistent with those featured in table 5.7.	Accepted
Richard Taylor (International Hydropower Association)	5	61	10	61	10	5.8.1	-	-	Add ""scale"" after ""large"" and before ""hydro"" and after ""small"" and before ""hydro""	Accepted
China (China Meteorological Administration)	5	61	38	61	39	5.8.2	-	-	All the investment cost units are verified as **\$/kW instead of **\$/kWh.	Accepted
United States (U.S. Department of State)	5	62	10	-	-	-	-	-	Pg. 62, L. 10: Remove comma.	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.
Gerrit Hansen (TSU)	5	62	22	-	-	-	-	-	wrong reference (should read EIA 2009)	needs to be checked - may be line 6
Frederic Louis (EDF Hydro Engineering Centre)	5	63	4	-	6	-	-	-	Sentence is not clear. More precise reference to today's preferred sourcing locations should be made : China, Brazil, India, Russia, Argentina in particular.	clarify sentence
United States (U.S. Department of State)	5	64	12	-	-	-	-	-	Change 5 MW to 1 MW and the source of this information should be cited. Also, recent experience in the U.S. has shown that hydro modernization projects for projects in the mid range between 5-10 MW can be cheap and cost-competitive.	paragraph to be deleted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	64	40	-	-	-	-	-	It is recommended to omit the sentence 'The issue of estimating costs and projections <sup>ç</sup> '.	Accepted
United States (U.S. Department of State)	5	64	17	-	-	-	-	-	Pg. 64, L. 17: There is a need to share the cost ...multipurposes, like...	Accepted
United States (U.S. Department of State)	5	64	18	64	19	-	-	-	Pg. 64, L. 18-19: I do not understand the consumptive nature statement. Remove?	Accepted
United States (U.S. Department of State)	5	64	27	-	-	-	-	-	Pg. 64, L. 27: Change to "decision. The recent liberalization".	Accepted
United States (U.S. Department of State)	5	64	30	64	33	-	-	-	Pg. 64, L. 30-33: Place an "i.e." in each parenthesis.	The final draft of the SRREN will be processed by a professional copy-editor. All editorial comments such as this will be resolved at that time.

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United States (U.S. Department of State)	5	64	40	64	41	-	-	-	Pg. 64, L. 40-41: This sentence is off topic. Remove.	Accepted
Gerrit Hansen (TSU)	5	64	40	-	41	-	-	-	sentence is confusing to the reader, should be omitted or content rephrased and references added.	Accepted
United States (U.S. Department of State)	5	64	6	64	7	-	-	-	The second sentence in this paragraph is questionable because the opposite can be true; that is, in India it has been found that one large project can be cheaper than multiple projects in the Cascade.	modify message
Australia (0)	5	64	40	64	41	-	-	-	Unconnected sentence.	delete
Frederic Louis (EDF Hydro Engineering Centre)	5	64	8	-	9	-	-	-	Use of local labor is not only an advantage for small scale projects. For the 1070 MW project in central Laos, more than half of the work force was recruited in the host country. I propose to delete "", which is an advantage for small scale hydroelectric projects".	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	65	10	-	-	-	-	-	'carbon and energy scenarios' should be 'energy and climate mitigation scenarios'	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	65	4	-	-	-	-	-	'With good conditions, the cost of hydro energy can be less than USD 0.02/kWh' should be 'Today, the cost of hydro energy can be between USD 0.023/kWh (low interest rate) and USD 0.048/kWh (high interest rate)'	Some hydro projects may have a cost lower than USD 0.02/kWh (reference IEA, 2010 "Projected Costs of Generating Electricity, 2010 Edition")
United States (U.S. Department of State)	5	65	25	65	30	-	-	-	Pg 65: the numbers and percentages in the text in lines 25-30 don't jive. If the percentages correspond to different total values by the different studies, this would make sense. However, the reader is apt to become confused as he/she reads it the way it's currently phrased. Please clarify this paragraph.	the purpose of the paragraph is precisely to explain that there are different figures from different figures
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	65	16	-	-	-	-	-	The global hydropower capacity of 923 GW includes hydro pumped storage. Please add text for explanation.	Accepted
United States (U.S. Department of State)	5	66	11	-	-	-	-	-	Define RE. Need to use acronyms like RE and RES more consistently throughout the chapter.	RE = Renewable Energy as in the whole SRREN
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	66	3	-	-	-	-	-	However, annual increases of 2.3%, 3.4% and 4.8% do not sum up to 1436 GW, 1659 GW, and 1981 GW	From 2006 to 2030, the average annual increase are correct (CAAGR = compounded average annual growth rate) in %
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	66	1	-	-	-	-	-	It is recommended to omit the sentence 'Hydro can increase annually by roughly 5%'.	this comes from from IEA , see text
United States (U.S. Department of State)	5	66	12	-	-	-	-	-	Pg. 66, L. 12: change to "Figure 25 presents modeling results" and drop the leading clause.	Accepted

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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	66	3	-	-	-	-	-	Table 5.9 uses 919 GW as representing the global installed hydro capacity (including hydro pumped storage)	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	67	16	-	-	-	-	-	'200-440 ppm stabilization $\zeta$ ' should be '300-440 ppm stabilization $\zeta$ '	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	67	11	-	-	-	-	-	'300-400 ppm-CO <sub>2</sub> $\zeta$ ' should be '300-440 ppm-CO <sub>2</sub> $\zeta$ '	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	67	14	-	-	-	-	-	'range from 5-26 EJ...' should be 'range from 12-21 EJ...' (25th to 75th percentile range)	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	67	16	-	-	-	-	-	'ranges from 12-32 EJ $\zeta$ ' should be 'ranges from 17-24 EJ $\zeta$ ' (25th to 75th percentile range)	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	67	9	-	-	-	-	-	'Therefore hydro remains the main RES technology' should be 'Therefore hydro remains the main RES'	Accepted
United States (U.S. Department of State)	5	67	11	67	12	-	-	-	Pg 67: fill in the missing values (e.g., x and y on lines 11,15,17 and ~ on line 12).	Unfortunately, those data have not been provided to chapter 5' authors by modellers - cla's reiterate the request
United States (U.S. Department of State)	5	67	22	67	27	-	-	-	Pg 67: lines 22-27 repeat information previously stated - remove or condense.	This paragraph is very important for RE inter-comparison
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	67	9	-	-	-	-	-	technology in the next few decades'	Accepted
Norway (Climate and Pollution Agency)	5	67	-	-	-	-	5.29	-	Figure 5.29 seems to indicate that for some scenarios hydropower generation could diminish. On what assumptions have these scenarios been based and how has this been documented?	still needs to be clarified with ch 10
Oluf Ulseth (Statkraft AS)	5	67	-	-	-	-	5.29	-	This figure seems to indicate that for some scenarios hydropower generation could diminish. On what assumptions this scenarios have been based and how has this been documented ? Clarification is needed on this subject.	same as comment "387/118"
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	68	18	-	-	-	-	-	'global resource estimates $\zeta$ ' should be 'technically feasible global potential $\zeta$ '	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	68	4	-	-	-	-	-	It is recommended to omit the sentence 'To achieve this contribution requires hydro $\zeta$ '.	Accepted

