

Expert Review Comments on the IPCC WGIII AR5 First Order Draft – Chapter 10

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12628	10					I disagree with CCS having a high degree of risk. This needs to be clarified and referenced.	Accepted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
12671	10					I disagree with CCS having a high degree of risk. This needs to be clarified and referenced.	comment is duplicate of 12628
16140	10					Very interesting table 10.3. Maybe the process CO2 emissions such as those from cement production could be added in one line, as well as the total energy CO2 for comparison purpose. Or maybe combine with figure 10.3 for a single table ?	Rejected - Table 3 is for Non CO2 gases.
2103	10					Throughout chapter, the "EPA 2011" reference as used in the text is a different "EPA 2011" reference as listed in the references section. The EPA 2011 reference in the text appears to indicate the U.S. EPA Draft Report 430-D-11-003, "DRAFT: Global Anthropogenic Non-CO2 Greenhouse Gas Emissions: 1990-2030" August 2011.	Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
2105	10					Opportunities to reduce length of chapter: throughout chapter, less text on the services sector featuring tourism. For example, text on tourism could be reduced by half without sacrificing meaning.	Noted - cf. Response to comment 2279
2106	10					Figure 10.6 does not illuminate the understanding greatly, and could be removed for chapter length reduction.	Accepted
17526	10					Green City	Fragment of comment 17525
17527	10					Environmental and Social Responsibility in an Industrial Cluster	Fragment of comment 17525
17634	10					The framing of this chapter, based significantly on the work of Allwood & Cullen is thoughtful and appropriate. Because materials extraction and processing are responsible for a disproportionate share of GHG emissions, it makes sense to take a materials-based perspective. However, some cross-cutting perspectives that capture aspects of industrial GHG emissions should also be presented. For example, emissions from semi-conductor manufacture. Also, the potential leverage provided by information and communication technology to reduce emissions is relevant.	Taken into consideration when revisiting section 10.4
17489	10					The layout is confusing and nonstandard. The format of the table should make it obvious that there are 2 halves of the table side-by-side. Without such indication, readers will assume (at first) that information in the rows refers to one, single entry.	Accepted - layout has been improved in SOD
17491	10					As with table 10.1, the layout is confusing and nonstandard. The format of the table should make it obvious that there are 2 halves of the table side-by-side. Without such indication, readers will assume (at first) that information in the rows refers to one, single entry.	Accepted - layout has been improved in SOD
17493	10					Either fill in the missing value for SF6 (1990) or indicate that it is unavailable and why.	Accepted. The information is not available for 1990. Discussions underway on source data for non-CO2 gases (cf. Response to 7719). In the meantime cell has been filled with "N/A".
17499	10					To what does (d) in the Total world row refer?	Was part of a footnote in the original source. The Table no longer appears in SOD
17504	10					The explanation for "industrial synergies" should include a mention of geographic proximity as that is a defining feature of this notion. Otherwise there is no difference between "industrial synergies" and recycling. Also removed the caption from the original figure.	Taken into account - figure 10.5 is now deleted as the relevant ideas are covered in the intro to 10.4
17516	10					To what regions and what periods do the data in this table refer?	Accepted - But table 10.5 has been removed from SOD

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17511	10					Figure very difficult to read in black & white.	Noted - the figure has been deleted. The report's figures will be checked by a graphic designer after the SOD stage.
17537	10					What is the column heading for 4th column? Horizontal alignment of entries needs more attention so that contents line up where it is appropriate and do not line up where a relationship is not meant to be inferred. Not all entries in the last column fit the label "Total" Table notes should define acronyms and abbreviations.	Accepted - Section has been revised thoroughly in SOD and will be further improved in Final Draft
17513	10					"Specific" needs to be defined or explained (in data legend)	Accepted - But figure 10.8 has been removed from SOD
17520	10					To what year(s) does this figure refer?	Accepted - But figure 10.9 has been removed from SOD
17485	10					Lines between boxes should indicate directionality, i.e., they should be arrows.	Rejected - this was considered but the chapter team agreed that giving directionality to the lines was not desirable.
17487	10					Caption should include interpretative guidance. It should at least say that thickness of lines indicates magnitude of flow.	Noted - this valuable feedback will be used in completing the work of publishing this diagram. However, the position within the WG3 report will most likely be changed and the diagram included in one of the framing chapters (chapter 5)
17494	10					Sections in small pie on left not readable	Accepted - but figure no longer appears in SOD
17495	10					Define acronyms used in figure in the table caption or a legend. Differences of sections of bars not discernable in black & white.	Accepted - will consider these comments when developing final figures with help of a professional graphic designer
7087	10					It would be better to use a more up-to-date figure published by the World Resources Institute that was updated in 2012. - i.e. Baumert, K., Herzog, T., and Pershing, J. Navigating the Numbers: Greenhouse Gas Data and International Climate Policy (data updated in 2012). Washington DC: World Resources Institute, 2005	Noted - this valuable feedback will be used in completing the work of publishing this diagram. However, the position within the WG3 report will most likely be changed and the diagram included in one of the framing chapters (chapter 5)
7088	10					it is incorrect to attribute the land use change to specific sectors (as this figure does). The causes are seldom easy to identify and often involve multiple drivers. In the words of an FAO report (FAO 2010), "The causes of deforestation are multiple, complex and vary from location to location. Although deforestation at the global scale is "mainly due to conversion of forests to agricultural land..." (FAO, 2006), the underlying causes are less well understood. The most significant underlying factors contributing to deforestation are often identified as high population density and low per capita income (e.g. Uusivuori, 2002; Kauppi, 2006), but this view may obscure the complexity of the problem. (continued below) (references are shown two lines below)	Noted - this valuable feedback will be used in completing the work of publishing this diagram. However, the position within the WG3 report will most likely be changed and the diagram included in one of the framing chapters (chapter 5)

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7089	10					(continued from above) The Scenarios Working Group of the Millennium Ecosystem Assessment (2005) reported that "Ten years of research within the international programme on land use and land cover change of [the International Global-Biosphere Programme] concluded that neither population nor poverty alone constituted the sole and major underlying causes of land cover change worldwide". The working group cited a meta-analysis of 152 case studies, which concluded that "The multiple factors intervening in tropical deforestation ... make it particularly difficult to develop generic and widely applicable policies that best attempt to control the process. Many land-use policies are underlain by simplifications on the drivers of change.... From the results of the meta-analysis it is clear that any universal policy or global attempt to control deforestation (e.g. through poverty alleviation) is doomed to failure." (references below)	Noted - this valuable feedback will be used in completing the work of publishing this diagram. However, the position within the WG3 report will most likely be changed and the diagram included in one of the framing chapters (chapter 5)
7090	10					(continued from two previous rows - references for those rows) -FAO. (2010). Impact of the global forest industry on atmospheric greenhouse gases: FAO Forestry Paper 159. Rome: United Nations Food and Agriculture Organization - FAO. 2006. Global Forest Resources Assessment 2005 – Progress towards sustainable forest management. FAO Forestry Paper 147. Rome. - Uusivuori, J.E. 2002. Population, income and ecological conditions as determinants of forest area variation in the tropics. Global Environmental Change, 12(4): 313–323. - Kauppi, P.J. 2006. Returning forests analyzed with the forest identity. Washington, DC, USA, National Academy of Sciences of the United States of America - Millennium Ecosystem Assessment. 2005. Ecosystems and human well-being, Vol. 2, Scenarios. Washington, DC, USA, Island Press.	Noted - this valuable feedback will be used in completing the work of publishing this diagram. However, the position within the WG3 report will most likely be changed and the diagram included in one of the framing chapters (chapter 5)
7091	10					The figure is incorrect in that it misses the large carbon sink attributable to the growth and expansion of forests - i.e. see Pan, Y., Birdsey, R., Fang, J., Houghton, R., Kauppi, P., Kurz, W., et al. (2011). A Large and Persistent Carbon Sink in the World's Forests. Science Vol. 333 , 988-993. - which documents a large net sink for global forests, which may be partly due to atmospheric fertilization and climate change but according to the Pan et. al. study is clearly largely due to other factors.	Rejected: figure focuses on emission and not mitigation options, discussion about the mitigation potential of forest growth is covered in chapter 11. In any case this feedback has been forwarded to the authors of the framing chapter to which the diagram has now been transferred.
10631	10					Chemicals; GHG Intensity, "polymer synthesis" should be replaced with "steam cracking", because the steam cracking is the most energy consuming process rather than polymer synthesis.	Accepted - But table 10.6 has been removed from SOD
15266	10					Table 10.7 indicates total additional investment from 2010-2050. I think those amount of the investment are very important indicators to assess the feasibility of each of the mitigation measure. However, at the same time, I think that the figure have to be a firm one, not to mislead the readers to inappropriate direction in any case. Therefore, I believe that those figures will also indicate its error and uncertainty like other scenarios.	Taken into account when revising the section
7523	10					In general, balanced description of "Material Efficiency" and "Energy Efficiency" is of key importance.	Taken into consideration when revising the chapter

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7524	10					<p>It is little difficult to swallow "Material Efficiency", because policy measures for "Material Efficiency" could lead unexpected side-effects under the current complex competitiveness among materials.</p> <p>The history in Former Soviet Union and China reveals the difficulty for "Material Efficiency".</p> <p>See also: Daniel Yergin, Joseph Stanislaw (1998). The Commanding Heights: The Battle between Government and the Marketplace.</p>	Taken into consideration when revising the chapter
2294	10					Non-ferrous needs to consider more than just emission factors. The majority of the GHG generated in the Al industry is from the energy required for the process - not considered. Also other gases (PFCs) in Al are not quantified. Both of these areas are major considerations that were not explored.	PFC production is now quantified and indirect emissions are now discussed for aluminium production.
2297	10					under steel - I would either eliminate electrolysis or include note (actual GHG savings depend on carbon footprint of electricity used). Also under alternate fuels - H2? Under Al - note on inert electrodes?	Accepted but more relevant for section on mitigatio options - see revised section 10.4
2282	10					should emphasize the role of in-process recycling, in-process capturing of energy (recuperation) - more life cycle approach	Rejected - space constraints do not allow to go into more details
2299	10					Can't read. Eliminate for condensing information.	Noted - but figure no longer appears in SOD
2300	10					Figure and explanation in text - seem more like opinions than technical discussion - suggest eliminate	Accepted - table no longer appears in SOD
2283	10					I found this diagram confusing and not as applicable as some other types of similar diagrams. Figure 5.2.2 in chapter 5 shows all of the industries and the GHG from each - I would refer to it and eliminate this figure to save space.	Accepted - issue of double counting has been discussed among report authors as it is important for the whole report. The topic has been transferred to chapter 5
10202	10					1. Point 6 missing in graph, 2. waste from owners and users missing in graph	Accepted - figure 10.1 has been modified
10204	10					Lack reduced demand and material/resource use and reuse for textiles	Accepted - there is now a cross-reference to box 10.2
15711	10					I would recommend including some indication of what fraction of global anthropogenic emissions that these industry related emissions account for. It is important to the reader to understand the relative impact of these emissions to the total in terms of impact of emissions reductions.	Accepted - the relative contribution is explained in the Executive Summary, section 10.2 and FAQ 10.1 of the Second Order Draft
16048	10					In cement production there can be reduced the GHG emissions more than 30% using CELITEMENT technology (http://www.celitement.de/en/celitement-binders.html)	Accepted - now mentioned in 10.7.1
3033	10					Please improve the quality of the table. It is impossible to read it. Should we use a Table to depict several graphs?	Accepted
3030	10					I am not very comfortable with the idea of considering the Clean Air Act (or other command and control policies for local pollutants) as a barrier to industrial CHP. Local pollutants regulation is a requirement of societies and should not be removed as a barrier to mitigate GHG emissions.	Accepted -- reference to the CAA removed (note this is a repeat of comment 3029)
4281	10					Please note that Tanaka (2011) holds error from the reporting of policies from Sweden	Taken into consideration when revising the text. The figure used from Tanaka 2011 is now a different one.

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4531	10					The reference list is missing. An incorrect reference list of another chapter has been added	Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
4532	10					The chapter states that it takes a "life-cycle" approach. While this could be interesting, the remainder of the report has a focus on sectors. Taking this approach in a single chapter may result in doublecounting and other issues. Moreover, the approach has not been applied consistently	Taken into consideration - the discussion of double counting in the introduction of chapter 10 has been shifted to chapter 5 and therefore highlighted for the whole report
4533	10					The chapter now contains sections on the services sector (most notably the "tourism industry"). This is ABSURD. This is totally inconsistent with previous reporting by IPCC, statistical data, and any other international reports on climate and energy. By moving these sections to those chapters where it belongs (i.e. buildings and transport) the chapter can be shortened considerably. All sections on these sectors should be deleted. Especially, as the sections that are included in this report are vague and lack any depth.	Accepted and substantial changes incorporated. Decision to include tourism was made by the IPCC plenary at the very beginning of AR 5 process. In light of this and other reviewer comment and comments by review editors a detailed discussion took place. It was agreed to prioritise the balance and logical flow in the chapter which is primarily on the industry sector. The discussion on tourism was repositioned as a demand-side driver for industrial products and product services and now appears in the SOD as Box 10.2. Moreover we have improved and intensified coordination with the transport and buildings chapter. In the SOD tourism is used as one of two illustrative examples to show how service or product demand have an effect on industry related GHG emissions directly or even indirectly. In this context, tourism works as a more weak link between services demand and industry activities, while textiles represent a more direct and much stronger link
4534	10					It is strange to see that energy use to transport tourists is included in this chapter, while shipping of industrial products isn't. Hence, the life-cycle approach is really used inconsistently. Moreover, it is absurd, to see this as part of industry.	cf. Response to comment 4533. Due to space constraints there is no room to discuss other transport related emissions having their origin in the industry sector. Chapter 8 covers the discussion about the main drivers of transport related emissions.

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4535	10					The choice to include services and tourism in this chapter, makes that the data presented in this chapter are incomparable to that report in statistics and industry and in previous IPCC reports. This makes it virtually impossible to draw any conclusions by the reader on the changes in the overall knowledge basis on mitigating industrial GHG emissions.	Noted - cf. Response to comment 2279
4536	10					The "life-cycle" approach is not used in a consistent manner in the various sections of the chapter.	Taken into consideration when revising the chapter
4537	10					Petroleum refining and coke production are currently not included in the report. In previous AR5 it was finally included in the industry chapter, as the energy conversion chapter in reality hardly addresses these sectors (i.e. It focuses only on the power sector). I have not checked the chapter on the energy sector, but the reference list now included in chapter 10 seems to come from the chapter on the energy sector. It does not contain any real references on petroleum refining....	Rejected: the discussion of the provision of primary energy carriers is included in chapter 7
4538	10					Throughout the report important claims are made, that are only based on a single reference. I do not think that the IPCC can do this without reflecting on a wider body of literature.	Take into consideration: a broader set of literature has been considered when revising the text and if available
4544	10					This is an example of where system boundaries become important. Are these figures with or without services, tourism.... I suspect without. This makes the whole chapter impossible to read, when the boundaries of reported data keep changing between different figures and tables.	Rejected - Table is clearly labeled as "manufacturing"
4562	10					The text and these tables are not clear. Just counting the number of policies and policy instruments does not give a good picture of the importance of policy as a driver in industry, especially as regulation has been weakening in the period, but other voluntary programs have been implemented that have far less reach.	Accepted - figure no longer appears in SOD
4541	10					While I love this figure, I do not think it is appropriate for Chapter 10. It should be used in the more general chapters upfront in AR5 to show the interlinkages and distribution over the various sectors.	Accepted - issue of double counting has been discussed among report authors as it is important for the whole report. The topic has been transferred to chapter 5
8856	10					This is a very fragmented chapter. Coherence among sections needs to be enhanced. More data would be needed, while limitation/applicability of data presented needs to be clarified with consistency. It's important to compile/analyze/present data on the costs of conserved energy for efficiency measures in consistent manner, in comparisons with traditional energy sources and emerging renewable energy addressed in other chapters (e.g. chapter 7).	Accepted - consistency has been improved and cost and potentials section (10.7) has been revised
16137	10					The approach of chapter 10 in AR5 is extremely interesting, because it widens the scope of policy with a systemic approach. This part should be kept (or even expanded) even in the case of cuts in the length of the text.	Noted
2281	10					Importance of recycling should be emphasized	Taken into consideration for revision of waste section (10.14)
10282	10					Consistent and no redundant descriptions with Chapters 13-15 will be needed.	Taken into consideration when revising the text
3032	10					Why is EU ETS analyzed in this section instead of in Section 10.10.2, since it includes not only energy efficiency measures and is focused on emission efficiency?	Taken into account - no specific discussion of EU ETS here, but in chapter 15
15270	10					I strongly agree with the idea to improve the material efficiency with maintaining the amount of service, i.e., increasing the added value, to reduce the CO2 emission amount. However, someone like me would wonder if it is a realistic solution for further mitigation to reduce the amount of service per person, especially in developing countries. The economical effect of the service reduction policy need to be discussed here.	Taken into account - the issue has been considered in drafting box 10.2 but macroeconomic effects cannot be covered in this chapter in detail

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3653	10					Delete or massively reduce to save space as overlapping with chapter 6.	Rejected: focus of the section is clearly on sector- specific issues in light of chapter 6 analysis and other sources
17352	10					The discussion regarding global tourism needs to be cross referencing with Chapter 8, the changes in lifestyle aking to substituting leisure for long distance tourism need to be discussed in light of current studies. The trends show there is little room for substitution, one is complementing the other (leisure at home vs tourism). Please coordinate with Chapter 8.	Noted - cf. Response to comment 2279. It is true that in the short term substitution potential are limited. However we are here discussing in a long-term perspective where such considerations are far less relevant. Consider how much tourism has changed in the last 50 years; there are no reasons why it's conditions could just change as much in the next 50 years.
16258	10					Chapter 12 also includes a section on waste management (although much shorter). Coordination may be useful to avoid too much overlap and cover all relevant aspects.	Accepted - coordination underway with Chapter 12 on overlapping issues
8862	10					10.14. waste water section may benefit from technology characterizations (cost and savings potential) of emerging technologies applicable to this sector (Xu et al. 2011): Xu, T., J. Slaa, J. Sathaye. 2011. Developing Information on Energy Savings and Associated Costs and Benefits of Energy Efficient Emerging Technologies Applicable in California. Lawrence Berkeley National Laboratory Report, LBNL-4434E.	Taken into account in Costs and potentials section (10.7) of SOD. Moreover reference used in wastewater subsection.
15713	10					The discussion of tourism seems to fit better in other chapters. As a minimum, the text does not need to be duplicated in several chapters and the sectoral accounting needs to be clarified.	cf. Response to comment 2279
3016	10					As a general comment, I would like to raise the need to consider novel and original options to curb GHG emissions in industry. I feel that this section is fine, in general, but lacks the opportunity to emphasize some interesting approaches that should be included in the portfolio of options, if we want to meet ambitious targets for GHG emission reductions. Among these options, it is crucial to consider the integration of exergy flows within process chains, which can increase overall efficiency of combined industrial processes from 4 to 30%. The same is valid for the integration of processes inside the same operation of industrial facilities; for instance, the report should have explored the possibility that in the medium term, the major developments include the integration of different distillation columns into one reactor (e.g. dividing-wall column) or the development of alternative processing routes allowing for combination of conversion and distillation (e.g. reactive distillation). Please see as an example: SCHULTZ, M. et al. Reduce Costs with Dividing-Wall Columns. Chemical Engineering Progress, n. 196, p. 64-71, May, 2002. As it is, I think the report lacks the opportunity of indicating novel and disruptive approaches to curb GHG emissions in industry. These approaches can be adopted in various industrial chains. I do recognize that some of these novel approaches (e.g. process intensification) were mentioned further in other sections of the document (e.g. Table 10.7 in page 42). Yet, they should have been mentioned in section 10.4.1 too.	Noted - but this is rather a general comment, followed by a reference to a particular technology. For now, we haven't made a specific change in response to this comment - but note to changes in cement section earlier, for an increased reference to novel technologies.