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Gerrit Hansen (TSU)	5	68	14	-	16	-	-	-	Paragraph needs to be rephrased, as it is non-scientific in style and content, and not in accordance with the OOA (comparison to other technologies). The second sentence does not introduce the following paragraphs in a consistent manner.	to be deleted
Gerrit Hansen (TSU)	5	68	17	70	29	-	-	-	Please cut the numbering (First, Second), and rephrase this section in scientific language, refraining from comparing HP to other RES . This section ought to address the conditions/policies needed to enable high HP deployment, so you may consider to include certain points of concern that have been discussed in length during the chapter, as e.g. the challenges of long lead times and high upfront investments for large hydro or the need for regional cooperation/watershed management.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	68	9	-	-	-	-	-	Please explain what is meant with 'With econometrical changing assumptions'	will be clarified
Gerrit Hansen (TSU)	5	68	22	-	-	-	-	-	Please reconcile statement with chapter 10, section 10.2.3, there is a contradiction in content (compare e.g. 5.2.1 [...] These charts illustrate that undeveloped capacity ranges from about 70 percent in Europe and North America to 95 percent in Africa indicating large opportunities for hydropower development worldwide [...] North America and Europe, that have been developing their hydropower resources for more than a century still have the sufficient potential to double their hydropower capacity; belying the perception that the hydropower resources in these highly developed parts of the world are tapped out.) while chapter 10 states [...] the majority of available potential in OECD countries has been exhausted [...]	consistency will be improved within chapter 5 and between ch 5 and 10
Gerrit Hansen (TSU)	5	68	6	-	10	-	-	-	This para is not clear in content and style: "low cost trend scenarios" are not defined in 5.8, the term "realistic sustainable potential" is not defined, nor is a source given for the dimension (9000 TWh). According to the OOA, sustainable potentials are being derived in chapter 9, not in technology chapters. The last sentence is very general and also needs references.	will be further clarified
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	69	10	-	-	-	-	-	'cost competitive with other thermal units' should be 'cost competitive to thermal power plants'	Accepted
Gerrit Hansen (TSU)	5	69	16	-	23	-	-	-	insert a reference to Fig.5.2 and 5.3 in section 5.2, that is showing capacity factors (=load factor: annual gen/inst.capacity x 8769 h) for different continents.	text could not be found
Gerrit Hansen (TSU)	5	69	4	-	8	-	-	-	sentence is not clear, please rephrase	Accepted
Gerrit Hansen (TSU)	5	69	9	70	2	-	-	-	you may consider to insert a sentence on the challenge to attract the according investment flows as discussed in 5.8. Please refrain from comparing statements regarding other technologies	will be considered and second part accepted



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Canada (Environment Canada)	5	69	1	69	3	5.9.2.	-	5.10	Canada's hydro power generation in 2006 was 349.5 TWh (source: Statistics Canada's 2006 catalogue 57-202 Electric Power Generation, Transmission and Distribution available at: <a href="http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=57-202-X&amp;lang=eng&amp;chprog=1">http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=57-202-X&amp;lang=eng&amp;chprog=1</a> ) and not 352 TWh. The National Energy Board (NEB) in its report "Canada's Energy Future - Reference Case & Scenarios to 2030" estimated Canada's hydro power generation in 2030 at maximum 419.5 TWh rather than 447 TWh as it appears in the report. See report's appendix 5, Tables 5.3/5.4, 5.8/5.9, and 5.13/5.14, available at: <a href="http://www.neb-one.gc.ca/clf-nsi/nrgynfntn/nrgyprtr/nrgyfr/2007/nrgyfr2007ppndc-eng.pdf">http://www.neb-one.gc.ca/clf-nsi/nrgynfntn/nrgyprtr/nrgyfr/2007/nrgyfr2007ppndc-eng.pdf</a> .	we use a unique source for all countries
Gian-Kasper Plattner (IPCC WGI TSU, University of Bern)	5	70	41	70	43	-	-	-	"climate change will probably lead to changes in the hydrological regime in many countries, with increased variability and more frequent hydrological extremes (floods and droughts)." -- what's this statement based on, you need to provide a reference if this is to be kept. I actually don't think the "more frequent hydrological extremes" statement in the case of floods is supported by literature, at least not by AR4. Even if this is based on a more recent studies, I suggest to avoid making general statements.	same as comments "360/6" and "369/61" - replicate the language in AR4
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	70	21	-	-	-	-	-	20 years, remaining hydro as the leader of RES, are feasible', e.g.: 'Overall, the evidence suggests that hydro	sentence to be rephrased
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	70	21	-	-	-	-	-	based on current projections may remain the leading RES technology in the next few decades'	sentence to be rephrased
United States (U.S. Department of State)	5	70	21	-	-	-	-	-	Pg. 70, L. 21: Change to "that high hydropower development" to be consistent.	Accepted
United States (U.S. Department of State)	5	70	22	-	-	-	-	-	Pg. 70, L. 22: Change to "hydropower's share" to be consistent.	Accepted
United States (U.S. Department of State)	5	70	23	-	-	-	-	-	Pg. 70, L. 23: Use full word "hydropower" here and throughout.	Accepted
Gerrit Hansen (TSU)	5	70	16	-	-	-	-	-	please correct reference	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	70	21	-	-	-	-	-	Please rephrase the sentence 'Overall, the evidence suggests that hydro high deployment levels in the next	sentence to be rephrased
United States (U.S. Department of State)	5	70	46	-	-	-	-	-	Sentence is a bit confusing. Maybe it would help to replace word "reintroduce" with "introduce".	Accepted
Gerrit Hansen (TSU)	5	70	19	-	20	-	-	-	this conclusion can not be drawn from section 5.6 text, please include references supporting this statement here or in 5.6, e.g. case studies of successful mitigation, or scientific literature	sentence to be deleted

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United States (U.S. Department of State)	5	70	25	70	27	-	-	-	This issue of hydropower being part of multi-purpose water projects is important and should be at the beginning of the chapter and not at the end.	introduce the next section, however - sentences will be edited and made more to the point, not repeating arguments that now will appear in full in 5.10 (line 26 to 29)
Gian-Kasper Plattner (IPCC WGI TSU, University of Bern)	5	70	41	70	43	5.10.1	-	-	Comment by Simon Allen, Science Officer WGI TSU, University of Bern: The AR4 supports the statement that there will be more more frequent droughts, but DOES NOT support the same statement relating to floods, due to insufficient literature. To my knowledge new studies post-AR4 are still insufficient to support any claim that flood frequency will increase. The authors must provide references to support this statement, and any such general statements that are in conflict with the findings from AR4 should only be included if based on carefully assessed, multiple lines of evidence.	same as comment "360/6"
Simon Allen (IPCC WGI TSU, University of Bern)	5	70	41	70	43	5.10.1	-	-	The AR4 supports the statement that there will be more more frequent droughts, but DOES NOT support the same statement relating to floods, due to insufficient literature. To my knowledge new studies post-AR4 are still insufficient to support any claim that flood frequency will increase. The authors must provide references to support this statement, and any such general statements that are in conflict with the findings from AR4 should only be included if based on carefully assessed, multiple lines of evidence.	AR4 SYR p 49 does mention increase in severity and frequency of floods and droughts
United States (U.S. Department of State)	5	71	38	-	-	-	-	-	Change title of section 5.10.2 to "multi-purpose water projects".	would be too broad in this context
David Clubb (European Environment Agency)	5	71	38	72	27	-	-	-	Duplication: Many of these issues are covered previously	developments on mpp exclusively in 5.10. Other section may refer to 5.10
United States (U.S. Department of State)	5	71	7	71	26	-	-	-	Pg. 71: box 5.1 and the paragraph below (lines 7-26) are very good. Might consider similar boxes included elsewhere to highlight key points.	Accepted
United States (U.S. Department of State)	5	71	21	-	-	-	-	-	The use of mitigation in the 2 senses of environmental litigation and climate change mitigation is going to be confusing unless there is more explanation and a more careful use of the terms. Insert "climate change" in front of the word mitigation on line 21.	Accepted
China (China Meteorological Administration)	5	71	21	71	26	5.10.1	-	-	The multi-purpose hydropower with seasonal and interannual variability will play an increasingly important role in flood control, water storage and water supply when climate change increases the occurrence probability of the extreme meteorological events, therefore, it is suggested to provide details in this part and refer to the reports concerned ([1] IPCC Climate change 2001: Synthesis Report-Contribution of Working Group I, II and III to the Third Assessment Report of the IPCC 2001 [2] Milly PCD. Wetherald R T. Dunne K A Increasing risk of great floods in a changing climate, Nature. 2002 Jan 31; 415(6871): 514-7).	Accepted

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United States (U.S. Department of State)	5	72	19	72	20	-	-	-	Re-Write the last sentence to something like the following "New technology for utilizing low head sites also opens up the opportunity for new hydropower development at many smaller irrigation dams and conveyance systems".	Accepted
Canada (Environment Canada)	5	72	24	72	24	-	-	-	Suggest primary purposes also include navigation and power generation.	provide reference
United States (U.S. Department of State)	5	72	17	72	19	-	-	-	There are more than 2500 dams that do not have hydropower plants therefore this sentence seems to be incorrect. Also the reference is not likely to be about just U.S. resources. Either add a U.S. specific reference or expand and clarify the discussion here.	Delete "the" in front of 2500 dams. The reference (UNWWAP, 2006: Water - A Shared Responsibility Book. United Nations World Water Assessment Program, pp.) provided this value (2,500 dams in USA).
United States (U.S. Department of State)	5	73	38	73	39	-	-	-	Check proper format - these are EIA reports that should be cited as such.	Accepted
United States (U.S. Department of State)	5	73	40	-	-	-	-	-	Check the format of this - these reports have authors that should be cited directly	Accepted
Gerrit Hansen (TSU)	5	73	-	78	-	-	-	-	Reference list needs to be completed and revised. The references for the world energy outlook 2008 and 2009 are wrong or misleading, the WEO 2008 is cited as IEA 2009, and the WEO 2007 and IEA 2008. EIA 2009 is missing completely. Altogether	Accepted
United States (U.S. Department of State)	5	74	38	-	-	-	-	-	This reference is being misused at several places in the document and in different ways. Where this is meant to support resource assessment analyses the proper reference should be Hall et al. 2004 (DOE/ID-11111) and in places where the reference is being used to support cost information the proper reference is a different Hall et al. report (INEEL/EXT-03-00662). Furthermore neither of these reports include international data of any type.	Accepted
Oluf Ulseth (Statkraft AS)	5	75	14	75	15	-	-	-	Add 3 Volumes ; only Volume II, which is the main report, has 172 pages.	Accepted
Netherlands (KNMI (Royal Dutch Meteorological Institute))	5	75	48	-	-	-	-	-	Please change reference in the following way: Lako, P., H. Eder, M. de Noord and H. Reisinger, 2003: Hydropower development with a focus on Asia and western Europe - Overview in the framework of VLEEM 2. ECN & Verbundplan, ECN-C--03-027.	Accepted

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Oluf Ulseth (Statkraft AS)	5	75	15	-	-	-	-	-	Two major IEA research reports seems to have erroneously slipped out of this chapter's bibliography. Please add the following IEA reports to this chapters Reference section: (1) IEA. 2000c: Hydropower and the Environment. Survey on Positive and Negative Environmental and Social Impacts and Effects of Mitigation Measures on Hydropower Development , Annex III - Subtask I, International Energy Agency, pp 82 + appendices; <a href="http://www.ieahydro.org/reports/IEA%20AIII%20ST1%20Vol%20I.pdf">http://www.ieahydro.org/reports/IEA%20AIII%20ST1%20Vol%20I.pdf</a> (2) IEA. 2006: Hydropower Good Practices: Environmental mitigation measures and benefits. Summary report, 15 pages plus CD Rom (including with 60 case studies); International Energy Agency, Annex VIII <a href="http://www.ieahydro.org/annex8.htm">http://www.ieahydro.org/annex8.htm</a>	Accepted
Oluf Ulseth (Statkraft AS)	5	76	11	76	12	-	-	-	This is not a very credible source for a scientific document: The McCully 2001 reference should be deleted.	to be deleted
United States (U.S. Department of State)	5	78	2	-	-	-	-	-	Wellinghoff reference is a Draft Report. It would be better to cite to the final report.	Accepted
Patrick Matschoss (TSU)	5	-	-	-	-	-	-	-	check definitions in glossary: p. 4, l.37-43; liaise with chapter 1 if not consistent	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.1	-	-	Introduction does not adhere to Oslo-Oxford-Accord, more than twice the recommended length acquainting information that might be placed better elsewhere, and omitting information that was agreed to be included in the OOA. Suggestion for a shortened and rephrased version is provided in Addendum by the TSU	5.1 was rewritten acc to the OOA
Gerrit Hansen (TSU)	5	-	-	-	-	5.1	-	-	section on structure of chapter is missing (OOA)	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.1.2	-	-	section contains much detail, some redundant formulation and is too long, could be shortened (compare Addendum provided by TSU)	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.1.3	-	-	section contains much detail that is important but might be better placed in the technology section (5.3). A definition of how "small" and "large" HP is used in the context of the SRREN is needed and should be included in a respective paragraph in section 5.3. Some numerical information on the varying categories might prove useful (e.g. in table format). (compare Addendum provided by TSU)	"small" and "large" as concepts based on size (MW) can not be defined
Gerrit Hansen (TSU)	5	-	-	-	-	5.1.4	-	-	section/heading is not envisioned in OOA, could be integrated together with section 5.1.5 and 5.1.6 into a section on technology status and application (compare Addendum provided by TSU)	cla will consider and decide the final structure
Gerrit Hansen (TSU)	5	-	-	-	-	5.1.5	-	-	content might be perceived as biased, equalling HP with large reservoir HP	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.1.5	-	-	section/heading is not envisaged by OOA, could be integrated together with section 5.1.4 and 5.1.6 into a section on technology status and application (compare Addendum provided by TSU)	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.1.6	-	-	content might be perceived as biased, equalling HP with large reservoir HP	We aim at presenting HP as a continuum and 5.6.1 cannot treat spesificly various point on this continuum