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3017	10					I recommend include advanced process control as an important option to improve production reliability and thus increased product yield, curbing GHG emissions in industry. Modern control systems are often not solely designed for energy efficiency, but rather to improve productivity, product quality and efficiency of a production line. Control systems result in reduced down time, reduced maintenance costs, reduced processing time, and increased resource and energy efficiency, as well as improved emissions control. Large potentials remain to implement control systems. For instance, Worrell and Galitsky (2005) indicate savings potential varying from 2 to 18% for US refineries, using moisture, oxygen, air flow and temperature controls based on fuzzy logic or rule-based systems.	Accepted - control systems mentioned in Executive Summary and in various instances in section 10.4
3018	10					It is worth listing some measures that can be applied by all industrial facilities in order to save fuel. Section 10.4.1. summarizes opportunities for "efficiency .. in the design and operation of systems using motors", but did not summarize opportunities for heat integration, which is even more worthwhile in industrial facilities. These opportunities include: use of waste heat in absorption refrigeration systems; use of waste heat to pre-heat feeds (e.g., through the installation of waste heat boilers or heat recovery steam generators); heat and/or mass (water and hydrogen) integration; improvement of furnaces efficiencies combined with computer controlled combustion; direct feed of "intermediary products" to processes without cooling and storage, aiming at recovering the waste heat of these hot products; use of heat pumps; and decreased film temperature and increased turbulence on heat transfer surfaces.	See responses 12124 and 15885(a)
3021	10					I suggest stressing that fuel switching which favours natural gas has the side effect of also favouring CHP industrial facilities. This was the case in USA and Brazilian chemical plants. Please see SZKLO, A.S., SOARES, J.B., TOLMASQUIM, M.T., 2004, "Economic potential of natural gas-fired cogeneration--analysis of Brazil's chemical industry", Energy Policy, v. 32, pp. 1415-1428. KHRUSHCH, M, WORRELL, E, PRICE, L, MARTIN, N, EINSTEIN, D 1999 'Carbon emissions reduction potential in the US chemicals and pulp and paper industries by applying CHP technologies', In: Industry & innovation in the 21th century. Proceedings of the 1999 Aceee summer study on energy efficiency in industry. American council for an energy-efficient economy, Washington DC, Washington.	Taken into account - text revised: "These shares are forecast to change to 30% and 24% respectively by 2035 (IEA, 2011) resulting in lower emissions per unit of energy. Switching to natural gas also favours more efficient use of energy in industrial CHP installations. "
4547	10					It is amazing that the discussion of biomass is lacking from this section, especially as the pulp & paper industry today is one of the largest users of renewable energy in the form of biomass. Also, the development of biomass as a feedstock is slowly growing; see e.g. Li Shen, Ernst Worrell, Martin Patel. 'Present and future development in plastics from biomass' Biofuels, Bioproducts and Biorefining 1 4: 25 – 40 (2010).	Taken into account - thanks for this useful reference
3022	10					The issue of the green chemistry and the possibility of increasingly producing bio Platform Molecules (bPM – building block chemicals with potential use in the production of numerous value-added chemicals) were not stressed in the report. As I mention in another query (regarding disruptive technologies), the report lacks the opportunity of pointing out drastic changes that must be considered to the industrial sector. Green chemistry is part of the research that is being done in different countries, and there is already pilot and commercial plants producing plastics from biomass. See: Ren, T., 2009. Petrochemicals from Oil, Natural Gas, Coal and Biomass: Energy Use, Economics and Innovation. Ph.D. Thesis. Utrecht University, Copernicus Institute for Sustainable Development and Innovation. Utrecht. Ren, T., Patel, M., Blok, K., 2006. Olefins from conventional and heavy feedstocks: energy use in steam cracking and alternative processes. Energy 31, pp. 425-451. Those references are already listed in other section of the study. They should have been cited here too.	Taken into account - appropriate references to these reports have been added.

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17351	10					This session should made cross-reference with Chapter 4 in production and consumption	Accepted - but we seemed to have lost the cross-reference during the final editing. Let's coordinate on this for the Final Draft. Some cross-links to chapter 4 have been made in other sections.
3025	10					I suggest including a section for discussing briefly the case of ceramics, since in many developing countries this sector is still based on fuelwood from deforestation burnt in low-efficiency kilns. Please see as an example: Schwob, M., Henriques, M. Szklo, A. Technical potential for developing natural gas use in the Brazilian red ceramic industry. Applied Energy 86 (2009) 1524–1531	Noted - thanks - but under space constraints we've been unable to do this.
10281	10					Current energy efficiency in iron & steel sector is important information in order to estimate the emission reduction potentials. Please cite the figure for energy efficiency in iron & steel sector for some countries estimated by Oda et al., Energy Policy, 2012 (http://www.sciencedirect.com/science/article/pii/S0301421512000298).	Accepted - The text has been revised to include the reference on the different specific energy intensities of regional BF-BOF production: "...furnaces before refining. The specific energy intensity of steel production varies by technology and region (Oda et al., 2012)" Reference: Oda, J., Akimoto, K., Tomoda, T., Nagashima, M., Wada, K., Sano, F. International comparisons of energy efficiency in power, steel, and cement industries. Energy Policy 44 (2012) 118-129
6740	10					The section should be reduced and streamlined. What is the status, what has been done and the results followed with what can be done with risk and potential.	Noted - thanks, but risks and potentials are covered in other sections

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2292	10					Steel production 1490 MT in 2011. Breakthrough technologies could save more than 15% quoted (line 47 page 24) if carbon base is reduced or eliminated. The 32% reduction in electric furnace is questionable unless you are only talking about process. EAFs are much closer to running at just above the theoretical. One of the greatest potentials for CO2 savings is in fuel switching. In this case we are talking about reductant switching. The idea of switching to electrolysis will greatly increase the energy use over current technologies and only reduces the overall GHG if there is carbonless energy industry. Aluminum has a much higher GHG footprint than iron and steel because it uses a similar electrolysis process.	<p>Taken into account - Text revised to "1490 Mt in 2011. In 2011, China led steel production, producing 46% of the world's steel. Other significant producers include EU-27 (12%), USA (8%), Japan (7%), India (5%) and Russia (5%) (WSA, 2012) Reference: World Steel Association, 2012 Crude steel production 2011 http://www.worldsteel.org/dms/internetDocumentList/steel-stats/2011/Crude-steel-production-2011/document/2011%20steel%20updated%20Feb2012.pdf</p> <p>For the second comment, the Energetics Inc. source defines the opportunity for energy savings as the difference between today's current use and the practical minimum. In their work, they state that today's energy use is 32% above the practical minimum, which is actually quite close for an industrial process. Therefore the second part of the comment has been rejected as it is not supported by the published literature.</p>
4549	10					I am a bit confused by this section. It cites a non-peer reviewed report for DOE, to state furtherdown that nothing can be said about ULCOS, as no "peer reviewed literature" is available. Birat has published a few papers (eg. In Revue de Metallurgie, albeit these are a few years old now). Note that the quoted Energetics report has been heavily criticized by a number of experts in the field. In the past a number of electrolytic processes have been proposed, but never became commercialized due to the price of power. Just referring to one particular process does not credit the other processes.	Noted - peer-reviewed literature on ULCOS will be considered for inclusion in FD
6749	10					For services in general and it services specifically the energy consumption is going down from technical innovation. Intel.com	Noted - but section on services has been removed in SOD (cf. Response to comment 2279)
3652	10					Alternatively delete chapter 10.4.2.11 to save space.	Accepted - cf. Response to comment 2279
3026	10					I suggest including CHP as an option for trigeneration (or CCHP) in hospitals, malls, hotels and universities. Several studies have assessed this possibility and there are commercial plants installed in developed in emerging countries.	Noted - but section on services has been removed in SOD (cf. Response to comment 2279)
6742	10					Start with a status to remind the reader how important this sector is.	Noted

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4553	10					This section is very superficial. Please also use D. Saygin, M.K. Patel, E. Worrell, C. Tam, D.J. Gielen. "Potential of best practice technology to improve energy efficiency in the global chemical and petrochemical sector Energy" Energy 36: 5779-5790 (2011). This section lacks a discussion on material efficiency, while several papers in the literature discuss plastic recycling, product optimization strategies for e.g. packaging, but also fertilizer use..	Accepted - reference has been included. Section to be further improved.
6743	10					Relate the values to the total emissions from industry	Noted - The request is not clear, no page or lines specified. The values provided in page 29-line 20 are emissions per unit output from the European pulp and paper industry and therefore relating them to total emissions from industry would be of little value given that they are not global figures.
4554	10					The report by Kramer mainly reports on commercially available technologies, not emerging technologies. Moreover, many papers have looked at paper recycling and optimization of (paper) packaging. For example, Laurijssen et al discuss the CO2 benefits of recycling over incinerating waste paper: Jobien Laurijssen, Marc Marsidi, Annita Westenbroek, Ernst Worrell and Andre Faaij. "Paper and Biomass for Energy? The Impact of Paper Recycling on Biomass Availability, Energy and CO2 Emissions" Resources, Conservation & Recycling 12 54: 1208–1218 (2010).	Taken into account - the term "emerging technologies" has been modified for "commercially available technologies". A brief reference to the suggested paper by Laurijssen et al has been added to the discussion.
16261	10					A publication that discusses the different mitigation options of the aluminium industry using a dynamic material stocks and flows model: Liu, Bangs and Müller (2012): Stock dynamics and emission pathways of the global aluminium cycle. Nature Climate Change. In press.	Accepted - the section now includes a focus on the shift from primary to secondary aluminium production and the associated challenges and uses the source suggested
2295	10					I didn't see reference to inert anodes (non C) and how it minimize process GHG for Al. This section is much weaker in depth when compared to the iron and steel section.	Inert anodes are mentioned at the end of the energy efficiency sub-section.
4555	10					The energy consumption figures for aluminium quoted in this section seem to vary with respect to system boundaries (e.g. Including alumina or not), and between primary and final energy use. Please be consistent, and specify what you use.	The system boundaries used in the referenced material is now clear in the text.
4556	10					The section on the food industry is primarily based on US reports. Some literature from Europe is missing; for example papers by Ramirez. Why is there a discussion on anaerobic digestion of food wastes in MSW in this chapter. Shouldn't that be in the chapter on the waste sector?	Accepted - see comment 8860
6748	10					Maybe this reference could add more possibilities in crushing equipment energy reduction. Hulthén, Erik: Real-Time Optimization of Cone Crushers. Göteborg : Chalmers University of Technology. Diss. ISBN/ISSN: 978 1 921522 28 4 http://publications.lib.chalmers.se/records/fulltext/128844.pdf or this work http://www.ceecthefuture.org/abstracts/early-rejection-of-gangue-how-much-energy-will-it-cost-to-save-energy	Noted
4557	10					This discussion is so generic, that it does not add any insights. Improve or delete...	Noted - section has been improved
2296	10					If looking for ways to reduce this chapter - I would suggest condensing this section	Accepted - section has been shortened in SOD

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
15267	10					It would be better to address the importance of assessment like life cycle assessment from "cradle to grave" (Ref: A. Gunasekaran, A. Spalanzan, Int. J. Production Economics 140, 35-47(2012)),here . In order to achieve effective cross sectional implications, the whole supply chain assessment is necessary.	Accepted
8861	10					Cost of conserved energy information on steel, cement, pulp and paper, waste water management sectors can benefit from the publications listed in the comment column Chapter 10 (different sub-sections).	Accepted - some references included. Section has been revised thoroughly in SOD and will be further improved in Final Draft
17979	10					I recommended to the other sector chapters to include similar introductory sentences with the second sentence slightly differently worded: "Co-benefits, co-costs, risks and uncertainties associated with alternative mitigation technologies as well as public perception thereof can affect investment decisions of companies and priority setting of governments." The usage of the term public perception was recommended by Chapter 2 LAs in Wellington to replace the terms "social acceptability" (heading of sub-section 10.8.3) or "public acceptability/acceptance" where possible to reflect some additional aspects discussed in Chapter 2.	Noted
17981	10					Please consider a broader discussion of risks and uncertainties along the classification of risks and uncertainties provided in Section 6.7. Please liaise with the other sector chapter LAs to discuss the process by which a more consistent approach can be reached.	Taken into account
4559	10					There is a wider body of literature on spill overs that is not used in this chapter, e.g. Papers by Michael Grubb or the paper by Vlasios Oikonomou, Martin Patel and Ernst Worrell. Climate Policy: Bucket or Drainer? Energy Policy 18 34 pp.3656-3668 (2006).	To be taken into account
17982	10					The usage of the terms "social acceptability" or "social acceptance" is inconsistent with agreements made in Wellington (p.36) and should be replaced, if appropriate, with the term "public perception" (see earlier comment).	Accepted - terms replaced where relevant
4560	10					This section is extremely generic, and does not address any issues related to industry. I think this could be better discussed elsewhere in the AR5 report.	Reject - section has been revised in SOD
17984	10					An introductory sentence along the example of Chapter 9 referring to the agreement reached in Wellington (p. 36) might be helpful for readers: "Barriers and opportunities are referred to as conditions that hinder or facilitate the implementation of the analyzed measures."	Accepted -- included in initial sentence in this section
4561	10					I do not understand the organisation of section 10.9. Why is it discussed by sub-sector and not by barrier? I think the latter would make much more sense. In the current format a lot of literature is missed and a lot of doubling of text will happen.	Accepted -- this section draws from literature that addresses barriers to mitigation at different steps in the industry supply chain and not general barriers which are covered in general chapters. Reference is given to Chapter 3 where a general discussion of technology barriers is given.
2298	10					Some redundancy with other areas - condense	Accepted -- redundancy reduced (e.g. between chapter 7 and 10 on the topic of CCS)

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
3031	10					This section should be improved. There are several barriers to implement GHG mitigation measures in the service sector. For example, for implementing CHP plants in hospitals in Brazil, Szklo et al (2004) found that Brazilian hospitals face the following barriers: availability of funds for investment; concern over the functioning of new items of equipment in existing facilities; professional skills levels among the administrators; and focus solely on health care services to the detriment of technical and economic feasibility analyses for hospital related engineering problems. [Szklo et al (2004). Energy consumption indicators and CHP technical potential in the Brazilian hospital sector. Energy Conversion and Management, 45 (2004) 2075–2091]	Accepted -- barriers to mitigation of emissions from buildings is covered in Chapter 9.
7559	10					Glass melting technology innovation has to be mentioned: Page 34 of http://www.wbcsd.org/Pages/Adm/Download.aspx?ID=276&ObjectTypeld=7 For example, insert the following sentences. The glass production industry is energy-intensive and consumes more than 70% of the total energy in the glass melting process. The new technology called 'in-flight melting' has the potential of achieving large energy savings in the glass industry, which contributes to meeting the global goal of GHG emission reductions. The traditional process of melting materials (such as silica sand and soda ash) is done with fuel oil to keep the large melting tank at a high temperatures for many hours, which is required to manufacture homogenous glass without bubbles. The new technology involves bringing granulated raw materials, made by spray dry methods, into a much higher temperature environment, produced with an oxygen combustion burner and/or plasma. The process changes the granulated materials to glass instantly. Estimates suggest that the energy required for glass melting with this technology could be up to almost 50% of the average energy required for melting most kinds of glass in Japan (WBCSD 2010).	Noted - thanks very much for offering this, but under pressure of space, we have had to remove this section.
2280	10					Items 20 - 22 are not supported at the same level (references?) as others - sound like opinions - suggest elimination	Taken into account - section on waste (10.14) and on longterm pathways have been significantly revised in the SOD. Hence corresponding messages in the Exec. Summary have improved.
12951	10					Very limited talk of carbon pricing as a necessary policy for driving abatement, while complementary measures have a dedicated paragraph. Carbon pricing should be more present as it is indispensable to creating the economic conditions for many of the key abatement measures discussed here	Rejected: carbon pricing is included in the overarching economic instruments in the ES. Due to space constraints no comprehensive discussion possible in the ES. Moreover, a general discussion about carbon pricing can be found in the policy chapters (most likely chapter 15)
6720	10	0				There do not seem to be a common way to describe emissions. CO ₂ , CO ₂ eq, CO ₂ eg subscripted, CO ₂ Equivalentts, etc	Accepted - mostly CO ₂ eq is used in SOD, unless data refers only to CO ₂ . Will be checked further in the future as part of general rules for the whole report.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6721	10	0				Do not use words as Billion or Trillion though they have different meaning in different countries. http://en.wikipedia.org/wiki/Long_and_short_scales	Accepted - only used in a few instances now. Will be checked further as part of final copy-edit process.
6722	10	0				The authors use often very great numbers to state energy reductions, improvements or other changes. This many times put in relation with something else, however to many times the number is left for the reader to try imagine the amount.	Accepted - context for the numbers has been provided in some instances in SOD. Will be considered further in next stage.
6757	10	0				To conclude my review: I think you should focus of the sector specific analyses, and cross sector Analyses to present specific mitigation tools, their risks and potential. Section 10.4.1 and 10.4.2 could be migrated to avoid having much information on two places. 10.7 to 10.9 can also be migrated. to sector specific chapter expand the policy chapter and make it clear what tools will impact how.	a) given the mandate from the IPCC plenary the general scope of the sector chapters is fixed. b) overlap between 10.4.1 and 10.4.2 has been reduced in SOD. Cobenefits, barriers sections and costs to certain extent try to discuss considering these mitigation options. Also Figures 10.1 and equation 10.1 have been clearly restated. c) context between costs, barriers and corresponding policy instruments will be made clear via improving the refereces between the sections (particularly in policies section)