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Gerrit Hansen (TSU)	5	-	-	-	-	5.1.6	-	-	section is not rightly placed in the introduction (OOA), suggested to be cut completely and contents moved/integrated to 5.4 subsection "impact of policies" as agreed in OOA	to be considered
United States (U.S. Department of State)	5	-	-	-	-	5.10	-	-	Pg. 70 section 5.10 is poorly phrased and difficult to follow.	however para will be revisited
Gerrit Hansen (TSU)	5	-	-	-	-	5.10	-	-	section contains a lot of valuable information but gives a "unfinished" impression, and also needs to be reconciled with other parts of the chapter (e.g 5.8.3, 5.6.4, parts of 5.6.1, 5.5.7, 5.3.5, and 5.2.2-5.2.5, 5.1.5. 5.1.6)	will be considered
Kristie Ebi (Department of Global Ecology)	5	-	-	-	-	5.10.1	-	-	Section 5.10.1, lines 1-6. There are quite a few other references not included, such as publications from Arnell.	additional ref will be searched
Kristie Ebi (Department of Global Ecology)	5	-	-	-	-	5.10.1	-	-	Section 5.10.1, lines 21-26. This paragraph doesn't include any information and should be deleted.	para gives relevant info but will be revisited
Gerrit Hansen (TSU)	5	-	-	-	-	5.10.2	-	-	section has considerable redundancy with other parts of the chapter on "multipurpose reservoirs". It is strongly recommended to focus the information in one or two sections, and not repeat statements but insert references to the relevant parts of the chapter.	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.2	-	-	For CC impacts on HP please consider the following study and references provided therein:Bernhard Lehnera,* , Gregor Czischb, Sara Vassoloa, The impact of global change on the hydropower potential of Europe:a model-based analysis, Energy Policy 33 (2005) 839¿855	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.2	-	-	section does not adhere adhere to OOA;	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.2	-	-	There is ample scientific literature on CC impacts on hydropower and water management. The section would profit from including the discussion on managing stationary resources in a changing climate, the vulnerability of the water resource to global environmental change, and consequences for HP planning and managment (including forecasts based on historical data and developments), as e.g. pointed out in Milly et al. 2008. Particularly section 5.2.5.7 needs to be based on more references.	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.2.1	-	-	subsection does not adhere adhere to OOA; e.g. first heading should read "global technical resource potential", technical potential estimate of AR4 is not referred to, DLR/Ecofys study is not mentioned, there is no comparison of the estimates of different studies for technical potential, practical limits to HP development are not discussed. Also, it should be made explicit to which extent estimates include "small"/distributed/RoR HP. Alternatively, a short discussion of the state and challenges of HP potential estimates could be inserted between heading 5.2 and 5.2.1 (compare Addendum provided by TSU). A reference to 5.7 should be inserted.	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.2.2	-	-	heading should read "Possible Impact of climate change on resource potential" according to OOA	will be considered

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Gerrit Hansen (TSU)	5	-	-	-	-	5.2.4	-	-	include available information on river flow changes in mountain regions with high HP potential but high vulnerability, e.g. Peru, Nepal, Pakistan, possibly as case study?	no references found up till now but will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.2.5	-	-	harmonize regional information, either reporting figures (e.g. % HP electricity generation) for all regions, or for none. Paragraph on South America is currently reporting information on status quo, not a projection for future. Paragraph on North America is very detailed compared to other regional sections. Sections on Asia, Africa and South America need to be amended if possible. If information is lacking, this should be indicated/pointed out as a knowledge gap. (5.2.5.1-6)	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.2.5.7	-	-	literature base is weak for this section	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.3	-	-	it might prove useful to include a paragraph on classification of HP projects, giving numerical examples of different categories, and a definition how the terms "small" and "large" HPP are used within chapter 5. this could be in the format of a subsection of 5.3.1 or 5.3.2 or else a section of its own (suggestion by TSU: include as 5.3.2 "classification of HP projects", compare also Addendum provided by TSU). Also, a reference as to how much of world installed potential belongs to which category (e.g. < 1 MW, < 20 MW, < 50 MW) might be appreciated. If this should prove not feasible the reasons should be made transparent.	ch 5 presents HP as a continuum, ref 5.1.3
Gerrit Hansen (TSU)	5	-	-	-	-	5.3	-	-	short introductory text could be placed here, defining the focus of the section, possibly explaining the (non)equivalent use of Hydropower and "large scale reservoir type HP" in parts of the chapter	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.3.1.3	-	-	text is not clear, reference to "RoR scheme shown in fig.5.9" might cause confusion, as 5.9 has caption "instream technology HP projects". Also, formulation "to optimise existing facilities" is not clear.	to be considered
Canada (Environment Canada)	5	-	-	-	-	5.3.1.4	-	-	This section would be more appropriately titled "Low-head and Very Low-head technology at existing water structures" - "Instream" is misleading. Suggest adding a separate section or subset of section 5.3.1.4 on Hydrokinetic that is specific to river application (note: similar suggestion made for section 5.7.4).	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.3.2	-	-	TSU suggests restructuring the sections on tunneling omitting the 5th level, please refer to Addendum by TSU	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.3.2.1	-	-	Mm <sup>3</sup> is not a SI unit, if this unit/order of magnitude is standard in HP engineering, insert an according statement, else please use SI units. Overall, this section might be shortened (textbook style) and amended with some numerical information on recent developments/improvements. Consider to include information on high HP water to wire efficiency that is mentioned several times before and after in the text here. (compare also Addendum provided by TSU)	to be considered

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Gerrit Hansen (TSU)	5	-	-	-	-	5.3.2.2.1	-	-	fig 5.6 shows an example of a HP with aboveground penstocks, and deviation channel - a short reference to the type of project that usually requires blasting tunnels into hard rock, and on existing/developing alternatives could be useful to complete the picture, e.g as an introductory paragraph following 5.3.2.2 (compare Add. provided by TSU)	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.3.2.2.3	-	-	include information on cost dimension, project dimension suitable for this technology	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.3.3	-	-	first paragraph is misleading - should be rephrased to clearly state cause and effect of decreased sediment transport/siltation problems in rivers/reservoirs due to HP infrastructure (as opposed to soil erosion and high sediment load due to human activity). Some section content is not very clear due to unprecise language.	sedimentation to 5.6
Gerrit Hansen (TSU)	5	-	-	-	-	5.3.3	-	-	it is suggested to move 5.3.3 down one level so it is included under "5.3.2 technology status and development" as a subsection (compare Add provided by TSU)	to be considered
United States (U.S. Department of State)	5	-	-	-	-	5.3.3	-	-	Section 5.3.3 could also be shortened if necessary. In particular, the paragraph on pg. 22 lines 40-45 and pg 23, 1-4 could be eliminated with minimal overall impact. Besides, there is a separate section on sedimentation later in the chapter. Opportunity to consolidate?	sedimentation to 5.6
Hiromi Takeuchi (Advanced Industrial Science and Technology)	5	-	-	-	-	5.3.3	-	-	Sedimentation and renovation problem is very important for hydropower. But, these parts are too long taking account of the whole balance. So, these parts should be shortened into maximally one page.	sedimentation to 5.6
Hiromi Takeuchi (Advanced Industrial Science and Technology)	5	-	-	-	-	5.3.4	-	-	ditto	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.3.4	-	-	it is suggested to move 5.3.4 down one level so it is included under "5.3.2 technology status and development" as a subsection (compare Add provided by TSU)	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.3.5	-	-	subsection does not correspond to title of section "technology and application", First para could be moved to 5.6 environmental benefits, and second para to 5.5 "integration issues". Both statements are repeated several times in the text, therefore this subsection could be cut (compare Add. provided by TSU)	to be considered

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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Gerrit Hansen (TSU)	5	-	-	-	-	5.4	-	-	according to the OOA, this section should cover: Global status and trends, regional status and trends, Industry capacity and supply chains, and impacts of policies. TSU suggests to place short introductory text at 5.4, stressing maturity of technology and its large share in current world electricity production (key message 4, 1). Industry and supply chain issues should be briefly addressed, e.g. stating that there are considerable manufacturing capacities in developing countries, and that there is no supply chain bottlenecks to be expected. Thereafter, section could be restructured to adhere to these content requirements, including moving section 5.1.6 text into a subsection on regional cooperation and development (compare Add by TSU)	to be considered
United States (U.S. Department of State)	5	-	-	-	-	5.4	-	-	parts of this section seem redundant with previous sections that describe capacity -- only the generation parts are new. Move/combine with resource discussions?	redundancies will be removed
Gerrit Hansen (TSU)	5	-	-	-	-	5.4.1	-	-	this section does report status and historic development of the largest HP nations. Please consider to include information on trends, and on recent developments with distributed HP. Also update the reported numbers with most recent available data (e.g. IEA WEO 2010, REN21)	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.4.1 - 5.4.2	-	-	please reconsider "added value" of IEA pie charts (Fig. 5.12 - 5.15) for the SRREN	it is judged to add value
Gerrit Hansen (TSU)	5	-	-	-	-	5.4.2	-	-	this section lays much emphasis on the general development of world and regional energy (electricity) consumption, while its primary focus (according to the heading) would be expected to be on regional developments and trends in hydropower generation. Such general topics are not to be discussed in length in the technology chapters, but (if necessary) in chapter 1. If the authors feel that more general information is needed for context, please make a short statement and refer to the according sections of chapter 1 (e.g. Fig. 1.2, table 1.6, section 1.1.5, 1.3.3). It is suggested to cut the entire section, and replace it with regional information on HP development (which is at the moment partly covered in section 5.4.1, also Fig. 5.1 might be well placed here). compare also Addendum provided by TSU.	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.4.3	-	-	last paragraph should be moved to the front to introduce the topic. There is an inherent contradiction in this section, that first states that reservoir HP was virtually excluded from the CDM, and then describes that HP is the largest contributor to the flexible mechanism. Recent scientific literature on the additionality problem of HP projects e.g. in China (e.g. Schröder, M., Utilizing the clean development mechanism for the deployment of renewable energies in China; Applied Energy 86 (2009) 237-242), and on GHG intensity of reservoir hydro should be discussed and referenced. The section does not give a balanced and well-founded impression.	this is probably 5.4.4? text to be modified - check what is said on cdm and the power density rule -



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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
IBRAHIM ABDEL GELIL (Arabian Gulf University)	5	-	-	-	-	5.4.4	-	-	The role of the carbon market in RE deployment is not only limited to hydropower, it is one of the driving forces as well as a tool to overcome financing barrier in developing countries. it should be discussed in a separate section of the report, e.g. in Chapter 11	seeline 579
IBRAHIM ABDEL GELIL (Arabian Gulf University)	5	-	-	-	-	5.4.4	-	-	The role of the carbon market in RE deployment is not only limited to hydropower, it is one of the driving forces as well as a tool to overcome financing barrier in developing countries. it should be discussed in a separate section of the report, e.g. in Chapter 11	some carbeon aspects special for hydro must be discussed
Gerrit Hansen (TSU)	5	-	-	-	-	5.4.5	-	-	so far, the chapter has not explicitly identified barriers to HP development, therefore it is recommended to do this in a section called "barriers to HP development", followed by the next section labelled "impact of policies" (as determined by OOA) which elaborates on how to remove those barriers. (compare Add by TSU). Also, the section is descriptive and gives more information about particular disadvantageous situations than informing about how to remove those. The according section would greatly benefit from reformulating, e.g. using the french case as an example for a more common principle. As many barriers are tied to socio-economic or environmental impacts, section 5.6 should be referenced.	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.5	-	-	the subchapter has several redundancies and is not clearly structured. A restructuring of this subchapter along the following lines is recommended: after the short abstract summing key topics following 5.5, 5.1 Supply characteristics, 5.2 peak load management (including the facilitation of optimal operation of thermal plants), 5.3 mass energy storage 5.4 pumped storage (including load balancing), 5.5 Interaction with other REN, 5.6 offgrid/independent applications 5.6 rural electrification (5.5 and 5.6 could also be merged into one subchapter). no content changes but shifting of subsections according to new structure is required, with the exception of 5.5.7, which is suggested to be incorporated into 5.4.2, as it does not deal with integration into energy systems, but rather with crossborder watershed management and enabling policy frameworks. Also, redundancies need to be eliminated, as in its current form the chapter repeats the same statements several time. compare also Addendum provided by TSU	to be considered

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Gerrit Hansen (TSU)	5	-	-	-	-	5.5	-	-	while the paragraph following 5.5 gives a clear reference to HP role in any energysystem, and in system transformation, the section as it is does not give a clear view on structural requirements of different energy systems, particularly when large shares of variable REN are integrated. The frequent use of the categories "base load" and "peak load" is confusing, as it gives the impression that this is/remains the "standard" case, while the SRREN is trying to assess different development pathways. The extent to which HP is compatible with or facilitating different systems could be discussed and stated more clearly.	comment difficult to understand but will be considered - contact to be taken with GH by AK - topic at the top may belong to integration ch - last sentence is a major message from ch 5
Gerrit Hansen (TSU)	5	-	-	-	-	5.5.1	-	-	could be integrated into a broader subsection on load management, no subsection needed.	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.5.2	-	-	please rephrase section heading	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.5.2	-	-	section could be merged with section 5.5.3, possibly along the following lines: 5.5.x off-grid and mini grid applications, 5.5.x.1 captive power plants, 5.5.x.2 rural electrification. Regardless wheter the separate sections are to be kept, to specific content of 5.5.2 needs to be emphasized, in its current state it is not very clear, and has therefor not been changed in the Addendum provided by the TSU.	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.5.3	-	-	Details of rural electrification are very important but not well placed in the technology chapter. There is abundant information on this in chapter 9 (e.g., Box 9.1). It is therefore proposed to cut all detail, move table 5.3 to chapter 9 (or possibly 1) and concentrate on HP specific information (compare Add by TSU)	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.5.6	-	-	text must be checked for reduncancies with other subsections.	will be considered
United States (U.S. Department of State)	5	-	-	-	-	5.5.6.3	-	-	Pg 38, section 5.5.6.3: this seems repetitious. Potentially delete?	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.5.7	-	-	as subsection 5.5. concern integration of facilities into broader energy systems, not regional integration and management, it might be more rightly placed in subsection 5.4, with contents possibly shared between "impact of policies" and "deployment: regional status" compare also Addendum provided by TSU (here, it is proposed to include this subsection in 5.4.4.4	will be considered
Atle 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 many impacts!	will be considered
Christoph von Stechow (IPCC WGIII TSU)	5	-	-	-	-	5.6	-	-	Please consider adding the environmental references on impacts of hydorenergy that are mentioned in chapter 10: Bates et al. (2008) on page 72, line 7; Rosa et al. (2004) and dos Santos et al. (2006) on page 73, lines 42-3, Fearnside (1999, 2005) on page 76, line 37.	Chapter 10 should refer to Chapter 5 and not the other way