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
15870	10	0				<ul style="list-style-type: none"> • Need more consistent treatment/structure of each sector by providing similar format and information: e.g., include CO2/ton emission factors for each technology • Omission of fossil fuel extractive industries (oil, gas, coal). Please coordinate with Chap. 7 and 8 since there are many similarities between mining (Chap. 10) and upstream oil/gas/coal and with manufacturing (Chap. 10) and oil refining and gas processing (LNG,NGLs, etc) • More use of tables/graphs to summarize text. E.g., could show CO2 marginal abatement curves (\$/tCO2 vs. tCO2 mitigation potential) • Could use more quantitative data, especially costs, also case studies based on real performance • Might include a discussion on the effectiveness of international standards for industry e.g., ISO 50001 (energy management), 14040 (life cycle analysis) • Check missing references – noted in text body but not in reference section (e.g., UNIDO) • Might include more industry references to strengthen doc: e.g., associations (IPIECA, ASME, etc), journals, UNIDO 	<p>a) Accepted - presentation of numbers in tables and figures has been improved and harmonized where possible b) Noted - there is a clear agreement with chapter 7 in terms of consideration of the extractive industries. Energy chapter will discuss energy carrier extraction in their chapter. References between the chapters have been improved c) Accepted - cost and potentials section has been revised and overview tables has been included d) cost and potential section has been improved and specific examples given. e) Standards are now mentioned in policy section but due to space limitations no in-depth analysis has been made. f) Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved. g) Noted - but due to very strict IPCC rules in terms of using "grey literature" there is only a limited possibility to use references directly from industry (however main documents will be considered)</p>
15884	10	0				<p>Sections to shorten in Chap. 10:</p> <ul style="list-style-type: none"> • Special focus on tourism seemed a little out of place – it is one of smallest service sectors (p.9). Instead, choose a sector with greater global impact as a focus item (e.g., food?) and one which also impacts basic sustainability. Or eliminate the focus item completely • 10.8.2 – CCS discussion is somewhat long and is already covered in Chap. 7. CCS for power and industry is similar • More use of graphs or streamlined tables to eliminate text 	<p>a) cf. Response to comment 2279. b) Accepted - CCS discussion has been substantially shortened and focus is now only on industry specific aspects. c) Accepted - we have used tables where possible, and tried to improve presentation style</p>
15885	10	0				<p>Ch. 10 needs more coverage on other efficiency technology options, both existing and new ones. For example, (p. 21, line 2) – there are more than just motors and furnaces—waste heat recovery, advanced cooling systems, pinch analysis, load tracking, variable speed/frequency drives, nanotechnology, etc). The Cement sector well presented and could be used as a template for the others. Each sector should include energy performance chart, best practices, current state, challenges and costs</p>	<p>a) Taken into account - text at start of section 10.4 revised to indicate three categories: steam systems, process heating systems (furnaces and boilers), motor systems (...), with examples from USDOE reports. b) Taken into account- the team has attempted to give more consistent coverage of each sector</p>

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
15886	10	0				Need to keep the audience in mind. The industry chapter may attract attention from company CEOs, CTOs, and plant managers. Questions they might ask: What is in this for me? How can this report help me?	Accepted - we have improved the reader guidance by a more focused executive summary. ES tries to focus on answers to the key questions the chapter is dealing with which are useful for practical purposes.
15887	10	0				<ul style="list-style-type: none"> • More specific case studies including actual data on CO2 saved, \$ invested would be useful o Only a few cases are included (p. 32- Taiwan/India , p.44 Philippines,...). Many other examples can be found in industry journals o Try to cover data for both OECD and developing world – e.g., in some cases, only EU data are stated o Careful to site actual data based on real performance, not “expected” performance touted before project is actually implemented since many times expectations are too optimistic and actual projects end up over budget and underperforming. 	a) cf. Response to comment 15870. b) accepted - more case-studies can be found in SOD. c) accepted - despite the shortage of data for Non-OECD we have tried to present more information d) very good comment, we have tried to be more careful and explicit about this in SOD
15890	10	0				Should include a discussion on water use in industry and associated energy (water-energy nexus). Also discuss the potential climate change impact on water availability for industry sector which uses a lot of water for power, cooling and processing. Might include the latter in a section on adaptation?	Noted - there are now at least two mentions of the water nexus, one in section 10.5 and one in a footnote in 10.6. While we consider the issue important, as stated in 10.6 the general impact issue (direct and indirect through resources) is dealt with in working group 2. The section is restricted to the potential impacts of climate change and adaptation measures on the emissions, the mitigation measures and associated potential of industry.
15895	10	0				Lack of cost data in general in report. McKinsey is quoted several times (e.g., but I would add other sources for balance since McKinsey numbers are sometimes questionable.	Accepted. Additional information on Costs is has been provided in SOD. Mc Kinsey data has been used among other sources in section 10.7. Lack of access to data is also mentioned in the section.
15902	10	0				Highlight what changed from AR4 at high level. More detailed lookback would be good	Accepted - introduction has been revised

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
16949	10	0				<p>I regret I have not had time to review the Sectoral chapters in depth. It may be interesting to clarify the extent to which industrial energy use is driven by rational "Domain 2" decisionmaking processes (the System 2 of the FOD Chapter 2), at least compared to decisionmaking in buildings and transport. This – within limits – is the broad suggestion laid out in the structure-setting Chapter 3 of Grubb, Hourcade and Neuhoﬀ, Planetary Economics: the Three Domains of Sustainable Energy Development, Taylor & Francis forthcoming (Chapters 1 – 5 submitted, others in draft available on request).</p> <p>This industry chapter might also find the data and analysis on distributional impacts of pricing in this book (Chapter 8) to be of particular interest.</p> <p>Finally, an important source of analysis of industry international flows and policy options are the Carbon Trust reports, Tackling Carbon Leakage: specific approaches in a world of unequal carbon prices (2010); and Global Carbon Flows (2011) □</p>	<p>Noted - factors affecting decision-making in the sector are partly considered in the barriers and sectoral policy section, but will be checked again and if necessary discussed more in detail. We acknowledge the importance of the other points in this comment - literature suggested to be studied further.</p>
8353	10	0				<p>I suggest the summary of AR4 and what's new be added like Chapter. 9.</p>	<p>Accepted - introduction has been revised</p>
11661	10	0				<p>Tourism is focused as one of the most dynamic service sectors, but emissions from tourism overlaps with those from transport sector. The differentiation between emissions in tourism and those in transport (Chapter 8) is not straightforward.</p>	<p>Accepted and substantial changes incorporated. Decision to include tourism was made by the IPCC plenary at the very beginning of AR 5 process. In light of this and other reviewer comment and comments by review editors a detailed discussion took place. It was agreed to prioritise the balance and logical flow in the chapter which is primarily on the industry sector. The discussion on tourism was repositioned as a demand-side driver for industrial products and product services and now appears in the SOD as Box 10.2. Moreover we have improved and intensified coordination with the transport and buildings chapter. In the SOD tourism is used as one of two illustrative examples to show how service or product demand have an effect on industry related GHG emissions directly or even indirectly. In this context, tourism works as a more weak link between services demand and industry activities, while textiles represent a more direct and much stronger link</p>

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2277	10	0				The chapter needs to use common units and basis for comparing the different industries and mitigation opportunities. Tons CO2 total and/or tons CO2 per ton of material suggested (LCA type of approach using GHG from raw materials, energy and process). Otherwise the reader is left with the wrong impression. Fig 10.5 showing emission factors for non-Fe metals make it appear that non-Fe are responsible for less GHG than Ferrous, concrete, etc. This is because the figure ignores the tremendous amount of electrical energy required to produce Al, Mg, etc. GHG production for Al is higher than other materials - this does not indicate it.	a) Accepted - units used are consistent where possible. b) Noted - relevance of indirect emissions (e.g. due to electricity consumption in the production process) highlighted in the chapter and in ES. The table on non-Fe metals has been removed.
2279	10	0			12	Tourism is emphasized too much in the chapter versus other major industry sectors (extractive too little)	Accepted and substantial changes incorporated. Decision to include tourism was made by the IPCC plenary at the very beginning of AR 5 process. In light of this and other reviewer comment and comments by review editors a detailed discussion took place. It was agreed to prioritise the balance and logical flow in the chapter which is primarily on the industry sector. The discussion on tourism was repositioned as a demand-side driver for industrial products and product services and now appears in the SOD as Box 10.2. Moreover we have improved and intensified coordination with the transport and buildings chapter. In the SOD tourism is used as one of two illustrative examples to show how service or product demand have an effect on industry related GHG emissions directly or even indirectly. In this context, tourism works as a more weak link between services demand and industry activities, while textiles represent a more direct and much stronger link

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5215	10	0				Regarding the UNWTO 2008 report has later been published in reviewed papers: Dubois, G., Ceron, J. P., Peeters, P., & Gössling, S. (2011). The future tourism mobility of the world population: emission growth versus climate policy Transportation Research - A, 45, 1031-1042. Gössling, S., Hall, C. M., Peeters, P., & Scott, D. (2010). The Future of Tourism: Can Tourism Growth and Climate Policy be Reconciled? A Climate Change Mitigation Perspective. Tourism Recreation Research, 35, 119-130. Peeters, P., & Landré, M. (2012). The emerging global tourism geography – an environmental sustainability perspective. Sustainability, 4, 42-71. Peeters, P. M., & Dubois, G. (2010). Tourism travel under climate change mitigation constraints. Journal of Transport Geography, 18, 447–457. Scott, D., Peeters, P., & Gössling, S. (2010). Can tourism deliver its 'aspirational' greenhouse gas emission reduction targets? Journal of Sustainable Tourism, 18, 393 - 408.	Noted - cf. Response to 2279. References will be updated if still appropriate in the new approach to the tourism sector.
18535	10	0				The terminology that is used to present and discuss the different categories of mitigation options is often mixed throughout the chapter, which can be confusing. For example, energy efficiency is also referenced as energy intensity, and reducing energy requirements. GHG intensity is also refereed to as reducing emissions and fuel-switching. It would be useful to pick one set of terms and apply them throughout the chapter. Introduce and explain the alternative terminology up-front, but stick with the one.	Accepted - consistency check will be done for the whole chapter (consistent use of important terms)
18552	10	0				The way that CCS is discussed in Chapter 10 (especially in Sections 10.8 and 10.9) is very similar to the coverage in Chapter 7. There doesn't seem to be a clear differentiation in what is covered in which chapter. To save space it may be useful simply to refer to their broader discussions of CCS, and focus all Ch 10 discussions on industry related CCS and how that differs in each relevant sub-section.	Accepted - CCS-related text in chapter 10 has been shortened and revised, with stronger focus on industry-specific aspects and more cross-references to chapter 7.
18562	10	0				Across the chapter, a more consistent treatment of the different industries would be useful.	Accepted - we have tried our best to do this in the SOD
18563	10	0				The Chapter is in a good state for the FOD, and has strongly implemented the kaya identity throughout its structure, though there are some opportunities to make sure that the sections adhere more strictly to this master structure.	Accepted - we have tried our best to do this in the SOD
18564	10	0				The sections from which a reader would pull the meat of the output of the chapter (e.g. 10.7 and 10.11) have not yet been well developed. With the structure of the chapter well in place, it would be useful to focus SOD preparations on those sections.	Accepted - SOD includes fully revised sections
3015	10	0				I suggest use t instead of ton as the abbreviation of tonne in all manuscript. The SI unit symbol for the tonne is "t"	Accepted - mostly t is used in SOD. Will be checked further as part of final copy-edit process.
3168	10	0				This chapter has a note on p.7 about double counting. I think this should be addressed earlier in WG3—maybe in chapter 1. This chapter is about industry but it is surprisingly thin on two things that really matter in industry: a) costs; and b) industrial organization (that is, the structure and ownership of industry and how those factors affect the design of policy and industrial investment decisions).	a) Accepted - issue of double counting has been discussed and the note has been transferred to chapter 5. b) section on cost is significantly revised in SOD c) consequences of specific ownership structure in the industry sector is partly considered in the barriers and sectorial policy section, but will be checked again and if necessary discussed more in detail

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
18770	10	0				Please consider discussing planned obsolescence in context of sustainability - possibly discuss this also in such a general manner that this section can be referenced e.g. from Ch.8 and 9.	Accepted - Issue of product lifetime is now discussed in more in depth in SOD and reflected in framing identity and schematic diagram in 10.1
17482	10	0	0	0	0	Many of the figures in this chapter reproduce very poorly in black & white. I suspect many, if not most, readers will read chapters in the IPCC report as PDF documents, i.e., without benefit of color display or reproduction. If that is true, the figures need to be systematically reviewed to ensure that they can be understood without color.	Accepted. We have tried our best to make the figures readable this time. In Final Draft figures will be further elaborated with the help of a professional graphic designer
17483	10	0	0	0	0	Many, many references are missing from reference throughout this chapter. This makes review difficult as the support for statements that reviewers may want to investigate cannot be assessed.	Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
12340	10	1		2		The heading should be renamed to for instance "Industry and services" to reflect the fact that service and tourism is included in the chapter. We think that reflects in a better way the content of the chapter	In the light of comments from reviewers, services and tourism are dealt with very differently as compared FOD (cf. response to comment 2279), so we feel that renaming is no longer necessary.
2284	10	10	14	10	20	The wording and data for this paragraph need to be cleaned up and checked. Iron ore increased by 264% but steel only 153%? I found 1970 world production of 431 million tons (USGS database) and 1490 million in 2011 (WSA website) which is 246% increase in annual production for steel. Check data and rewrite to flow a better.	Accepted - Wording revised. Numbers revised and according to WSA and USGS are fine.
4543	10	10	21	10	39	The focus on copper and rare earth seems to be misplaced when you are concerned about the trends in industrial GHG emissions. These elements are important, but from a completely different perspective.	Mineral extraction is part of Chapter 10 so is mandatory to include it. Rare elements are mentioned because of its increasing importance in energy. Mining is excluded from Table 1.2 to avoid misunderstanding of its importance in emissions
15707	10	10	24	10	24	The sentence is a little awkward in that South Africa produces about 75% of the world's platinum as the top country, Chile produces about 30% of the world's copper as the top country, but China only produces about 15% of the world's gold as the top producer. Not a critical sentence but the distribution is much more important in this context than the largest producer for gold, silver, and copper.	Accepted - text revised
2285	10	10	28	10	30	Sentence does not make sense - "per capita production of what over what period?" Something missing in sentence structure.	Accepted – text revised
8269	10	10	29			China's per capita production increase (of what?)	Accepted - text revised
15899	10	10	35			add "energy storage" to list of technologies using rare minerals	Accepted - included
8270	10	10	38			"reveal increase reserves" - unclear	Accepted - text revised

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
5746	10	10	4	10	5	This is consistent with the (22+15)% found by the recent FAO report on Energy-Smart Food (http://www.fao.org/docrep/014/i2454e/i2454e00.pdf)	Noted - thanks for the link, this valuable feedback will be used in completing the work of publishing this diagram. However, the position within the WG3 report will most likely be changed and the diagram included in one of the framing chapters (chapter 5)
16138	10	10	40	11	17	Paragraph difficult to read. Maybe a graph would help here.	Accepted - text revised
5250	10	10	40	11	17	There is no reflection here of 'embedded emissions'. So China only exported 5.3% of the rolled steel it produced for what purposes was it used? What proportion of China's production of this and other products were used in manufactured goods for export? What was the scale of embedded emissions in those products imported by major industrialised countries. This is intellectually bogus analysis.	Noted - GHG emissions embodied in trade are discussed in Chapter 14, and a cross-reference to this chapter has been made in the section
15708	10	10	42	11	17	The production changes for steel, concrete, and potentially other goods is impacted by global trade. The text tends to imply that national consumption and production are directly linked and not impacted by global trade. I do not think this was the intention of the authors, so this needs to be clarified. Likewise, the implication to CO2 emissions from global transport of commodities is an important issue.	Noted - Most of China's production is for domestic consumption. Emissions related to trade are discussed in Chapter 14, and a cross-reference to this chapter has been made in the section
12954	10	10	43	10	45	Economic downturn deepened in 2009 not 2010. 2010 was a recovery year from the trough in 2009.	Accepted - text revised
2286	10	11	1	11	17	This section is one of the most important sections in this chapter. However, it does not flow well and needs to develop the theme better - currently it reads like a review of statistics and is not clear.	Accepted - text revised
15903	10	11	18	11	28	Interesting discussion on impact of trade, emissions offshoring/structural changes, leakages, BUT need to note that lowering footprint for one nation could increase that of another due to leakage, emissions offshoring	Noted - GHG emissions embodied in trade are discussed in Chapter 14, and a cross-reference to this chapter has been made in the section

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
16139	10	11	36	12	2	On tourism, the split in several parts (economic situation, emissions, policy) along the chapter make reading difficult. At least one should catch the share of transport or consumption in emissions, from the outset and not wait for the next development.	Accepted and substantial changes incorporated. Decision to include tourism was made by the IPCC plenary at the very beginning of AR 5 process. In light of this and other reviewer comment and comments by review editors a detailed discussion took place. It was agreed to prioritise the balance and logical flow in the chapter which is primarily on the industry sector. The discussion on tourism was repositioned as a demand-side driver for industrial products and product services and now appears in the SOD as Box 10.2. Moreover we have improved and intensified coordination with the transport and buildings chapter. In the SOD tourism is used as one of two illustrative examples to show how service or product demand have an effect on industry related GHG emissions directly or even indirectly. In this context, tourism works as a more weak link between services demand and industry activities, while textiles represent a more direct and much stronger link
15709	10	11	36	12	2	The components of tourism that belong in Chapter 10 and other chapters needs to be clarified. The production of goods that support tourism seem to fit well within Chapter 10 but emissions from the services of tourism see to fit better in other chapters.	cf. Response to comment 2279
7096	10	11	46	11	46	Reference UNWTO and UNEP 2008 should be UNWTO, UNEP and WMO 2008	Noted, thanks - but it has been deleted from SOD
7097	10	11	47	12	2	the WTTC might not be an appropriate source for economic estimates, as it is unclear what tourism as a sector is meant to comprise- often, this includes all sorts of associated industries and services. "world" is apparently meant to be "world".	Noted - see revised text on tourism in box 10.2 of SOD. UNWTO estimates that in 2012 of the contribution of tourism to world GDP is around 5% and its contribution to direct and indirect employment is in the order of 6 to 7%(UNWTO 2012)
17488	10	11	footnote	11	footnote	Why is footnote 1 needed?	Accepted - footnote deleted
12955	10	11	4	11	7	The measures of the share of production of these key commodities coming from developing countries is a key fact and should be in the executive summary in one form or another.	Taken into account - however due to space restrictions this was not included in the ES

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5216	10	12	2	12	2	Be very careful with 'indirect' economic impacts: these are vulnerable to extensive double counting (tourism claims the whole aircraft manufacturing industry and the latter claim tourism as 'indirect' economy), ignore that, in case other sectors were growing at the expense of tourism, there would also be indirect activities, so the indirect impact is only relevant in comparison with alternative economies or spendings. So, please keep these data to direct economic ones only. Eventually add input-output analysis to get a more comprehensive idea of tourism in the economy. analysis like	Taken into consideration: discussion about tourism is more focussed and repositioned (tourism will serve as one of two illustrative example to explain interaction between service/product demand and industry activities). cf. Response to comment 2279
15282	10	12	2	12	2	"word" to be "world"	Editorial - copyedit to be completed prior to publication
11046	10	13		13		Unit is needed	This comment has been addressed to Ch.10 by error and is meant as a comment to Ch.16
15881	10	13	1			Add energy intensity in J/tonne (or J per unit activity) since this is more indicative of energy efficiency than kg/capita	Accepted in part - The section is on activity trends not energy or emissions, for energy indicators see section 10.3 and 10.4
6723	10	13	2	13	2	The references to the Table were not found in the reference list. I could therefore not check the numbers. For example US steel kg/cap has a 90% decrease between 2005 and 2011.	Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
10134	10	14	26			"final energy use" is wrong in this context. It is "final fossil fuel use"	Rejected - This is final energy use as defined in footnote 3 of FOD (footnote 4 of the SOD). This is not just "final fossil fuel use" but also includes renewable energy sources
10135	10	14	27		29	This sentence should be deleted as it delivers no relevant information. As is stated correctly, in the chemical industry most of the carbon contained in the fossil fuel used as raw material is transferred into chemical products. Only few processes exist, in which CO ₂ is produced as a by-product. Because the chemical industry is growing, the CO ₂ emissions from these processes are also growing. Alternatively it could be helpful to add the following sentence: "Fossil fuels used as raw materials in the chemical industry cause emissions at the end of their life-span in the disposal phase. These emissions are accounted for in the waste disposal industry's emissions."	Accepted - sentence included in SOD
15900	10	14	37			footnote 3: how are electricity and heat flows allocated?	Question unclear - footnote 3 of the FOD (now footnote 4 in SOD) has a long description and also gives a reference
17490	10	14	7	14	8	Indicate the period of time that is encompassed by this statement.	Accepted - reference deleted as non peer-reviewed source.

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18518	10	14	2			This section includes nothing on the emissions of extractive industries, but covers only the energy consumption. Are there extractive industries that have more emissions than others? How do they compare?	Noted - see note under Table 10.3 in SOD: "Energy use for mining and quarrying is not included in the final and primary energy values; energy-related CO2 emissions from mining and quarrying, which are estimated to be less than 3% of total industry emissions, are included due to data limitations" (IEA detailed CO2 data for 2010 are not available at the time of this writing). Mining CO2 emissions for 2010 will be included in the final version of the report.
11131	10	14	31	14	37	Line 32 implies that the levels of HFC-23 per tonne of HCFC-22 manufacture have doubled. This is not the case. It is the total quantity emitted that has doubled.	Accepted - text revised
4792	10	14	37	14	38	(Footnote 3), please change the sentence to "In order to calculate primary energy for non-fossil fuel (nuclear, hydro and other renewables)," as hydropower is a renewable energy source	Accepted - text revised
15710	10	15	1	15	2	The sentence addressing the sources of N2O needs to be clarified. Presumably, the sentence reference to the source of industrial emissions of N2O. Nitric acid and adipic acid manufacturing only make up about 6-7 percent of all anthropogenic N2O emissions.	Accepted - text revised
17492	10	15	6	15	6	What does "industry and non-energy industry" mean?	Accepted - revised to "energy and non-energy industry"
12956	10	15				Agree with proposition of making the table a stronger visual impact as the information is very important to communicate clearly but is very detailed as is.	Noted - will be considered in final draft when the help of a professional graphic designer becomes available

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
11132	10	16		16		<p>Table 10.3: Emissions of non-CO2 GHGs (EPA 2011) Emissions (MtCO2e) Source 1990 2005 2010 HFC-23 from HCFC-22 production 91 177 309 Data from UNFCCC (CRF emissions from Annex A) 88 37 20 Data for Global emissions from Miller & Kuijpers (2011) and Miller et al. (2010) 96 142 117 ODS Substitutes 0 73 93 Data from UNFCCC (CRF emissions from Annex A) 3 184 237</p> <p>The above shows the first two rows of Table 10.3 (in bold), taken from the reference EPA (2011). In fact, this reference does not exist in the draft and I presume that it is actually:</p> <p>Alsalam J., and S. Ragnauth. (2011). Draft Global Anthropogenic NonCO2 Greenhouse Gas Emissions: 23 1990-2030. US EPA, Washington. Available at: http://www.epa.gov/climatechange/economics.</p> <p>I've compared the EPA numbers with the literature sources:</p> <p>UNFCCC data, unfortunately only for Annex A because the main emitters (India and China) do not report, and Ben Miller's papers on HFC-23 emissions:</p> <p>Miller, B. R., Rigby, M., Kuijpers, L. J. M., Krummel, P. B., Steele, L. P., Leist, M., Fraser, P. J., McCulloch, A., Harth, C., Salameh, P., Muehle, J., Weiss, R. F., Prinn, R. G., Wang, R. H. J., O'Doherty, S., Grealley, B. R., and Simmonds, P. G.: HFC-23 (CHF3) emission trend response to HCFC-22 (CHClF2) production and recent HFC-23 emission abatement measures, Atmos. Chem. Phys., 10, 7875-7890, doi:10.5194/acp-10-7875-2010, 2010.</p> <p>Miller B. R. and Kuijpers L. J. M., Projecting future HFC-23 emissions, Atmos. Chem. Phys. Discuss., 11, 23081–23102, doi:10.5194/acpd-11-23081-2011, 2011</p> <p>It is clear that the EPA data are completely at odds with Miller's numbers and this means that the EPA data are wrong. The emissions in the Miller papers are consistent with measured atmospheric concentrations; effectively they have been verified against measurements.</p> <p>I also had a look at the numbers in the table for ODS substitutes. The last two rows of the table above show the direct comparison between the EPA data and the values reported by countries to UNFCCC. Again there are huge differences but, for the ODS substitutes, they are in the opposite direction - the EPA data are far too small. Verification of the UNFCCC data for the most abundant HFC (134a) against its atmospheric concentrations, as published by AGAGE showed that the UNFCCC data are closer to reality than the low EPA value.</p> <p>Should the reference be (Alsalam J., and S. Ragnauth., 2011)? However in that document I cant find those numbers. Maybe another source?</p>	<p>Noted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved. The data corresponded to the EPA 2011 draft report, which in the SOD has been updated to EPA 2012. Two sources are used for Non CO2 emissions in the SOD (EDGAR and US EPA). There are currently discussions underway on the discrepancies between the two sources. This comment will be considered in the discussion.</p>
6724	10	16	1	16	1	<p>Should the reference be (Alsalam J., and S. Ragnauth., 2011)? However in that document I cant find those numbers. Maybe another source?</p>	<p>Noted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved. The numbers corresponded to the EPA 2011 draft report, which in the SOD has been updated to EPA 2012.</p>

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2287	10	16	3			For iron and steel and cement industry, much of the CO2 emission arise from the chemical reactions not fossil fuel combustion. Sentence should be "CO2 emissions occur due to chemical reactions and fossil fuel combustion." $\text{CaCO}_3 = \text{CaO} + \text{CO}_2$ - calcining major source of CO2 for cement and for iron and steel, $\text{Fe}_2\text{O}_3 + 2\text{C} + 1/2\text{O}_2 = 2\text{Fe} + 2\text{CO}_2$ - major source of CO2	Accepted - sentence changed to: Most of these manufacturing CO2 emissions arise due to chemical reactions and fossil fuel combustion largely used to provide the intense heat that is often required to bring about the physical and chemical transformations that convert raw materials into industrial products
7719	10	16	1			The emissions from ODS substitutes should be updated by the 2012 TEAP Progress report or related Task Force Report to Decision XXIII/9 to make the present situation clearer.	Noted. Two sources are used for Non CO2 emissions in the SOD (EDGAR and US EPA). There are currently discussions underway on the discrepancies between the two sources. This comment will be considered in the discussion.
11133	10	17		17		As previous comments	cf. Response to comment 11132
18519	10	17				Please clarify which industries are included in 'other'.	Noted - the figure has been removed
18520	10	17				Two comments: 1) Please clarify the abbreviations of the world regions to make the figure stand-alone; 2) As waste is covered in a separate, independent section to the chapter, it seems strange that waste emissions are included here. It may be more consistent to decouple these here to keep the discussion within the boundaries of this chapter section.	1) Accepted - in Table 10.3 of the SOD the acronyms have been briefly spelt out and a note has been included in the caption: "For definitions of regions see Annex II (Metrics and Methodology)" 2) Figure 10.2 and Table 10.2 of SOD show major waste categories separately. Waste sector falls within the scope of the industry chapter.
3014	10	17	11		12	The discussion about the relationship between trade and GHG emissions lacks important scientific contributions, for USA, Brazil and China. Please see the following papers LIU, H., XI, Y., LI, X., 2010, "Energy embodied in the international trade of China: An energy input-output analysis", Energy Policy, v. 38, pp. 3957-3964. MACHADO, G., SCHAEFFER, R. E WORRELL, E., 2001, "Energy and carbon embodied in the international trade of Brazil: an input-output approach", Ecological Economics, v. 39, pp. 409-424. WEBER, C. L., PETERS, P. P., 2009, "Climate change and international trade: Policy considerations in the US", Energy Policy, v. 37, pp. 432-440. WTO, 2009, Trade and Climate Change: A report by the United Nations Environment Programme and the World Trade Organization.	Accepted - this paragraph has been significantly reduced in the SOD, referring readers to Chapter 14 where this issue is fully covered.
6725	10	17	2	17	2	The reference is not correct or found.	Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
6726	10	17	3	17	4	The F-gases use, is there possible a double counting or is it excluded in for example "Chemicals and petrochemicals" please clarify the note.	Noted - the figure has been removed
12344	10	17	6			Is the pie chart to the right related to the figure to the left, or are they independent? Further explanation of the figure would ease the reading.	Noted - the figure has been removed
15905	10	17	6			Not clear why there are 2 pie wedges for F-gases	Noted - the figure has been removed

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6727	10	17	7			Reference problem, see 6	Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
6728	10	17	8	18	16	This part of trade could probable both use a table and an own sub-section to help reader to find how this impacts everything	Accepted - this paragraph has been significantly reduced in the SOD, referring readers to Chapter 14 where this issue is fully covered.
16141	10	17	8	18	13	Important paragraph, maybe there should be a reference to international policy -or absence of- described in other chapters?	Accepted - this paragraph has been significantly reduced in the SOD, referring readers to Chapter 14 where this issue is fully covered.
15712	10	17	8	17	10	The discussion of this issue needs to be better coordinated with Chapter 8 (Transport).	Accepted - this paragraph has been significantly reduced in the SOD, referring readers to Chapter 14 where this issue is fully covered.
12957	10	17				Graph legend needed. Who is REF? Who is MAF?	Accepted - in Table 10.3 of the SOD the acronyms have been briefly spelt out and a note has been included in the caption: "For definitions of regions see Annex II (Metrics and Methodology)"
17496	10	18	1	18	2	The sentence reads "In large economies of Western Europe net 1 imported emissions account for 260%,..." 20-50% of what?	Accepted - this paragraph has been significantly reduced in the SOD, referring readers to Chapter 14 where this issue is fully covered.
8271	10	18	12			"CO2 emissions to grow in comparison" - missing "are expected" to grow	Editorial - copyedit to be completed prior to publication
17497	10	18	15	18	16	"With regard to GHG emissions, service sector is less diverse, as it comprises only energyrelated emissions" Are repair shops included in the category of service sector? If so, aren't there releases of refrigerants in this sector? I suggest having this read "as it generally comprises only ..."	Accepted - but coverage of services sector has been significantly reduced in SOD, cf. Response to comment 2279
5217	10	18	16	18	17	I am unsure if the enerdata data given here include transportation related to the servioces sectorm, i.e. including all ourist's transport, but looking at the figures, it does not. Either include (would be my preference) or make a clear note in this.	Note - the data from enerdata do not include within services the emissions related to transport. This section has been deleted as coverage of services sector has been significantly reduced in SOD, cf. Response to comment 2279.
6730	10	18	17	18	18	What about Aircraft and combustion engines for transports?	cf. Comment 5217
15907	10	18	35	18	41	service sector may lower emissions, but manufacturing related GHGs are then tranfered to another country--> leakage	Noted - dealt with in same page (18), line 42 onwards
8272	10	18	44			missing "to" - "leads TO total energy use reduction"	Editorial - copyedit to be completed prior to publication
8273	10	18	45			"as" is not needed	Editorial - copyedit to be completed prior to publication

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
15906	10	18				shorten this section	Accepted - cf. Response to comment 2279
8276	10	19				Table 10.4 does not reflect the text below: need to create a sub category - transportation	Accepted - but due to new approach (cf response 2279) table no longer appears in SOD
18521	10	19				When discussing tourism emissions, it would be very useful to refer back to the discussion in Box 1 on double-counting emissions so that readers understand that emissions quantified here are also primarily accounted for in other chapters (Chapters 8 and 9).	<p>Noted - Tourism is a human activity, a use of leisure time which, according to its different forms (touring, visiting friends and relatives...) more or less calls upon merchant services (catering, tour organisation etc). It has specific drivers and dynamics which cannot be caught by sectoral approaches (e.g. transport, building), an issue which is of some importance owing to its contribution to emissions. This justifies the bottom-up approach. It is not surprising that the question of the coherence between the bottom-up approach and the historically dominating top-down approach is posed. This is also relevant for services (e.g. education, health services etc). services (e.g. tourism) can be seen as end users and can be connected to the sectors that feed them through a Stankey diagram..</p> <p>Thus, the two approaches can be expected to coexist in the AR5 . The coherence of the two should be assessed as far as possible and double counting should not be considered as a difficulty since it is clear for instance that the emissions of transport in tourism are not ever meant to be added to those of transport given by the top-down approach.</p>

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7102	10	19	1	19	7	Best estimate share of tourism CO2 emissions is correct, suggest that section on share of tourism in radiative forcing (Scott et al. Reference) is moved up to follow directly after estimate on CO2. It is not necessarily correct that the share of tourism in national emissions is higher in affluent countries (see e.g. Australia; Dwyer et al. 2010, Journal of Sustainable Tourism), while in particular small island nations can have particularly high tourism emissions, though they may rank low in terms of GDP per capita. Note as well that all of the quoted studies on national emissions have different system boundaries.	Points taken into account. See response to comment 2279 on new approach to tourism in SOD.
2288	10	19	14	19	16	The reference is one of the only references to using a life cycle perspective. The importance of this to reducing GHGs should be emphasized.	Noted in general for the chapter which has attempted to give this perspective from outset (see Figure 10.1)
6729	10	19	19			Shouldn't it be possible to update the table to today's value. Ask same organisation to redo analyse?	Noted - updated sources used. Table no longer appears in SOD.
7104	10	19	19			Table should be moved up, the sentence "the origins of emissions..." should be re-written (sounds odd) and integrated in first section. The reference to table 10.4 should be UNWTO, UNEP and WMO 2008.	Accepted - but due to new approach (cf response 2279) table no longer appears in SOD
7105	10	19	24	19	31	not sure this is relevant?	Accepted - revised to "981MT from transport" - but due to new approach (cf response 2279) table and text no longer appear in SOD
8277	10	19	24			Total of 981Mt (table 10.4 shows 1302MT) or need to clarify "world total of TRANSPORTATION emissions from tourism"	Accepted - but due to new approach (cf response 2279) table and text no longer appear in SOD
15908	10	19	25			"hundred"????	Accepted - revised to "same day visitors 133MT" - but due to new approach (cf response 2279) table and text no longer appear in SOD
8278	10	19	25			Overnight stays 844Mt (table 10.4 shows 274Mt from accomodation)	Rejected - 844 Mt sums transport, accommodation and activities related to overnight stays. Due to new approach (cf response 2279) table and text no longer appear in SOD
8279	10	19	31			global figure of 981Mt - need to show in the table that 981 is the sum of air transport, car and other transport	Accepted - but due to new approach (cf response 2279) table and text no longer appear in SOD
17498	10	19	6	19	6	Aviation's role in tourism should have been introduced earlier, rather than as an aside in this quantitative statement.	Rejected - The importance of aviation is made as clear as possible though it is not stated in the first four lines, see table and text below. See response to comment 2279 on new approach to tourism in SOD.
8274	10	19	6			from 5.2% in which year?	Accepted- changed "from" to "between", the figures state a margin of error. See response to comment 2279 on new approach to tourism in SOD.