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Gerrit Hansen (TSU)	5	-	-	-	-	5.6	-	-	Section 5.6 contains a lot of valuable information, but also displays potential for shortening and condensing, it has 15 pages length at the moment, and there are considerable redundancies. Also, overlaps with chapter 9 should be examined carefully. Many subsections lack references, and particularly the subsections of 5.6.1 read as if they have been summed up from few grey literature sources, particularly WCD 2000. The section could be improved considerably by defining a clear structure, either going by type of impact (e.g. aggregating the 11 subsections into socioeconomic/biodiversity-habitat/hydrologic/...), or by cause (e.g. large scale inundations through reservoirs, flow alteration of rivers, revenue creation). In some chapters a distinction is made between (large) reservoir hydro and RoR, but in most cases impacts are not properly allocated, and the impression is created that all HPP have the same impacts (in most cases, as the section appears to be based largely on WCD 2000, those are the impacts of large dams in developing country context). Also more clearly defining impacts and separating them from mitigation measures might improve readability. For overview please consider to integrate a table, e.g. concentrating stylized information on potential positive and negative impacts of different types of HP. Introductory text of 5.6 and 5.6.1 partly overlap and might be merged for reasons of readability and length. Please make sure that the content of this section is consistent with chapter 9, also concerning the use of the terms "large/small hydro", and the allocation of impacts to certain categories (e.g sediment rich rivers, large dams, ...)	International Conference for Renewable Energies (Bonn, 2004) and other United Nations organised conferences clearly consider hydropower (whatever the size) as a RE. Chapter 5 of this IPCC/SRREN substantiates the reasons behind not classifying hydropower projects according to size, but rather according to type and use. Natural and social facts, as well as technical and hydrological features are more relevant than the size of the scheme to characterise the possible impacts.
Atle Harby (SINTEF Energy Research)	5	-	-	-	-	5.6	-	-	Still I think the idea of using examples is good, but it is not very credible to show mostly examples with positive effect.	The following 11 sub-section detail all the issues associated with the creation of hydropower scheme, including negative impacts
Gerrit Hansen (TSU)	5	-	-	-	-	5.6.1	-	-	Section repeats information from introductory text, both have very narrative structure and do not clearly "set the scene" nor sum up the following information. To do this in a more concise manner could greatly improve the quality of subsection 5.6. It is again clearly recommended to specify if/when impacts are referring to large dams/large reservoir hydro only (as the references used suggest), or to HP in general. Given the current structure of the chapter it might be an option to have particular subsections on RoR and small hydropower, and concentrate the bulk of information in subchapters on large reservoir projects. Also, a section discussing the allocation of impacts to "small" versus "large" (according/instead of the paragraph in 5.1.3) may be inserted.	International Conference for Renewable Energies (Bonn, 2004) and other United Nations organised conferences clearly consider hydropower (whatever the size) as a RE. Chapter 5 of this IPCC/SRREN substantiates the reasons behind not classifying hydropower projects according to size, but rather according to type and use. Natural and social facts, as well as technical and hydrological features are more relevant than the size of the scheme to characterise the possible impacts.

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United States (U.S. Department of State)	5	-	-	-	-	5.6.1	-	-	The comprehensive approach described here is accurate to a point, but it is most relevant to large projects, and should be tailored for the size/type of impacts, not necessarily applied to all projects.	It is clearly mentioned that each project is site specific. Furthermore International Conference for Renewable Energies (Bonn, 2004) and other United Nations organised conferences clearly consider hydropower (whatever the size) as a RE. Chapter 5 of this IPCC/SRREN substantiates the reasons behind not classifying hydropower projects according to size, but rather according to type and use. Natural and social facts, as well as technical and hydrological features are more relevant than the size of the scheme to characterise the possible impacts.
Atle Harby (SINTEF Energy Research)	5	-	-	-	-	5.6.1.5	-	-	Strongly improved since FOD - very good!	will be considered
United States (U.S. Department of State)	5	-	-	-	-	5.6.1.8	-	-	This section is redundant and repetitive with previous subsection. Consolidate, but consider adding illustrative examples where possible (eg. China?). Similarly, there is too much repetition in sections 5.6.1.10 and 5.6.1.11. A page or two could be saved in this part of the report.	Not redundant because in most international safeguards (WB, ADB, IFC) vulnerable groups and indigenous people require special treatment distinct from general compensation for resettlers. Furthermore topics in section 5.6.1.10 and 5.6.1.11 are also clearly distinct
Gerrit Hansen (TSU)	5	-	-	-	-	5.6.2	-	-	please consider condensing information in this section, focusing on recent developments and current regulation (post-WCD and WCD perception). Again, specify more clearly if regulations refer to large HP developments only. It might be considered to amend this section by information on RoR/small hydro	Accepted for condensing This guidelines and regulation apply to all kind of hydropower plants development, regardless of their size
United States (U.S. Department of State)	5	-	-	-	-	5.6.3	-	-	As with much of the current "scientific" discussion on this topic, this subsection is too generalized to be of use at specific projects. It would be especially useful if it could be accompanied by some data that defines where existing projects and undeveloped resources are located globally (i.e., how much/many in which types of ecoregions). Some consolidation is possible here.	Data not available regarding location per eco-region

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Richard Taylor (International Hydropower Association)	5	-	-	-	-	5.6.3	-	-	<p>Comment: LCA is a problematic concept as applied to hydropower given its long and often indefinite life span as well as for methodological reasons (cf. Chapter 9 - Sustainable Development). Suggest renaming this section ""GHG emissions of hydropower"", since that is what it is primarily about. Move discussion about LCA, highlighting its problems in regard to hydropower, to the introduction of section 5.6 - this is the approach taken in the other RES chapters.</p> <p>Methodological issues include lack of credible data to conduct full LCAs for most other RE technologies, defining sound functional units such that RE technologies can be properly compared to each other and to existing fossil fuel sources, and consensus on analytical system boundaries. For increased policy relevance LCA needs to move beyond characterization of straightforward RE technology footprints (i.e., an attributional LCA approach) towards analyses that assess the impacts of RE technologies in more dynamic and macro-economic contexts (i.e. a consequential LCA approach). A move toward the latter approach would allow the full effects of RE technologies on environmental, social, and economic systems to be assessed simultaneously for more informed policy making (cf. lines 42-2, pp. 51-52, section 9.6.2, Chapter 9 -Sustainable Development). Clearly, the energy payback ratio discussion is also relevant to this discussion.</p>	<p>Proposition : new title "5.6.3 GHG emissions of hydropower"</p> <p>Proposition : remove sentence "Life cycle assessment (LCA) ... (GHG).", and start "Life cycle assessment of electricity generation in terms of greenhouse gas (GHG) emissions was elaborated by the International Energy Agency. In contrast with thermal generating units, in the case of hydro, there is no GHG emissions associated with the fuel production and fuel transportation, but only with the electricity generation itself. GHG emissions associated with a hydroelectric kWh may occur during 3 main stages:"</p> <p>Hydro LCA limits (intro §5.6): In addition to methodological difficulties regarding LCA common to all RES technologies (such as "... or refer to §5.9), a specific difficulty regarding hydropower lies in its indefinite lifespan, and refer to 5.6.3, for GHG emissions during all project stages.</p>
Gerrit Hansen (TSU)	5	-	-	-	-	5.6.4	-	-	<p>it is suggested to include 5.6.4 content into a chapter on socioeconomic effects. The fact that large reservoirs can have multiple purposes, and positive effects for tourism, industry, regional development etc. is mentioned several times (e.g. in 5.6.1.11, 5.6.1, the introductory text of 5.6, 5.10.2 and on several occasions throughout the chapter. it might be useful if this information was bundled and ideally underpinned by quantitative information, Structure could e.g. read sth. like 5.6.1x socio-economic effects, 5.6.x.1 direct effects (revenue generation, job creation) , 5.6.x.2 indirect effects (multiplier effect, multipurpose reservoirs)</p>	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.7	-	-	<p>please reconcile with current 5.3.4, and add a reference (cp.also section 5.3.4). TSU suggests to shorten 5.3.4 (cp. Structural changes in TSU Add) and report on details in 5.7. Content following 5.7 addresses 3 different topics, 1) capacity gains through RMU/efficiency gains, 2) new developments in low and very low head hydro, and 3) case study on small hydro developments (Norway). TSU suggests to insert subsections named, e.g. 5.7.1 equipment upgrading (RM&amp;U), 5.7.2 low head (conventional) hydro, then pull current section 5.7.4 (hydrokinetic turbines) to the front, and continue with current sections 5.7.1 to 5.7.3, 5.7.5-5.7.8.</p>	will be considered