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8275	10	19	6			5.4% and 8.3% in which years?	cf.response to 8274
5218	10	19	8	19	10	Cruise tourism is in the UNWTO report not included in 'other tourism' but in accommodations. This because cruises tend not to bring tourists somewhere, but are the destination itself, though a mobile one. Flights to and from ports are included in (air) transport.	Accepted - deleted "and included in other transport". See response to comment 2279 on new approach to tourism in SOD.
5219	10	19	8	19	10	Another issue: recommend strongly to include cruises not in a description of total emissions, but in an assessment of individual per tourist trip and per tourist night emissions for different forms of tourism to show the very large range and the high levels for most cruises and also with an eye on the large opportunities this diversity gives. In effect a minority of trips causes the majority of emissions and thus policies might be best directed at this minority (also because these minority trips tend to grow very fast at this moment).	Noted - it would be quite a good idea if we had space to devote to a more detailed analysis of cruise tourism. The unequal repartition of emissions is dealt with in the first paragraph next page
7103	10	19	9	19	9	"and included in "other transport"" - difficult to understand, remove, or rewrite to read "Cruise travel represents about 1.5% of global emissions of CO2 (e.g. Gössling 2012, Carbon Management, Routledge); it is the most energy intense form of tourism if calculated on a per tourist basis. Cruise travel has grown at an average annual rate...	Accepted - removed
12958	10	19	2	19	4	figures missing for France, Switzerland;	Rejected - the French and Swiss sources make the same case as the others, yet the figures they give (e.g. emissions from transport only) are not comparable to the other studies and so are not given here. See response to comment 2279 on new approach to tourism in SOD.
12959	10	19	5	19	7	There seems to be an inconsistency between the claim that GHG emissions associated with tourism represent 12.5% of CO2eq and the Sankey diagram in figure 10.2. The latter implies that Tourism and leisure together account for around 5% of global GHGs in CO2eq in 2008. If this is not a discrepancy it should be explained why not as it is not clear.	Noted - regarding tourism the two sources are rather coherent, it is quite good news to see different approaches meet. The UNWTO data include overnight stays (strictly tourism) and same day visits (i.e. part of leisure). They do not include all leisure near the home. Yet they point that transport is the greater part of emissions and that the weight of activities is much lower. Thus, the order of magnitude seems to fit. See response to comment 2279 on new approach to tourism in SOD.
3651	10	2	1	2	1	If the service sector is included in the analysis, please consider to add it to the title of the chapter.	cf. response to comment 12340

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7106	10	20	1	20	3	these are references to national studies, an overview of studies indicating unequal distribution in per capita emissions is provided in Gössling et al. 2009. It is also unclear what the references refer to?	Rejected - Gossling et al 2009 is quoted in the paragraph. It also seems important to refer back to national studies since they not all referred to in Gossling et al, and since it gives a link to primary sources. Also see response to 12958.
16143	10	20	14	20	15	This line is controversial : there are several radical technologies being explored such as innovative cement processes or changes in the steelmaking. Although they are not yet in industrial scale, they suggest that paths are not necessarily incremental in large energy intensive industries.	Rejected - but if there is space we could add comments to illustrate the lack of evidence such claims.
4545	10	20	14	20	25	This is not a Kaya-identity. The Kaya-identity differentiates between economic growth, economic structure and intensity changes. The formula 1 does not do this, as structure of demand is lacking.	Taken into account in revisions and identity shifted forwards in the chapter to be near to the structuring figure 10.1
18522	10	20	20		25	It may be more useful to place this equation right up front next to Figure 10.1 to clarify in detail how the two fit together. The description here doesn't make it crystal clear. It might be useful to e.g. include the green circled numbers from Figure 10.1 in this equation as well to better clarify exactly which components represent energy efficiency, materials use efficiency, reduction of demand, etc..	Accepted - Taken into account in revisions and identity shifted forwards in the chapter to be near to the structuring figure 10.1
3019	10	20	20			Please fix the word off-shire. I think you intended to write offshore.	Editorial - copyedit to be completed prior to publication
15909	10	20	37			offshore not offshire	Editorial - copyedit to be completed prior to publication
8280	10	20	37			off-shire should be off-shore	Editorial - copyedit to be completed prior to publication
10414	10	20	37			"off-shore" is got wrong here as "off-shire"	Editorial - copyedit to be completed prior to publication
16142	10	20	8	20	11	Excellent paragraph that sums the problem	Noted, thanks.
7112	10	20	9			Bows et al. 2009: does not focus on tourism?	Looking at the title: "Air transport, climate change and tourism." it seems it does. However not included in SOD.
6731	10	20				I would like a better structure in this part that would be the same for all sub-sections. What is the status, what has been done and the results followed with what can be done with risk and potential.	Taken into account, cf. Response to comment 18534
18534	10	20				The overall structure of the section is very useful (using 10.4.1 to explain the over-arching options and 10.4.2 how they apply to different industries). It is, however, inconsistently applied in 10.4.2, with some sections (e.g. steel and cement) following very closely, and others (e.g. food and textiles) following only to a very limited extent. It would be useful to have a consistent application throughout that section. Where that is not possible, please explain why, e.g. is there no option for material substitution in that industry?	Taken into account - it has been used as consistently as possible, but for several sectors, no published evidence related to some of the options was found. In revising the report, we have tried to make it clear that the absence of an option indicates the absence of evidence

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18526	10	20				One option to shorten 10.4.1 (and thereby the chapter), would be to cut industry-specific examples to the relevant sections of 10.4.2.	Accepted - 10.4.1 has been shortened to summarise the five approaches, with all sector specific examples inserted into the relevant sections of 10.4.2
8501	10	20	12	24	30	The section 10.4.1 can be simplified and make it as general statement since the specific elaboration has been detailed in section 10.4.2 according to sectors. Therefore a few pages can be extracted in order to achieve target number of pages for this chapter. Repeation of statements in section 10.4.1 and 10.4.2 can be misleading and inaccurate in technicalities. It also good to combined section 10.4.1 and 10.4.2 with introduction of table when explaining types of mitigation according to sector specific.	Accepted - 10.4.1 has been shortened to summarise the five approaches, with all sector specific examples inserted into the relevant sections of 10.4.2
12124	10	20	27	20	29	Sector Wide Mitigation Opportunities is missing many strategies - 1) waste heat loss minimisation and waste heat recovery Reference for this - US DOE (2008) Waste Heat Recovery: Technology and Opportunities in U.S. Industry. US DOE at http://www1.eere.energy.gov/manufacturing/intensiveprocesses/pdfs/waste_heat_recovery.pdf + US DOE (2004) Waste Heat Reduction and Recovery for Improving Furnace Efficiency Productivity and Emissions Performance. A Best Practices Process Heating Technical Brief. US DOE. http://www1.eere.energy.gov/manufacturing/tech_deployment/pdfs/35876.pdf - 2) Combined Heat and Power - Co/Tri Generation - Ref Oland, C. (2004) Guide to Combined Heat and Power. Prepared for the U.S. Department of Energy. Industrial Technologies Program. Prepared by Oak Ridge National Laboratory. At http://www1.eere.energy.gov/manufacturing/tech_deployment/pdfs/guide_chp_boiler.pdf	Accepted - References added at the start of section 10.4 (U.S. DOE, 2008; U.S. DOE, 2004) and within the costs and potentials section 10.7 (Oland, 2004)

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12125	10	20	27	20	29	<p>Sector wide Mitigation Opportunities - missing many strategies - 3) improving the operational energy efficiency of manufactured products, appliances, IT vehicles, industrial and commercial cooking equipment. Whilst energy efficiency of product manufacturing processes is important, it is important to note that that life cycle analysis shows that for most "energy using" manufactured products (vehicles, computers, electric motors, appliances, engines, toner cartridges and buildings) over 70% of the total life cycle energy use occurs over the 5-30 plus years of operation</p> <p>For example - Product, % of lifecycle energy usage from operation , reference. Cars, SUVs, pickups, buses - 65-74% (Chester, M.V. and Horvath, A. (2009) Environmental assessment of passenger transportation should include infrastructure and supply chains. Environmental Research Letters, vol. 4, no. 2, pp. 1-8) US Family Sedan 85% (Sullivan, J. L., et al., 1998, Life cycle inventory of a generic U.S. family sedan – Overview of results USCAR AMP Project, proceedings of Total Life Cycle Conference Land, Sea and Air Mobility SAE International P-339, pp.114) Passenger transportation (private and public): 63-70% (Chester, M.V., Horvath, A. and Madanat, S. (2010) Comparison of life-cycle energy and emissions footprints of passenger transportation in metropolitan regions. Atmospheric Environment, vol. 44, no. 8, pp. 1071-1079.) Aircraft 69-79% (Chester, M.V., Horvath, A. and Madanat, S. (2010) Comparison of life-cycle energy and emissions footprints of passenger transportation in metropolitan regions. Atmospheric Environment, vol. 44, no. 8, pp. 1071-1079.) Residential Buildings 80-90% (Ramesh, T., Prakash, R. and Shukla, K.K. (2010) Life cycle energy analysis of buildings: an overview. Energy and Buildings, vol. 42, no. 10, pp. 1592-1600)</p> <p>Lighting – All Forms 98% Office Buildings 86% ICT network and mobile phones (e.g., 2G and 3G, not office network): 84% 79 -84%</p>	<p>Noted - but the absolutely valid point about use/embodyed energy is dealt with by the overall structure of the WG3 report. The use of buildings and appliances is dealt with in the section on buildings and the use of vehicles is dealt with in the section on transport. This chapter covers only the industrial emissions related to making buildings, vehicles, equipment and other goods (i.e the other ~30% not listed by the reviewer).</p>
12126	10	20	27	20	29	<p>Sector wide Mitigation Opportunities is missing many strategies - Reducing GHG through core industrial/manufacturing process innovation. I can send refs and text to support this strategy if interested.</p>	<p>Noted – but this chapter can not attempt to review every technology which is currently under development, and given the space limitations of the chapter, the reviewers offer to send further specific information has not been taken up.</p>
12127	10	20	27	20	29	<p>Sector wide Mitigation Opportunities is missing many strategies - Renewable Energy is missing. Renewable Energy is relevant for all these sectors including mining. Many mining sites are in remote areas off the grid and highly suitable to renewable energy.</p>	<p>Noted - section 10.4 does mention this briefly, but the main discussion on renewable energy in WG3 is in Chapter 7 on energy systems</p>
6732	10	21	1	21	9	<p>I am missing out risks and costs for the improvements.</p>	<p>Noted - this is discussed in sections 10.7 and 10.8</p>
16146	10	21	10	21	24	<p>This paragraph is too prudent and contradicts other parts of the chapter. Line 22 the "asymptote" of efficiency does not mean the potential is not there, especially in an industry with a limited number of players. For example, the Wuppertal Institut has shown that furnaces in the German Steel Industry nearly did not move in efficiency for 20 years, although technology did not stay idle...</p>	<p>Taken into account - cf. Response to comment 4546</p>

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
17501	10	21	10	21	10	Spell out acronyms at first use in chapter. What is EOR?	Editorial - copyedit to be completed prior to publication
8281	10	21	10			What does it mean "within a factor of two of the absolute theoretical limit defined by Gibbs"	Accepted - text revised, theoretical limits now only discussed in general
4546	10	21	10	21	24	This section mixes up best practice, best available technology and technical limits, and makes for a confused story. The argument also builds on only 3 references. The argument should first state what savings are between current average practice and best practices (and BAT). Next to this it can then look at future technologies, beyond BAT. The thermodynamic limits are still far away from many processes. The last sentence of this paragraph is incorrect, given all the material described above and without definition of the word "future". Saygin et al. (2011) look at current best available technologies, but note that savings are possible in areas not included in BAT (e.g. process integration, CHP, recycling).	Taken into account: this paragraph has been rewritten in response, and more references added.
16145	10	21	11	21	12	Word missing (if?)	Editorial - copyedit to be completed prior to publication
17502	10	21	12	21	12	Another reference that would be appropriate here: Brent, G. F., D. J. Allen, B. R. Eichler, J. G. Petrie, J. P. Mann, and B. S. Haynes. 2012. Mineral Carbonation as the Core of an Industrial Symbiosis for Energy-Intensive Minerals Conversion. <i>Journal of Industrial Ecology</i> 16(1): 94-104.	Accepted but due to space restrictions the statement was deleted
6733	10	21	13	21	20	EJ and PJ are to big numbers to grab. Use relative values. 54 PJ lacks a comparable number.	Accepted - context for the numbers has been provided in some instances in SOD. Will be considered further in next stage.
17503	10	21	13	21	31	To what does "its" refer?	Editorial - copyedit to be completed prior to publication
8282	10	21	13			annual GLOBAL energy savings?	Accepted but due to space restrictions the statement was deleted - section 10.7 now includes a reference to mitigation potential data from Saygin et al 2011.
8283	10	21	15			19 to 32% - why a range?	Accepted but due to space restrictions the statement was deleted - most mitigation potential data can now be found in section 10.7
15910	10	21	2			Add "boilers" after "furnaces. There are more technologies to consider—waste heat recovery, advanced cooling systems, pinch analysis, load tracking, variable speed/frequency drives, nanotechnology, etc)	Noted - cf. Response to comment 15885
17500	10	21	21	21	21	A new paragraph should start with the sentence "Similar limits..." or the sentences should be edited to provide a segue.	Taken into account
16147	10	21	22	21	24	Radical technology, e.g. direct reduction of iron oxide for steel, or radical cements do exist, even if they are still to implement. Thus this sentence may be misleading. Maybe add "in the short term"	Noted - some mentions have been added, e.g. new cement technologies. However chapter is concerned with general trends and possibilities; it does not address specific technologies which are currently under development or whose viability is still unproven

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8284	10	21	23			"is the limit to likely future .." should be "is likely the limit to future..."	Reject
15911	10	21	26			coal and oil for industry mostly used in developing nations, not OECD. OECD uses mainly nat gas	Noted - but this pattern reflects the decision by developed countries to reduce their production of basic materials (such as steel) in favour of lower-energy downstream manufacturing - such as car making. So, it isn't clear that the distinction is a very important one in giving an overview of options for mitigation.
6735	10	21	29	21	30	What is the potential with three to four times more biofuel, how much could that decrease total emissions from energy in the industry.	Noted - section 10.4 does mention this briefly, but the main discussion on renewable energy in WG3 is in Chapter 7 on energy systems
6734	10	21	33	21	39	Try to find numbers to show the potential otherwise remove the part with "if power is decarbonised..."	Noted - see response 12345

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12345	10	21	33	21	36	Wider use of heat pumps can be implemented independently of decarbonized power generation, because the heat pumps have efficiency rates of producing heat >1. Please reflect this fact.	Reject - the Unido report cited by the reviewer makes two arguments which suggest that decarbonisation of the electricity grid is required to any significant savings from heat pumps. Firstly, page 37 clearly points out that the efficiency of electricity generation must be considered when comparing heat pump technologies to other options, such as direct combustion of the fuel. "So, for example, if the electricity comes from fossil fuel generation with an efficiency of 40%, the coefficient of performance of the heat pump needs to be higher than 2.5 if the pump is to save primary energy and be considered as providing renewable heat." (i.e. a COP >2.5 for the heat pump is required for the heat pump to start saving CO2). Secondly, page 39 explains the efficiency of heat pumps falls quickly when producing high temperature heat (governed by Carnot's Law), making heat pump technology more suited for low temperature heat in buildings, rather than high temperature heat in industry. Page 38 calculates the potential for heat pumps to provide process heat in industry, by 2050, as 4.87EJ, a small amount compared to the projected 230EJ per year of industrial energy use, and gives no estimate of the CO2 abated from this strategy. Therefore a decarbonised electricity supply is required to make meaningful reductions in CO2 emissions from the use of heat pumps in industry.
15912	10	21	33	21	39	issues for using renewable include intermittency and area footprint which are limitations for industry	Noted - but the main discussion on renewable energy in WG3 is in Chapter 7 on energy systems
9535	10	21	33	21	36	Good comment	Noted
10014	10	21	33	21	36	This part should be kept in SOD because "heat pump technology" has huge potential to reduce GHG emissions from industrial sectors, as described in (IEA/OECD, 2010, pages 65-83) and (UNIDO, page 38, Fig 14). These literatures are listed in the No 47 line of this table.	See response to comment 12345
9541	10	21	36			Please, add the following; the analysis has identified the potential for heat pumps to meet 4.87EJ/yr of industry's process heat demands in 2050. (renewable energy in industrial applications, UNIDO)	See response to comment 12345

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
16148	10	21	38			Maybe precise "large scale" solar systems in use in industries.	Noted - but the main discussion on renewable energy in WG3 is in Chapter 7 on energy systems
16144	10	21	4			The list does not include explicitly the efficiency of the motor itself. Maybe add "in addition to improvements to the motors themselves."	Taken into account - changed to "motor systems" which includes motors
16149	10	21	44			The destruction of HFC23 as a CDM benefit is controversial, this should show in the sentence, for example with "the controversial destruction of HFC-23 is the major source..."	Noted. This is now mentioned only in section 10.11. The statement reflects a fact: HFC23 destruction is a major source of CDM credits. The controversy is not related to this fact, but has been discussed by the chapter team who will look for other opportunities to raise the issue of concern to the reviewer
7510	10	21	25	22	26	It should be explained that CCS requires huge energy for capture and storage of CO2. As far as carbon free energy is not available, additional CO2 emission is inevitable. High costs of CCS is stated at line 25 of page 22. And it should be added that for industry, the issue is "Who will pay for the cost of CCS?" and how the cost should be passed on to the consumer.	Noted - but most of the CCS text in chapter 10 has been removed and cross-reference is made to chapter 7 on energy which covers the issue in more detail
11134	10	21	41	21	41	mistyping. Should say "hydrochlorofluorocarbons"	Editorial - copyedit to be completed prior to publication
15913	10	22	13	22	26	CCS for industry assume that plants will be around for long term - may not be true for many industries and might preclude CCS from these sectors	Noted and discussed in section 10.9 on barriers
3020	10	22	17		18	I suggest including ethanol and sugar production as one of the major sources of cheap and pure CO2 that can be easily captured and, depending on the location of the industrial facility, used as a refrigerant fluid or as an input to food and beverage industries. CO2 in ethanol distilleries can also in the future be an input for producing succinic acid, which is a valuable bioplatfrom to produce different chemical products.	Taken into consideration, if we find literature than it could be included in section 10.5 cross industry cooperation
2289	10	22	19	22	20	Check data. The offgas from iron and steel is typically much lower in CO2 content than from power plants. EAF especially much lower (use baghouses with air cooling reducing to very low CO2 levels) versus typical ESP for powerplants where CO2 is much higher.	Accepted - comparison with power plants omitted
12627	10	22	24	22	26	This statement is factually incorrect. There are very well known and accepted assessment techniques for geological storage potential. CCS on a \$/tonne of CO2 basis is cost competitive with many renewables and other technologies, most CCS projects globally have not experienced public engagement issues beyond what is common for large industrial projects, there is 5 large-scale proof of concept projects each storing in the order of million tonnes of CO2 per year.	Noted - see section 10.9.2 which now summarises barriers on CCS for industry. The statement that the costs are uncertain is factually correct, because there are so few installations operating to date. The reviewers comment that there are "5 large-scale proof of concept projects" rather underlines the small scale of CCS to date, and hence the correct use of the word "uncertainty."

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12670	10	22	24	22	26	This statement is factually incorrect. There are very well known and accepted assessment techniques for geological storage potential. CCS on a \$/tonne of co2 basis is cost competitive with many renewables and other technologies, most CCS projects globally have not experienced public engagement issues beyond what is common for large industrial projects, there is 5 large-scale proof of concept projects each storing in the order of 1 million tonnes of CO2 per year.	Duplicate of comment 12627
8909	10	22	26			The reference for "high costs" of CCS should be deleted. High costs relative to what? Offshore wind turbines are an extremely high cost way of mitigating CO2, as are many other technologies. The reason that the IEA blue map scenario contains a large proportion of CCS is that overall it is an extremely cost-effective method of CO2 abatement, particularly when issues of grid stability and balancing are taken into account. From the IEA CCS roadmap "Carbon capture and storage (CCS) is an important part of the lowest-cost greenhouse gas (GHG) mitigation portfolio. IEA analysis suggests that without CCS, overall costs to reduce emissions to 2005 levels by 2050 increase by 70%." http://www.iea.org/papers/2009/CCS_Roadmap.pdf	Taken into account - text revised to: "their comparatively high costs", based on the IEA's BLUE map marginal abatement curve (Figure 2.34 and 2.35, pg109-110, IEA (2009b). Energy Technology Perspectives 2010. Scenarios and Strategies to 2050. International Energy Agency, Paris.) which shows 37% of the abatement potential in industry coming from CCS, with a price range of US\$50 to US\$100/tCO2, which is comparatively high compared with other options.
11999	10	22	26			It is wrong that there is no large-scale proof of concept for the CCS: Look at the Sleipner project in the Northern Sea where Statoil has been injecting 1 million of CO2 per year since 1990. It works very well and CCS has suffered from way too much scaring and generalization from generalists. The CO2 contained in the combined fossil fuel reserves known today is over 2600 Gt. CCS is feasible and defendable provided the necessary Quality assurance is applied throughout the whole process. We have overcome bigger challenges and should definitely use CCS much more in the future. We cannot afford not to use it and there is nothing speaking against using it if done professionally.	Taken into consideration - there are some large scale storage projects (Sleipner, In Dsalah, Weyburn), but not large scale project connected with industry processes
9914	10	22	27			The standard ISO 14051 "Material Flow Cost Accounting" released by the end of 2011 should be referred to as a guidance document to assist decision makers in companies in reducing both their material and their energy use.	Rejected - not related to the context mentioned
10136	10	22	4		8	To clarify the statement the following reformulation is recommended: "... was too small, to become a significant means for mitigating climate change. Due to the large energy amount that is necessary to transform the low-energy-content CO2 molecule into other chemical products, the overall CO2 balance for reactions using CO2 as raw material depends on the carbon-factor of the energy used. A recent analysis....". The sentence in lines 6 to 8 should be deleted as it creates a wrong impression. CO2 as raw material for urea production is not a pilot or demonstration project, but a long-established process. Pilot projects on CO2 as building blocks for polymers do exist because they make commercial sense for reasons very specific to each project. The carbon emission avoidance of these projects depends on the primary energy source used.	Noted - but most of the CCS text in chapter 10 has been removed and cross-reference is made to chapter 7 on energy which covers the issue in more detail
6736	10	23	11	23	12	The chapter could have a section for re-use. It has a lot of potential if products were made of more standardized parts designed for disassembly.	Rejected - reuse is discussed in section 10.4.1.3

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
5457	10	23	16	23	17	Kiln drying process of wood products uses more energy than sawing process etc., but it could not be called "energy intensive", comparing metal material processing energy.	Taken into account. The statement has been changed to "but is in effect still energy intensive due to kiln drying and the need for greater volumes of wood to provide the same strength or stiffness as steel"
6737	10	23	24	23	24	This could be avoided with smarter design for manufacturing.	Accepted - the statement now reads "This could be reduced by process innovations and new approaches to design."
15914	10	23	24			add after "process innovations" , "and better product energy management"	Taken into account - covered in section 10.4.2.1 - heat and energy recovery in the iron and steel sector. The authors do not feel that better product energy management would contribute to an increased product yield, which is the focus of section 10.4.1.3.
7093	10	23	24	23	24	change "avoided" to "reduced"	accepted
17507	10	23	27	23	27	A word is missing in this sentence.	MYR: Editorial - copyedit to be completed prior to publication
8285	10	23	27			A more in depth discussion could be found in the ...	MYR: Editorial - copyedit to be completed prior to publication
17506	10	23	28	23	28	While cement cannot be recycled as such, cement in concrete is recycled when concrete debris is downcycled into civil engineering applications.	Taken into account - text revised to "There is no recycling possible for cement although concrete can be crushed and down-cycled into aggregates or engineering fill ..."
10138	10	23	28		29	Delete "plastics recycling is greatly inhibited by the wide variety of incompatible compositions" and exchange with: "for plastics recycling different possibilities are in practice depending on the cleanliness and conformity of the plastics waste". See comment referring to page 67 lines 16 to 23 for more details.	Taken into account. Text will be modified to convey right message. there are clear limits to future possible recycling of plastics due to the high variety of plastics in use, regardless of the cleanliness of plastics waste. The reality is that plastics are useful precisely because they can be tailored easily to specific applications, generally in small parts - so it is very unlikely that we will ever achieve a significant "conformity of plastics waste"

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12009	10	23	28	23	29	The statement is too simple and misleading. A very important reason why there exist variety of plastics is to serve best to the needs. For example, wrapping and containers require shielding, damper, protection and other performance and specific needs widely differ by applications. The best suit plastics much contribute to resource and energy saving. Product specific recycling systems have been developed to enhance recycling. See more info on the following webs. http://www.plasticseurope.co.uk/ http://www.jpif.gr.jp/7teigen/teigen.htm	Noted - but the reviewer's comment does not contradict what is written
7094	10	23	29	23	30	Recycling may also reduce GHGs by reducing methane emissions from landfills, but the size of this avoided emission depends on the amounts of paper that would have been landfilled if not recycled. For instance, see FAO. (2010). Impact of the global forest industry on atmospheric greenhouse gases: FAO Forestry Paper 159. Rome: United Nations Food and Agriculture Organization (FAO).	Noted- it is clear that paper recycling could also reduce GHGs if paper waste is diverted from landfill, but this would not necessarily be the case if paper was incinerated and used as an energy source instead of landfilled. The statement in page 23-line 29 "...it does not always reduce emissions..." acknowledges this fact, but it also refers to the fact that virgin paper production is commonly fueled with biomass, whereas recycling is not, which means that in some cases the recycling production process could actually generate more carbon emissions than the virgin paper production process followed by incineration.
2290	10	23	4	23	24	lighter weight advanced high strength steels reduce the amount of steel required to make products and hence GHGs. The last sentence ignores many of the advances made in the metals industry in near net shape products resulting in very high yields (90+%) - thin slab casters, direct strip production, beam blanks production, etc.	Taken into account - the important role of yield improvements through technologies such as these are already covered in this section.
17505	10	23	7	23	7	Improvement of manufacturing yields is not a form of material substitution.	Rejected - the sub-heading for this section is not just material substitution.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
10137	10	23	7		8	Delete the sentence "For plastics...." and substitute it with the following more differentiated paragraph: "For plastics, a substitution of oil as feedstock by renewable resource has been discussed as GHG mitigation option. LCA studies show that other environmental parameters like eutrophication and stratospheric ozone are often influenced negatively and additional land use impacts, such as the potential loss of biodiversity, soil carbon depletion, soil erosion, deforestation, as well as greenhouse gas emissions from indirect land use change are often not quantified. Additionally, the studies show a large variability depending on the process analysed. This underlines the conclusion that feedstock change for plastics has to be analyzed based on various criteria and individually for each process over the complete life-cycle in order to assess the sustainability of this GHG mitigation potential." (Source: A Review of the Environmental Impacts of Biobased Materials, Martin Weiss et al., Journal of Industrial Ecology, Special Issue: Meta-Analysis of Life Cycle Assessments, Volume 16, Issue Supplement s1, pages S169–S181, April 2012.) For more details on the negative GHG emission effect of land use change for the plantation of bio-raw materials refer to the following source: Quantifying global greenhouse gas emissions from land-use change for crop production, HELEN C FLYNN et al., Global Change Biology (2012).	Taken into account: there isn't space to delve into the LCA study debate, but we have modified the statement to acknowledge that although feedstock substitution is technically feasible, it would require huge amounts of land, which has implications for food production, and CO2 emissions from changing land use, etc.
4548	10	23	8			Vegetable oil??? You must be kidding.....	Noted - but this is an issue of language. "Vegetable oil" and "crop-derived renewable substitute for fossil oil" have the same meaning.
6606	10	23	26	23	27	Delete this sentence. Cooperation between steel production of electric arc furnace (EAF) and blast furnace (BF) can establish the circulation system and iron and steel contributes for society as recycling oriented material. However, some people say "changing production of BF into EAF can achieve GHG reduction." The idea that promoting electric arc furnace instead of blast furnace is more environmental friendly is totally incorrect since it does not consider that production from iron ore by BF is and will be required for satisfaction of world steel demand for a long time and scrap was originally made by BF which has emitted GHG in the past. That means this idea handles only a portion of a huge circulating system. As you know, from a longer-term perspective, steel production is expected to exceed 2 billion tons in 2050 in analysis of IEA and RITE. This simplistic interpretation which has high risk of misleading shall not be included IPCC report. See Steel's contribution to a low carbon future by worldsteel. The simplistic thinking can be removed by this position paper. http://www.worldsteel.org/publications/bookshop?bookID=26c4d914-f159-4468-8933-94404015861b	Taken into account - it is not the intention of this section to suggest that production of steel via the EAF route should be promoted over the BF-BOF route, due to the constraint of scrap availability. However, all available scrap should be recycled to reduce overall steel sector emissions i.e. less primary production is required to replace lost scrap. The text has been revised to clarify the issue: Recycling of available scrap is already widely applied for metals as a means to use less energy, and is an additional GHG mitigation option if more scrap can be collected in future. "

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7511	10	23	25	24	8	There is difference in recycling situation between steel and alminum. Separate explanation is required. Post consumer scrap of steel is over 50% of recycled scrap in case of steel with around 85 % end-of life recycling rate of post consumer scrap. Despite high-grade steel like steel sheeet for automobile requires virgin iron from iron ore, obsolete scrap is successssfully used for production of steel for various usage as same sa the virgin material. The steel scrap is successfully recycled.	Taken into account - more detail on recycling will be provided in section 10.14 on waste
8003	10	23	25	24	8	It is not appropriate to discuss both steel and aluminum in a common manner. Steel's case is described in the following site: http://www.worldsteel.org/publications/fact-sheets.html	Rejected - This chapter is concerned with general trends and possibilities and as such, there are common lessons to be learnt across these metals
5019	10	23	25	24	8	The global rate of recycling of steel is 83% and some specific steel use sector shows much higher recycle rate. Reality and future of the recycling of steel is described in deteil in the following site of worldsteel association: http://www.worldsteel.org/publications/fact-sheets.html	Taken into account - covered in the section on waste.
7095	10	24	13	24	15	The completely "paperless" offices may not be realistic, but it is wrong to downplay the reduction in demand for printing and writing papers attributable to electronic communications devices. See, for instance, http://www.risiinfo.com/blogs/North-American-copy-paper-trends-at-home-vs-the-office-u2013-less-paper-but-far-from-paperless.html?source=rss	Noted - although paper production and consumption might be declining in North America, this is not the case for global production and consumption. Data from FAO (http://www.fao.org/forestry/46203/en/) for writing and printing paper clearly show that although production fell during the 2008 financial crisis, production levels have recovered now to the same pre-2008 level. There is no cocnclusive evidence in literature to attribute this variation in production levels to the use of electronic devices.
16150	10	24	18			"sustainable consumption" is a key issue and rightly mentioned. But section 10.11 is still in progress and not up to that ambitious -and new in AR5- direction for policy.	Noted - actually the report could have benefited from a whole chapter on demand and sustainable consumption - but the structure was determined at IPCC plenary prior to our involvement.
8286	10	24	22			backed BY	Editorial - copyedit to be completed prior to publication
14262	10	24	23	24	23	Does 'Clear' have some specific meaning or conotation?	Taken into account
17508	10	24	28	24	29	There is an emerging literature on "degrowth." See http://degrowth.org/publications	Noted - but we have limited space to examine this.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
16151	10	24	29			Excellent use of (Jackson 2011), but the term "last resort" is wrong here. If policy of decreased usage can be developed, it is by an optimising the distribution channels (e.g. replacing a product by a service, organizing the share or productions, or by complex patterns of change in consumption. A "last resort" suggests that only a crisis of large scale will bring this evolution, when it is only one possibility.	Accepted - see SOD box 10.2 for more on service demand reduction
2291	10	24	3	24	8	Recycling is more prevalent than indicated - especially in the steel industry. Most recycling of steel is aftermarket - not scrap generated in production. In the US and other developed countries - the majority of the feedstock is recycled materials. The quality of liquid steel from recycled material in the steel industry is no different than virgin material due to refining techniques. Agreed, there are differences in the aluminum and other metals industries - less recycling because of problems separating the metals (steel is magnetic and easy to separate) and liquid metal in aluminum is lower quality.	Rejected - not supported by the peer-reviewed published literature (Cullen et al., 2012) - this shows that post-consumer scrap is a smaller scrap input than scrap generated in production. While the US has a high proportion of EAF steel production and the majority of the input is recycled material, the global picture is different, with scrap material making up about a third of input material.
12128	10	24	33	25	10	Steel - As the Australian Prime Minister's Taskforce on Energy Efficiency clearly states "R&D from the Australian steel industry and CSIRO has the potential to reduce emissions by 50% in existing BOF plants. Since 2006, the Australian steel industry (BlueScope Steel and OneSteel) and CSIRO (Minerals Down Under Flagship) have been collaborating under the Australian CO2 Breakthrough Program. They have invested around \$7 million to develop breakthrough technologies for reductions in net emissions from the industry. This R&D program covers two focus areas — biomass and dry granulation of slags —which, if successful and implemented, could more than halve the greenhouse gas emissions from the industry. Furthermore, the technologies under development could be in widespread implementation in three to seven years' time, once the R&D is completed." Government report is at http://www.climatechange.gov.au/~media/submissions/pm-taskforce/report-prime-minister-task-group-energy-efficiency.pdf □	Noted - the abatement options suggested in this report (biomass, waste heat recovery, by-product utilisation etc.) are already covered by this section (energy efficiency, emissions efficiency, fuel switching etc.), however the timescales suggested in the report are much shorter than those anticipated in the peer-reviewed literature.
16152	10	24	42	25	16	The ambition of ULCOS was described in many publications in the trade journals. IPCC does not have to snub the program because it does not fit in the upscale journals.	Noted - peer-reviewed literature on ULCOS will be considered for inclusion in FD