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Atle Harby (SINTEF Energy Research)	5	-	-	-	-	5.7	-	-	The new title including "multi-purpose use of reservoirs" is good and I support this. I also propose to include not only reservoirs, but also regulated rivers in this context, as the multi-purpose use of both reservoirs and rivers (and other water bodies) should be evaluated and analysed as a whole. Other use such as navigation, irrigation, food, tourism and all kinds of ecosystem services applies both to reservoirs and regulated rivers	multipurpose refer to 5.10 - comment to be considered
United States (U.S. Department of State)	5	-	-	-	-	5.7	-	-	This section should be combined with 5.3.2 somehow.	to be considered
United States (U.S. Department of State)	5	-	-	-	-	5.7.3	-	-	Change title to "Advanced Turbines" and add aeration as an additional environmental performance attribute, along with reduced fish mortality. See previous comment for page 24, line 14 for Odeh, Sale and Cada full references.	but shall be considered
United States (U.S. Department of State)	5	-	-	-	-	5.7.4	-	-	It should be made more clear in this section that none of these technologies have been proven to be either technically feasible in long-term operation or economically viable. Is this topic covered in Chapter 6 -if so, consolidate.	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.7.6	-	-	please reconcile with subsection 5.3.2.2 to avoid redundancies, and insert references to both sections	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.7.7	-	-	please consider rephrasing this paragraph stating more clearly what the prospects for technology improvement and innovations are (and what the ICOLD's role is)	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.7.8	-	-	section is very general and lacks references	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.8	-	-	According to the OOA, this section should cover: Factors that affect the cost of energy, historical trends, current conditions and potentials for further reductions in the cost of energy. Whereas there is ample information on the breadth of per kW investment costs of projects, there is little or no information on historic development, (historic) learning curves (e.g. for E&M equipment) and current LCOE. Potentials for further reductions are not explicitly stated. If this information is deemed not relevant in the HP case (e.g. because of maturity of technology, and other factors influencing the development of costs), this could be expressed more clearly in the introductory section of 5.8.	to be considered
Steffen Schlömer (IPCC WGIII)	5	-	-	-	-	5.8	-	-	I recommend to restructure the section, since it is currently repetitive, mixing current cost and future cost developments and lacking a clear separation of the factors affecting the cost of installed capital and those affecting only the LCOE. Therefore I suggest to shift the individual parts of the text, such that they fit in the recommended structure below. This structure is in line with the decisions made in Oxford and slightly adjusted to the cost specifics of hydropower. The detailed proposal for restructuring is included in SRREN_Draft2_TSU-Review_Schloemer_Steffen_Addendum_Hydro_Cost.	to be considered

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United States (U.S. Department of State)	5	-	-	-	-	5.8	-	-	the inverse relation between project costs rates (\$/MW) and project size should be made more clear in this chapter -- the effect of this relation is to make small projects less cost-competitive, and it should be a target of further R&D.	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.8	-	-	This section could be improved by restructuring without changing the actual content. At the moment, 5.8.2 draws conclusions for the future from estimates of cost projections that are portrayed in section 5.8.1, but this is not clearly explained. Also, some general information on cost is in subsection 5.8.2 even though it does (also) apply to the current conditions. Fig. 5.27 refers to current condition but is also placed in the future section. It is not entirely clear, what timeframe Fig. 5.26 refers to, but from the legend it seems like 1990 to 2000 data, but it is nevertheless placed in the "future" section. Please refer to Addendum provided by the Steffen Schläömer/TSU [SRREN_Draft2_TSU-Review_Schloemer_Steffen_Addendum_Hydro_Cost.doc] for a proposal of restructuring the information provided in a manner that is also consistent throughout technology chapters.	to be considered
Steffen Schläömer (IPCC WGIII)	5	-	-	-	-	5.8	-	-	When discussing the impact of the capacity factor on costs, you should mention that - from an investor's perspective - it might be economically rationale to built larger projects with lower capacity factors and, hence, higher LCOE, if there is a market opportunity to sell more power during high-price periods.	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.8.1	-	-	it might be helpful to the reader, if the definitions of the relevant parameter for cost estimates are given before the results of the studies are presented. First paragraph needs rephrasing (too colloquial). It might also be helpful to include more detail on factors that influence costs, and how costs vary between project types.	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.8.1	-	-	the terms "energy costs" vs LCOE are not used consistently	to be considered
Rainer Walz (Fraunhofer Systems and Innovation Research)	5	-	-	-	-	5.8.2	-	-	in the section, long term development of costs are derived; however, the section fails to address the effects of technological change for hydropower. The reader asks if this is negelected, assumed to be zero, or implicitly included in the estimations. Clearly, the assumptions with regard to technological change should be made explicit.	this covered in 5.8.1 line 18-20 p58
Gerrit Hansen (TSU)	5	-	-	-	-	5.8.3	-	-	a reference to other section(s) dealing with multipurpose use of reservoirs might be of value to the reader.	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	5.9	-	-	according to the OOA there should be a section called 5.9.3 "conclusions regarding deployment"	Need OOA final version to proceed in the good way
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.1	-	Figure provides information that is not needed in the introduction, could be cut or moved to section 5.4, should be updated with 2009 or possibly 2010 data	to be considered

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Gerrit Hansen (TSU)	5	-	-	-	-	-	5.10	-	Figure needs to be embedded in chapter text, e.g. there is no definition/reference to "relative discharge", the text instead mentions the "duration curve of the inflow" - this might not be clear to lay readers and is somewhat contradictory with the extensive description of the formula in pf.19, line 25	is addressed in main text
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.11	-	please specify in caption if the excavation costs are for D&B tunneling methods only, or averaging across technologies	is addressed in main text
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.12	-	Figure should be updated with most recent available data (IEA WEO 2010)	will attempt to update
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.16	-	this figure is not providing essential information and should be omitted.	deleted
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.18	-	as hydro projects do not play a prominent role within the JI, it is suggested to cut figure 5.18 and add a phrase containing the most relevant information to the text (compare Add by TSU)	addressed in main text
United States (U.S. Department of State)	5	-	-	-	-	-	5.19	-	Enlarge figure.	will addressed in th elay out phase
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.19	-	this figure is not rightly place in this subsection. Also, the OOA requests to NOT compare performance of technologies to other RE technologies, or to fossil fuel technologies. It is suggested to cut this figure and move the according text to another section, e.g. the introductory part of 5.4, or to 5.1.4 (compare also Add provided by TSU)	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.2	-	"conventional HP" needs to be defined in text	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.22	-	caption is not clear, and it should be specified which dimension of project would undergo such planning	will be considered
United States (U.S. Department of State)	5	-	-	-	-	-	5.24	-	Check the units on the graph. Also check the reference in the caption - this reference definitely does not contain any data from the VLPPM project. Instead of caption "Sum installed capacity in MW" use "Cumulative Installed Capacity in MW"?	fig will be revisited
Peter Johnston (Environmental & Energy Consultants, Ltd)	5	-	-	-	-	-	5.24	-	Cost of hydro per kW increases as capacity increases ???? Re-label horizontal axis?	fig will be revisited
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.24	-	Caption should read "sum installed capacity" or "cumulative capacity", in accordance with Fig. 5.25. The conclusion that can be drawn from this graph should be made explicit in the text	will be addressed
United States (U.S. Department of State)	5	-	-	-	-	-	5.25	-	Instead of caption "Sum installed capacity in MW" use "Cumulative Installed Capacity in MW"? The reference cited is incorrect and better reference should be provided.	fig will be revisited