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7526	10	24	46	24	48	<p>The diffusion of existing energy efficient technologies is important no-regret option as a first step. More detail description is beneficial for world-wide readers and policy makers. Policy makers are interested in current policies rather than future possibility.</p> <p>IEA ETPs indicate energy/CO2 saving potentials. In addition, Oda et al., (2012) indicates specific energy consumption of BF-BOF route among countries. These specific materials can lead more comprehensive and objective IPCC Report.</p>	<p>Taken into account - this chapter is concerned with general trends and possibilities so more detailed descriptions of existing energy efficiency options are not included. The text has been revised to include the reference on the different specific energy intensities of regional BF-BOF production: (page 24 line 40) "...furnaces before refining. The specific energy intensity of steel production varies by technology and region (Oda et al., 2012)" Reference: Oda, J., Akimoto, K., Tomoda, T., Nagashima, M., Wada, K., Sano, F. International comparisons of energy efficiency in power, steel, and cement industries. Energy Policy 44 (2012) 118-129</p>
17509	10	24	47	24	47	Explain/define "specific energy"	Accepted - text added "specific energy consumption (GJ/tonne product)"
6738	10	24	5	24	5	Add a reference to the 20 %.	Accepted - Referenced added - paper is currently under review - with the original source of this in Aluminium for future generations/2008 update; International Aluminium Association: London, 2008; http://www.world-aluminium.org/media/aler/2012/06/12/f10000286.pdf/
8819	10	24	9	24	29	Good to see these options at least considered.	Noted - thanks
12010	10	24	9			It should be noted that durability of goods enables longer use and thus contribute to demand saving.	Noted - however very few products (mainly just infrastructure) are replaced due to a lack of durability.
2104	10	24		24		This section, "Reducing demand for product services" does not reflect consumption patterns in either the developed or developing world, and should be removed. No society in modern times has willingly reduced consumption for the greater good except perhaps in times of war.	Rejected - it doesn't attempt to reflect consumption patterns but to recognise that demand reduction has serious potential as a mitigation option.
4265	10	24				This section seems very thin given the recent public debate about the limits to economic growth as an indicator of economic success - rather than being a strategy of 'last resort' it should be considered as a serious policy option deserving of more study and emphasis	Accepted - see response to comment 16151

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
15915	10	24	20			happiness vs consumption discussion could be controversial. Recommend relooking at this section	Noted - but given that there is no chapter on sustainable consumption, this is the only place we can mention this growing literature
14261	10	24	20			This concept is more difficult for me to understand than the other four. The explanation little helps me further understand. More explanation with other examples is expected.	Taken into account - we have added some examples.
15916	10	24	30			Recommend including consistent format for industry sector, using cement section as a template for the others. Each sector should include energy performance chart, best practices, current state, challenges and costs. Include figures like Fig. 10.6 for all sectors	See response to comment 18534
12012	10	24	30			It should be mentioned that cascade heat/energy use among factories in an industrial park (Kombinat) can enable significant energy saving. See http://www.meti.go.jp/committee/materials/downloadfiles/g70528a17j.pdf	Noted - this is covered in section 10.5.1
11662	10	24	33	25	16	It should be emphasized that the diffusion of existing technologies will play an important role in improving energy efficiency before implementing break-through technologies. For example, Oda et al. (2012) show a large potential improvement in energy intensity when the existing technologies are diffused across regions. Reference: J. Oda et al. (2012) International comparison of energy efficiency in power, steel and cement industries, Energy Policy, 44, pp.118-129	Taken into account in section 10.10
6594	10	24	7	24	10	Delete "in short term" from this sentence. Coke dry quenching has a great effort on emission reduction not only in a short period, but also in a long-term.	Accepted - text revised: "short-term" removed
6593	10	24	7	thye	10	<p>Cooperation between steel production of electric arc furnace (EAF) and blast furnace (BF) can establish the circulation system and iron and steel contributes for society as recycling oriented material. However, some people say "changing production of BF into EAF can achieve GHG reduction."</p> <p>The idea that promoting electric arc furnace instead of blast furnace is more environmental friendly is totally incorrect since it does not consider that production from iron ore by BF is and will be required for satisfaction of world steel demand for a long time and scrap was originally made by BF which has emitted GHG in the past. That means this idea handles only a portion of a huge circulating system.</p> <p>As you know, from a longer-term perspective, steel production is expected to exceed 2 billion tons in 2050 in analysis of IEA and RITE.</p> <p>This simplistic interpretation which has high risk of misleading shall not be included IPCC report.</p> <p>See Steel's contribution to a low carbon future by worldsteel. The simplistic thinking can be removed by this position paper. http://www.worldsteel.org/publications/bookshop?bookID=26c4d914-f159-4468-8933-94404015861b</p>	cf. Response to comment 6606
12346	10	24	30			This is a very important and relevant section, and efforts should be made to improve it even more. Every sector has a description of its mitigation possibilities. The mitigation options are divided into groups like energy efficiency, emissions efficiency and fuel switching etc. Within the main groups of mitigation options more numbers on the magnitude of the emission reduction potentials, would be useful. More figures to illustrate would also improve the presentation. There could also be discussion of the mitigation groups compared to each other. For instance, within the iron and steel sector; what are the most important mitigation options of material efficiency and energy efficiency? Where are the potentials? CCS could also be added as a group of mitigation options, like for iron and steel and cement.	Taken into account. CCS is already discussed. Section 10.7 aims to define costs and potentials -but it is so far relatively difficult to define potentials for material efficiency, as the option has to date had so little attention.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
17510	10	25	11	25	11	What is the date by which the 50% reductions are to occur?	Accepted - it should say "emissions intensities"
3023	10	25	20			The study of Henriques et al. (2011) and Gouvello (2010), both focused on the Brazilian case, stressed the huge potential for curbing GHG emissions in steel production by replacing coal and charcoal derived from deforestation with charcoal from planted forestry. I suggest including this option, which can be an opportunity for emerging countries. The references are: DE GOUELLO, C., 2010, Brazil Low-carbon Country Case Study. World Bank, Sustainable Development Department of the Latin America and Caribbean Region. HENRIQUES JR., M.F., DANTAS, F., SCHAEFER, R., 2010, "Potential for reduction of CO2 emissions and a low-carbon scenario for the Brazilian industrial sector", Energy Policy, v. 38, pp. 1946–1961.	Accepted - text revised "notably in Brazil (Taibi et al, n.d., De Gouvello, 2010, Henriques et al., 2010) References: DE GOUELLO, C., 2010, Brazil Low-carbon Country Case Study. World Bank, Sustainable Development Department of the Latin America and Caribbean Region. HENRIQUES JR., M.F., DANTAS, F., SCHAEFER, R., 2010, "Potential for reduction of CO2 emissions and a low-carbon scenario for the Brazilian industrial sector", Energy Policy, v. 38, pp. 1946–1961.
12347	10	25	24	25	25	Hydrogen can be produced by emission-free sources today. If emission-free renewables are used to produce electricity, hydrogen can be produced emission-free from that power.	Taken into account - text revised to indicate that a renewable energy source for hydrogen production is not currently available or economic at the scales required. New text: "Hydrogen fuel might reduce emissions if a cost effective emissions free source of hydrogen were available at scale, but at present this is not the case.
6739	10	25	26	25	29	I do not feel this paragraphs trustfully. Leave out until it is a better proven technology.	Rejected - the technology is at the early stages of development, but this is clearly noted in the text
4550	10	25	30			While I am extremely happy to see that the report pays tribute to material efficiency as a mitigation opportunity currently not fully addressed in analyses, the authors should be careful with statements as "large potentials", especially after first "downsizing" the opportunities for energy efficiency improvements...	Accepted - changed to "significant potential for emissions reductions "
2293	10	25	37	25	38	Check context of Cooper reference. Reuse of 30% of all steel is questionable. Auto 100% recycled currently - could not be reused. White goods - 90% recycled currently - reuse. Buildings, bridges, etc. - high of reuse possible. Did reference talk about structural shape reuse? If so should spelled out.	Noted - Cooper et al. estimate a figure of 30% reuse of all steel products. This estimate is based on different strategies of reuse, not necessarily reuse in the same application. For example, automotive body sheet could be used to make smaller blanks. However, it is difficult to add more detail given overall space constraints

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6597	10	25	14	25	15	Energy saving technologies such as coke dry quenching have positive economical impacts besides energy saving, i.e. water-saving, less demand for fuel and others. It should be noted that CCS has no enough economical incentives to diffuse widely in steel industry unlike other energy saving technologies with positive economical impacts.	Taken into account - text added: "...emissions reduction with additional benefits of reduced water and fuel demand"
6596	10	25	25	25	26	Add "as COURSE 50" in the end or rewrite as follows: Hydrogen reduction is being investigated in the US 26 (Pinegar et al. 2011) and Japan as COURSE 50 (Matsumiya 2011). For reference: http://www.jsif.or.jp/course50/index_en.html	Accepted - text added: "and Japan as COURSE50"
8005	10	25	25	25	26	Hydrogen reduction is being investigated in the US and also in Japan in the national project named "COURSE50"(Matsuyama 2011). Details are reported in the following url: http://www.jsif.or.jp/course50/index_en.html	Accepted - text added: "and Japan as COURSE50"
11663	10	25	30	25	38	As some studies have already considered the material efficiency improvement in BAU scenario, implementing additional material efficiency improvement will lead to double counting in the potential emission reductions. For example, according to the ETP by IEA (2012), steel and cement production will be decoupled from population rise and economic growth, which implies an inclusion of material efficiency in BAU scenario.	Noted - but we have not tried to make numerical predictions of the combined effects of the different strategies, so hope that such double counting will not be a problem
7513	10	25	30	25	34	This paragraph should be revised. It is correct that material efficiency offers the potential for emissions. However, since material efficiency is one biggest component of production cost, not only steel producers but designers of cars and other products made of steel have competed each other to reduce material loss. This sentences are mis-leading and not worthy for IPCC report.	Taken into account - we have added the sentence "However, a significant challenge to the adoption of material efficiency in the use of steel (and other basic materials) is that bulk materials are relatively cheap in comparison to labour, and this difference is amplified by tax policy, so economic logic currently drives a preference for material inefficiency to reduce labour costs (Skelton and Allwood, 2013)."
7514	10	25	34	25	38	It is questionable.	Noted - but the text claims a potential only.
6595	10	25	39	25	46	Delete all sentences regarding "reduced product and service demand" in terms of steel experts' view and business impact. Indeed, one of the key contribution from the steel industry is to work closely with its customers in optimising the design and use of steel in steel-using products and to consider steel life cycle. However, discussion about reduction of steel production and demand only for GHG reduction is too simplistic thinking and has enormous damage for steel business. This simplistic interpretation which has high risk of misleading shall not be included IPCC report. See Steel's contribution to a low carbon future by worldsteel. The simplistic thinking can be removed by this position paper. http://www.worldsteel.org/publications/bookshop?bookID=26c4d914-f159-4468-8933-94404015861b	See response to comment 7513

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7515	10	25	39	25	41	30% reduction is questionable. All design is performed to reduce material weight. Car weight reduction by high strength steel application has not only reduced steel demand but also improved fuel efficiency by reducing the car weight and reduced consequential CO2 emission.	Noted - however Carruth et al. 2011 performed a case study on a car bodies and found a weight reduction potential of 17.5-25%, which was in-line with major car manufacturer targets. Evidence on construction in the UK suggests the figure for commercial buildings will be much higher. The average figure of 30% arises from the application of general weight-saving principles. Unfortunately, to date despite the increased use of high strength steels, cars are getting heavier and not lighter, because they are getting bigger and have more features.
7512	10	25	9	25	9	Delete "in short term" from this sentence. Coke dry quenching has a great effort on emission reduction not only in a short period, but also in a long-term.	Taken into account - text revised: "short-term" removed
6741	10	26	2	26	4	Use relative values and compare to total industry emissions.	Accepted. Changed sentence to: CO2 emissions from cement production in 2006 totalled 1.9 Gt CO2: 1.1 Gt CO2 from process emissions (calcination) and 0.8 Gt CO2 from fuel emissions (IEA 2009b), and a small contribution from grinding and transport (Bosoaga et al., 2009); cement industry CO2 emissions are approximately 5% of total global anthropogenic CO2 emissions (IEA/WBCSD, 2009).
7494	10	26	2	26	4	"CO2 emissions from cement production in 2006 totaled 1.9 Gt CO2: 1.1 Gt CO2 from process emissions (calcination) and 0.8 Gt CO2 from fuel emissions (IEA 2009b), and a small contribution from grinding and transport". When cement or concrete sets some CO2 is reabsorbed, especially on the skin of the cement. Also, in some areas, charcoal is used for cement manufacture and firewood used for lime burning. In several developing countries, burnt bricks are used in place of concrete and mortar is used as a binder (lime plus aggregate). Brick kilns/stacks are generally fired with wood.	Comment noted, however Collins (2010) reports that carbonation (absorption of carbon into cement) is "almost negligible" compared with production emissions. Need peer-reviewed literature citations to include comments regarding charcoal and burnt bricks. [Ref: Collins, F; "Inclusion of carbonation during the life cycle of built and recycled concrete: influence on their carbon footprint"; Int J Life Cycle Assess (2010) 15:549–556].
18527	10	26	5	26	22	Is there any option to improve the energy efficiency in the cement industry further? Or have we already approached the theoretical limits?	See 12129

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
10015	10	26	5	26	6	<p>In the footnote No.7, the losses associated with conversion of fuels into electricity are 67%. But this "67%" should be revised with recent data. The average 2001-2005 efficiencies of all fossil fired electricity production in OECD countries are 39%, as described in (Taylor, 2008, page17, Figure6).</p> <p><Reference> [1] Taylor, P., O. Lavagne d'Ortigue, N. Trudeau, & M. Francoeur (2008). Energy Efficiency Indicators for Public Electricity Production from Fossil Fuels, IEA Information Paper.</p>	Accepted - the loss percentage figure from the footnote has been deleted
9376	10	26	footnote7			Replace 67% with the latest figure.	see 10015
12011	10	26				<p>Japan is also a major country to use municipal wastes for cement production. Http://www.jcassoc.or.jp/cement/2eng/eh3.html</p>	Taken into account - while this is may be true, it is not supported by a peer-reviewed source. Text revised to "...countries (for example The Netherlands..." to make clear list is not exhaustive
7527	10	26	1			<p>The draft about "Energy efficiency" and "Emissions efficiency and fuel switching" is really excellent.</p> <p>For further grade up, trade-off between alternative fuels and energy efficiency is highly suggestive. The use of waste plastics requires additional electricity consumption for chlorine (Cl) bypass and removal system (Oda et al. 2012). Japan Cement Association and Dr. Izumi (yoshito-izumi@jcassoc.or.jp) have an actual data as for the trade-offs.</p>	Taken into account - text revised to "Even though processing alternative fuels requires additional electricity consumption (Oda et al., 2012), using alternative fuels can still reduce cement sector emissions by 0.16 Gt CO ₂ e per year by 2030 (Vattenfall, 2007). Increasing costs for alternative fuels could reduce the economic viability of this option between 2030 and 2050 (IEA/WBCSD, 2009).
12129	10	26	1	27	33	<p>Cement - completely ignores low carbon cement technologies - eg: The company Zeobond, in Australia, has pioneered the commercialisation of geopolymers which achieve up to 80% reductions in the energy intensity and GHG emissions of portland cement, and can be used for many major purposes for which Portland cement is currently used. Extensive Peer reviewed literature on the geopolymers being manufactured and sold by Zeobond Pty Ltd in Australia - based on 20 years of research at the University of Melbourne are available at http://www.chemeng.unimelb.edu.au/geopolymer/publications.html</p>	Taken into account. Added "There are also a number of emerging technologies or measures which are still under development or recently commercialised that focus on improving energy efficiency and reducing the emissions from cement and concrete production (Hasanbeigi et al., 2012). However, there are regulatory, supply chain, product confidence and technical barriers which must be overcome before such technologies (such as geopolymers cement) could be widely adopted (van Deventer et al., 2012)."
9302	10	26	26	27	7	<p>Toward a sustainable society, the cement industry contributes to recycle many of resources to establish a recycling based society. However, it should be recognized that the recycling processes in the cement plant require further additional energy for a primary treatment including drying and cutting. (http://www.jcassoc.or.jp/cement/2eng/eh1.html)</p>	See 7527