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Name (Institute)	Chapter	From page	From line	To page	To line	Section	Figure	Table Info	Comments	Consideration by writing team
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.28	-	The fact that the WEO 2009 has lower HP projection than the WEO 2008 could be read as if the IEA has re-adjusted assumptions or parameters - if both studies are cited, it should be mentioned in the text where the difference comes from, and why both result are included, as it would be expected that the more recent one would be more accurate. As the older one has substantially higher HP deployment potential, it might be perceived as biased to present the figure without comment.	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.29	-	According to the OOA, the same figure displaying % of Electricity generation should be included as well	if provided by ch 10
United States (U.S. Department of State)	5	-	-	-	-	-	5.29	-	Similarly, some of the figures and their captions should be more informative. For example, Figure 5.29 would be improved if the three entries for 2020 were grouped, the three for 2030 and the three for 2050. Vertical lines could provide the grouping, eliminating the need for the horizontal axis to have three $\zeta_{2020s}$ , $\zeta_{2030s}$ , $\zeta_{2050s}$ .	but figure will be discussed with ch 10
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.3	-	conventional HP needs to be defined in text	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.30	-	The figure arbitrarily mixes data points from different studies with varying assumptions, it is not clear what its informational value should be. The "low development scenario" takes data from a BAU scenario and mixes them with an ambitious mitigation scenario, whereas the "high development scenario" takes the (outdated) WEO 2008 data and choses a "realistic potential" endpoint that is not derived nor explained anywhere in the SRREN. The term "realistic potential" is not defined. The caption is not correct, as up to 2010 the actual deployment is displayed, and not a scenario. This figure needs serious improvement or should be cut.	comment will adressed in main text
United States (U.S. Department of State)	5	-	-	-	-	-	5.4	-	Figure should be enlarged; it is illogical and of little value the way it is presented.	the figure will be dealt with at the lay out stage
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.6	-	low informative value of photograph, photo does not coincide with the schematic drawing on the left, more precise caption helpful, description in drawing not clearly readable at this scale	is adressed in main text
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.7	-	low informative value of photograph, low quality of photograph (blurry), photo does not coincide with the schematic drawing on the left, more precise caption helpful, description in drawing not readable at this scale	is adressed in main text
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.8	-	very low informative value of photograph, more precise caption helpful	caption to be adressed
Gerrit Hansen (TSU)	5	-	-	-	-	-	5.9	-	very low informative value of photograph, photo does not coincide with the schematic drawing on the left, more precise caption helpful, description in drawing not readable at this scale	is adressed in main text

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Gerrit Hansen (TSU)	5	-	-	-	-	-	-	5.10	This table contains valuable information which need to be better integrated into the text. Namely it should be mentioned why a "reference case scenario" is used to exemplify regional distribution of ambitious HP deployment in the context of CC mitigation. Also, the section should inform about conditions (and policies) needed to enable very high deployment rates in non-OECD countries.	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	-	-	5.2	numbers should be updated with most recent available data (IEA WEO 2010), captions need to be improved	don't have this source
Robert Pietzcker (PIK)	5	-	-	-	-	-	-	5.24	Is that $\Delta$ capacity $\Delta$ or $\Delta$ cumulated/aggregated capacity $\Delta$ ?	will be addressed
Gerrit Hansen (TSU)	5	-	-	-	-	-	-	5.3	table should be updated with most recent available data and included in chapter 9! <a href="http://www.iea.org/weo/database_electricity/electricity_access_database.htm">http://www.iea.org/weo/database_electricity/electricity_access_database.htm</a>	to be considered
United States (U.S. Department of State)	5	-	-	-	-	-	-	5.4	EFOR is Equivalent Forced Outage Rate, not Equivalent Forced Outage Factor	will be considered
Gerrit Hansen (TSU)	5	-	-	-	-	-	-	5.4	is this table referring to a particular country situation (North-America) or giving average values/typical values? The text says "representative statistics", this should be covered also in the caption. "Internationally representative values", however, might need a short definition/explanation, according to varying circumstances (e.g. river flow, water availability) and technical standards.	to be removed
Gerrit Hansen (TSU)	5	-	-	-	-	-	-	5.6	according to the changes proposed by the TSU, it might be worthwhile considering to omit the WEA and Lako et al. Results from that table, as they represent rather a detailed collection of actual data, and the focus is not on cost projections for the future, whereas the other studies are similar in content and style. Alternatively, the two mentioned studies could be differentiated by visual means (double line, colour...). As the other studies (except for the BMU Leadstudy 2008) EREC, IEA ETP, IEA WEO, Krewitt et al. are referenced in other parts of the SRREN (namely chapter 10), the detailed description following the table might not be necessary. The entry for GP/EREC lacks year of publishing. Reference for the BMU study is missing in the reference list. The reference of WEA should be made consistent (later cited as UNDP/UNDESA/WEC (2000; 2004), WEA (2004)). Please give a clear source reference either within or directly attached to the table.	to be considered
Gerrit Hansen (TSU)	5	-	-	-	-	-	-	5.6	Does column 5 (Energy cost in ct/kWh) represent LCOE? Then this should be made explicit in the table head row. It is also somewhat confusing that a table that shows future cost estimates of different studies is displayed in subsection "Cost of project implementation" and not in the subsection "future costs of HP" (see also general remark in 5.8)	to be considered

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United States (U.S. Department of State)	5	-	-	-	-	-	-	5.6	It should be made clear that the "Energy cost in cent/kWh" is the levelized energy cost, which includes the investment costs and O&M costs. Maybe the following paragraph should introduce the concept of levelized cost of electricity generation since Table 5.7 uses it (LCOE column) but without first being introduced and explained.	LCOE needs to be defined at the whole SREN level glossary - some of the references may not be LCOE
United States (U.S. Department of State)	5	-	-	-	-	-	-	5.6	This table is very messy and inconclusive - what is the point here? Need to define terms like full load hours.	table is informative -full load hours shall be edited -
United States (U.S. Department of State)	5	-	-	-	-	-	-	5.7	LCOE is used in the table without previously introduced and explained (LCOE - levelized cost of electricity). Further, LCOE can be variable depending on whether projects are single purpose or multi-purpose. For example, LCOE for a multi-purpose irrigation project in India has been as low as 1-2 cents per kWh because it was added as a by-product to other project purposes.	LCOE needs to be defined at the whole SREN level (glossary)
United States (U.S. Department of State)	5	-	-	-	-	-	-	5.7	The point of this table seems to be about interest rates so a more descriptive caption should be provided. Further, the terms in the table like full load hours should be defined in a footnote.	table will be transformed to textform
Steffen Schlömer (IPCC WGIII)	5	-	-	-	-	-	-	5.7	This table is problematic. The future cost of hydropower are to a considerable extent depending on the additional deployment. If you state LCOEs at 2020 and 2050 based on assumptions about the capital cost of hydropower at that time, this has implicit implications for the maximally possible additional deployment between 2010 and 2020 and between 2020 and 2050, respectively, because of the resource constraint. These assumptions need to be made transparent. They also need to be reasonably in line with your section 5.9 and chapter 10 estimates. Cross-references to this sections/chapters have to be included in the text.	will be addressed
Gerrit Hansen (TSU)	5	-	-	-	-	-	-	5.8	These figures are taken from WEO 2008, while in the reference list the WEO 2007 is stated	editing needed
United States (U.S. Department of State)	5	-	-	-	-	-	-	5.9	This table is not self explanatory - needs a better caption and explanation.	will be considered