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12348	10	26	1			The calcination is addressed in the introduction as contributing 1.1 Gt CO ₂ from cement production globally. However, emissions from calcination is not really addressed in the mitigation options discussed, apart from measures in the material efficiency part and the reduce product and service demand. Since emissions from calcination is the major source of emissions from the cement industry, we would appreciate if measures to reduce these emissions was further investigated. EG. is it possible to use CCS?	Taken into account - CCS for cement kilns is covered in lines 11-14 on page 27
16153	10	27	15	27	25	This paragraph should mention the reuse of parts (cars) or bottles (glass) as possible gains in other industries.	Taken into account - reuse of steel is covered in section 10.4.2.1. Glass falls into section 10.4.2.8 but has not been reviewed.
8287	10	27	23	28	7	In Canada waste tires have been used as an alternative fuel in the cement industry. Reference: http://cieedac.sfu.ca/media/publications/Cement_report_2011__2010_data_Final.pdf Energy Use and Related Data: Canadian Cement Manufacturing Industry 1990 to 2010 John Nyboer, Michelle Bennett prepared for Cement Association of Canada	Noted:- The list is just illustrative and doesn't include many countries with lower alternative fuel use ratios.
4552	10	27	26	27	33	Blending is not equal to reduced product and service demand. I would discuss blending above, similarly as recycling within an industry would be discussed.	Accepted - text moved to previous paragraph, which now reads: "...concretes (Muller and Harnish, 2008). Demand for clinker can be reduced by reducing the clinker-to-cement ratio. Portland cement is comprised of 95% clinker and 5% gypsum. Cement can be produced with lower ratios of clinker use additives such as blast furnace slag from steel mills, fly ash from power plants, limestone, and natural or artificial pozzolans. The weighted average clinker-to-cement ratio for the companies participating in the WBCSD GNR project was 76% in 2009 (WBCSD, 2011). In China, this ratio was 63% in 2010 (China Cement, 2011; NDRC, 2011a). In India ratio is 80% (Sathaye et al. 2005). Reusing continuous concrete elements ..."
4551	10	27	4	27	5	The comment on one company in India has no meaning without further understanding of the context of this plant. Propose to delete this sentence.	Accepted - sentence removed
3024	10	27	7			I suggest considering the fact that in some countries the use of residual fuel oil and petcoke by cement facilities is increasing. The oversupply of high-sulphur petcoke in the Atlantic Basin, due to recent investments in delayed coking units in petroleum refineries, explains this fact. Hence, although the "cement industry could use up to 70% alternative fuels", the availability of low-cost residual fuels can undermine this opportunity.	Taken into account: The phrase that this comment refers to ("cement industry could use up to 70% alternative fuels") has been deleted. Would need peer reviewed literature to include this comment.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9303	10	27	7	27	7	This is completely mistakes. "Cement Technology Roadmap" studied by IEA shows "alternative fuel costs are likely to increase with high CO2 costs". Therefore, it dose not say "the cement industry could use up to 70% alternative fuels by 2050" but "it will be economically viable for the cement industry to use alternative fuels until 2030, when prices will reach about 30% of conventional fuel costs, increasing to 70% by 2050. So, please align this principle with the sentence. I would suggest to rewrite to "the cement industry in developed regions could use up to 60% alternative fuels by 2050 and in developing regions to 35%.	See response to comment 7527
9304	10	27	8	27	10	Good figure. This shows accurate regional estimation on energy efficiency (GJ per ton of clinker) as well as utilization of alternative fuels.	Noted
10148	10	28				Insert a paragraph on "emissions per unit energy" and add here: "Increasing the share of power from combined heat and power plants in the chemcial and petrochemical sector from currently 10 to 25% in most countries to 100% would result in energy savings up to 2 EJ for the activity level in 2006." (Source: IEA as quoted in comment 8)."	Accepted. Added "A theoretical estimate suggest that increasing the share of power from combined heat and power plants in the chemical and petrochemical sector from current levels of 10 to 25% to 100% would result in energy savings up to 2 EJ for the activity level in 2006 "
10139	10	28	11		13	Delete sentence and substitute it with the more specific sentence: "The global GHG emissions attributable to the chemical industry have been estimated to be about 1.81 GtCO ₂ e (CO ₂ , N ₂ O, F-gases, CH ₄). (Source: http://www.wri.org/publication/world-greenhouse-gas-emissions-in-2005 : World Greenhouse Gas Emissions in 2005 is a comprehensive view of global, anthropogenic greenhouse gas (GHG) emissions. The chart in this working paper is an updated version of the original chart, which appeared in Navigating the Numbers: Greenhouse Gas Data and International Climate Policy (WRI, 2005).) About 80% of the direct greenhouse gas emissions of the chemical industry are caused by the following products/processes: Nitric acid, cracker products, ammonia, adipic acid, hydrogen/syngas (including methanol), soda ash, aromatics, carbon black, with the first three products/procees being responsible for more than 50%. (Source: Methodology for the free allocation of emissions allowanced n the EU ETS post 2012 - sector report for the chemical industry, Ecofys (Study leader), Nov. 2009, EU Study contract: 07.0307/2008/515770/ETU/C2). It has been estimated that the worldwide energy saving potential related to the chemical and petrochemical sector in 2006 was about 35% as compared to reported final energy use in energy statistics. The saving potential stems from implementation of Best practice technology (1,8 EJ/yr primary energy savings), increased use of CHP (2 EJ/yr), process integration (0.9 EJ/yr), processing of post-consumer waste from products originating from the chemical and petrochemical sector (recycling and energy recovery, 2.4 EJ/yr). Additional potential for GHG emission reduction stems from fuel switch from coal to natural gas in China and India." (Source: Chemical and petrochemical sector - Potential of best practice technology and other measures for improving energy efficiency, IEA information patepr, Saygin et al., 2009)	Noted - although the suggested replacement simply seems to be a restatement of what is already in the text - albeit with the addition of a few other chemicals.
10140	10	28	15			Insert: "Additionally the synthesis of chlorine in the chlor-alkali electrolysis is responsible for about 40% of the electricity demand of the chemical industry, which causes indirect emissions for electricity production." (Source: Arn Mike et al., Estimating the carbon footprint of the worldwide chemical industry, Menlo Park, California: SRI Consulting, 2007). Delete the last sentence in line 15, as this does not refer to the emissions caused by the manufacturing of chemicals. It would belong to section 10.5., but then a general discussion of the value chain emissions of the chemical industry in general should be included there instead of just picking out one example.	Accepted

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
10141	10	28	16	29	2	The whole following paragraphs should be structured based on "GHG efficiency and energy efficiency of processes", "emissions per unit energy" and "Efficiency in use" according to the scheme on page 20. Within the first part on "GHG efficiency of processes" the options should be analysed according to their share of GHG emissions in the chemical industry (see comment above). Accordingly opportunities to reduce N2O emissions from nitric acid and adipic acid production would be discussed first (lines 28-32 and 41-47). Ethylene/Cracker products would be discussed second (lines 18-24) and ammonia/fertilizer production third (lines 24-28 and 39-41 and 47 ff.) See following comments for details. In general the references given in these paragraphs could not be found in the references section on page 70 ff.	Noted. Due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
10628	10	28	16	28	19	The sentences; "The majority of energy use in the production of ethylene is in the steam cracking process, which produces ethylene from a variety of hydrocarbon feedstocks. Steam cracking processes were responsible for emissions of around 180MtCO2/year (Ren et al. 2006), and consumed about 65% of the total energy used in ethylene production." should be replaced with the following sentences; "Steam cracking for the production of light olefins, such as ethylene and propylene, is the most energy consuming process in the chemical industry, which is responsible for emissions of around 180Mt CO2/year, and the pyrolysis section of steam cracking consumes about 65% of the total process energy (Ren et al. 2006)." The steam cracking consists of three sections; pyrolysis section (thermal cracking of hydrocarbons such as naphtha), fractionation and Compression section and separation section (recovery of light olefins such as ethylene and propylene). It should be clarified that pyrolysis section is the most energy consuming section in the course of steam cracking.	Accepted - but with the absolute number removed as it had no date
17512	10	28	18	28	19	To what period do these figures apply?	Absolute emissions number now removed - see response to comment 10628
10143	10	28	18			To which year does the figure refer?	See above
10144	10	28	22		24	Unclear what is meant with this statement. Concerning the use of biomass see comment no. 6 above. Potentially the study by Ren and Patel from 2009 did not include the quite recent findings on the influence of indirect land use change, yet. Unfortunately this cannot be checked as the reference cannot be found on page 70 ff.	Noted - see below, and also: due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
10629	10	28	23	28	24	The sentence; "avoided CO2 emissions are due to "electricity cogeneration" should be replaced with the following sentence; "fossil energy use could be avoided because biomass energy is used to produce electricity (electricity co-generation), resulting in reduction of CO2 emission." Because, "the electricity co-generation" is not self-explanatory.	Accepted. Changed to "Switching to a biomass-based route as an alternative to steam cracking could reduce total CO2 emissions per ton of output (Ren and Patel 2009) but with significantly higher energy use, and would increase demand for diverting land-use away from food production"
10145	10	28	26		28	43% energy savings in ammonia production are mentioned as being possible in these lines, whereas in line 39 to 41 it is stated that technological innovation within the current process of ammonia production is limited.	Changed to "with further savings possible by applying best available technology"

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
10142	10	28	31		32	The comment also refers to lines 41 to 47. Sentence should be changed to "The N2O decomposition technology allows reduction of emissions between 85% and 98% depending on the exact plant setup." The following sentence should be added: "While implementation of this technology has been largely completed in regions incentivizing carbon emission reduction like e.g. the EU through the ETS or China through CDM, the implementation of this technology still offers large mitigation potential in other regions like the former soviet union and the US." (Source: Industrial N2O Projects Under the CDM: The Case of Nitric Acid Production, Anja Kollmuss, Michael Lazarus, November 2010, Stockholm Environment Institute Working Paper WP-US-1007).	Accepted.
10147	10	28	33		36	Efficiency in Use: Delete the end of the first sentence "to the use of plastics as a means of demand reduction" and substitute by "to chemicals". Delete the sentence on recycling. Instead insert: "In the chemical production itself the integration of plants producing excess heat with plants requiring heat in a large plant verbund has shown to be able to reduce energy demand and GHG emissions considerably. Efforts to reduce the material input per product depend on chemical companies changing from material providers to solution providers, which is a trend observed in the industry. Chemical companies e.g. develop advanced fertilizers containing N2O-inhibiting components and train farmers on the efficient use of them. This results both in reduced...." (Source: BASF report 2011 reviewed by auditors, page 98 states: The Verbund system is an important component of our energy efficiency concept. Waste heat from one plant's production processes is used as energy in other plants. In this way, BASF saves more than 18 million MWh each year, which corresponds to savings of 3.7 million metric tons worth of carbon emissions annually. Furthermore, the by-products of one plant can be used as feedstock elsewhere, thus helping us to use raw materials more efficiently.)	Noted - this form of energy exchange between industries is discussed in section 10.5
10630	10	28	34	28	36	The sentence; "To produce a high value recycled material with favourable properties, a pure waste stream is required, as impurities in inputs to the recycling process greatly degrade the properties of the recycled material." should be deleted, because a pure waste stream is not always the solution for recycling of plastics, ie, in Asian countries including Japan, a mixture of polyethylene and polypropylene is used for recycling.	Taken into account. Added " Although some plastics can be produced from mixed waste streams, these generally have a lower value than virgin material."
10146	10	28	47	29	2	Does this paragraph refer to fuel switch? This most important option to reduce GHG emissions in the chemical industry is missing so far. The beginning should therefore read: "Fuel switch from coal to natural gas has a large impact on the emissions from chemical plants in general. E.g. the fuel switch in ammonia production plants can lead to the following significant GHG emission savings; for example....GHG emission savings....".	Accepted - the section restructured to give fuel-switching more priority earlier on.
16154	10	28	8			Reduced demand or "Sobriété" is described by authors such as Salomon et al. 2003 "A newagatt scenario for 2005-2050" ECEEE Stockholm. The European ECEEE has devoted important energy in its recent referenced publications (ECEE summer studies) to publish peer-reviewed studies on policy regarding patterns of consumption. Maybe it deserves to be quoted here.	Noted - while the suggested reference is interesting, it is not directly relevant to this chapter as it focuses on energy use in other sectors rather than in industry.
7720	10	28	30	28	32	The data on emissions N2O from industries are too old and outdated. Update should be necessary.	Accepted - has been updated
18528	10	28	9			This section contains good information, but the topics are often intermixed - i.e. it would be clearer for the reader the section were to adhere to the exact categorization of the other sections (e.g. material efficiency, emissions efficiency and fuel switching, etc.) with clear deliniations of text accordingly.	Noted - the section has been restructured

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
15917	10	29	11			might use pulp and paper figure for world, not just EU	Noted - We are currently unaware of any published global figures for this. In any case, the example is useful to point out that there are limits to energy efficiency even in the most developed nations unless new emerging technologies are adopted.
7495	10	29	31	30	4	“Black Liquor Gasification which uses the byproduct of the chemical pulping process has the potential to replace the commonly used Tomlinson recovery boiler as an alternative technology to increase safety, flexibility and energy efficiency of pulp and paper mills (Naqvi et al. 2010). With commercial maturity expected in 1015 years (Eriksson and Harvey 2004), Black Liquor Gasification can be utilized as a waste-to-energy method with the potential to achieve higher overall energy efficiency (38% for electricity generation) than the conventional recovery boiler (9-14% efficiency) while generating an energy-rich syngas from the liquor (Naqvi et al. 2010). The syngas can also be utilized as a feedstock for chemical production or to produce dimethyl ether, which can be used as a diesel substitute in road transport (Pettersson and Harvey 2012; Takeishi 2010)”. I think in Canada, methanol is made from black liquor.	Accepted - Yes, methanol can be produced from black liquor. This has been added to the text.
18530	10	29	4	29	19	This is a useful example from Europe, but what about the rest of the world? They won't have the same efficiencies. How do they compare to this European example?	Noted - We are unaware of any published global figures for this. In any case, the example is useful to point out that there are limits to energy efficiency even in the most developed nations unless new emerging technologies are quickly adopted.
18531	10	29	20	30	4	It seems that much of this discussion would actually belong under the category 'energy efficiency'.	Taken into account - The section has been re-structured to be consistent with other sections.
18529	10	29	3			This section misses an introduction to the pulp and paper industry that the preceding sections have, clarifying e.g. % of emissions, some basics of the process, etc. This would be useful, and would also then allow a clear delimitation of the beginning of the energy efficiency discussion.	Accepted - A short introduction has been added to the section.
17514	10	30	18	30	19	The substitution of electronic media for paper media produces mixed environmental outcomes. Contrary to the statement here, there is substantial research on this. See, e.g., Gard, D. L. and G. A. Keoleian. 2002. Digital versus print: Energy performance in the selection and use of scholarly journals. <i>Journal of Industrial Ecology</i> 6(2): 115-132; Reichart, I. and R. Hirsch. 2002. The environmental impact of getting the news: A comparison of on-line, television, and newspaper information delivery. <i>Journal of Industrial Ecology</i> 6(3-4): 185-200. □	Taken into account - the text has been modified to reflect the fact that there has been some research done in the area.
6744	10	30	2	30	4	State the potential with the proposed action.	Noted - No quantifiable potential is provided in the reviewed references.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
17515	10	30	21	30	21	Isn't there a more recent reference than 2003? The metals industry has been changing rapidly. I tried checking the citation indices, but could not locate the reference by Sjardin.	Noted - We are continuing to try and find more recent data, however this is currently the most comprehensive list of consistent system boundary emission factors found. Moreover: due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved.
6745	10	30	22	30	23	Use relative values and compare to total industry emissions.	Taken into account: Aluminium production (by mass) is now contrasted to that of steel
6746	10	30	25	30	25	Use relative values and compare to total industry emissions.	As above
12350	10	30	32			The emission factors in the table; do they apply for 100 % fossil reductants? Please specify what reductants the factors are based on.	Take into account: The emission factors are based on the average mix of reductants used in industry. Table has been removed in SOD.
12349	10	30	20			There are no description of mitigation options for PFCs. PFCs from aluminium production can be reduced substantially by process control.	Accepted - has been included. However, the ability to drastically reduce the production of PFCs is still limited by new process developments (such as inert anodes) and these remain elusive. Many details of PFC production were covered in section 3.5.4.2. - Working Group III: Climate Change 2001: Mitigation. Where possible, updates of this information will be included, including the potential with best available technology.
17517	10	31	1	31	1	what is "te"?	Accepted - it should have been 't'
17519	10	31	18	31	18	What is "net site electricity"?	Changed to net electricity (site). Definition of net electricity from EIA is: 'Net Electricity' is obtained by summing purchases, transfers in, and generation from noncombustible renewable resources, minus quantities sold and transferred out. It does not include electricity inputs from onsite cogeneration or generation from combustible fuels because that energy has already been included as generating fuel (for example, coal).

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
17518	10	31	27	31	29	19%, 15%, 14% -- of what? The energy use in the food industry? What makes up the other 50%? What dates are covered?	Accepted - of total energy use in the industry
18532	10	31	27	31	46	Is this US example representative for the rest of the world? If not, how does it vary?	Accepted - we don't know - so have clarified that we only have US data.
16155	10	31	47	32	13	Important paragraph, explicit findings. But does it not duplicate with chapter on agriculture?	Noted - we will coordinate with the Agriculture chapter on this for the final draft
5747	10	31	48	31	48	this loss is equivalent to around 1/3 of other resources like energy needed for example (http://www.fao.org/docrep/014/i2454e/i2454e00.pdf)	Accepted - sentence added "Therefore apparently one third of food related energy demand and associated emissions could be saved by avoiding waste"
9621	10	31				Please, insert this; the survey in 18 countries shows introducing heat pumps reduce CO2 emissions by 49 Mt per year.[1] [1]Yasuhiro Sakamoto, Masanobu Sasaki(2011), Analysis Methodology Proposal for CO2 and Primary Energy Reductions Potential with Heat Pump Technologies in the Food and Beverage Sector and its Results in Major Countries https://www.jstage.jst.go.jp/article/jee/6/4/6_4_830/_pdf	Noted - this seems to replicate the point, but is difficult to use as the 49Mt must be relative to total emissions for this sector in those countries, and be relative to a particular year.
10016	10	31				This section should include a good example; A total reduction of 49 Mt-CO2 per year can be expected for the 18 countries in the food and beverage sector, by substituting heat pumps for steam boilers among applications operating at an end use temperature below 100C, as described in (Sakamoto, 2011, page840). <Reference> [1] Sakamoto et al (2011). Analysis Methodology Proposal for CO2 and Primary Energy Reductions Potential with Heat Pump Technologies in the Food and Beverage Sector and its Results in Major Countries. Available at: https://www.jstage.jst.go.jp/article/jee/6/4/6_4_830/_pdf	Noted - this seems to replicate the point, but is difficult to use as the 49Mt must be relative to total emissions for this sector in those countries, and be relative to a particular year.
6747	10	32	1	32	13	This is important statements; however should it be placed under technology mitigation possibilities, maybe it could be move to policies.	Noted - but section 10.4 is the only section going into sufficient sector-specific detail. Moreover policy section must be based on assessments of policy effectiveness where possible. We will however consider making a cross-reference between this sub-section and policies section.
15918	10	32	13			sugesting that people eat less meat and milk could be controversial. Suggest revisiting this statement	Noted - but all of the statements made with regards to the possible reductions in emissions by reducing consumption of meat and dairy products cite peer reviewed papers
8288	10	32	23			Figure 10.9 does not provide much of an insight, could be removed to save the space, with text below slightly modified	Accepted

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16156	10	32	30			The figure in absolute terms is not very meaningful. Maybe a percentage would be more helpful	Sentence changed to: Hong et al. (2010) reports energy savings of CO2 emissions reductions of about 1% the Taiwan's textile industry following the adoption of energy-saving measures in 303 firms (which was less than 10% of the total number of textile firms in Taiwan in 2005) (Chiu, 2009).
8289	10	32	30			140 kt/CO2 - what is that unit?	Noted - but no longer relevant as the number has been replaced by a %, as above.
16157	10	33	15	33	17	Essential line in favour of recycling (link with paragraph on waste?)	Noted - thank you.
15879	10	33	4			Mining sector section could be expanded (e.g., use of solar thermal energy in Chilean copper mines, also in heavy oil (e.g., see Chevron's solar to steam facility in their Coalinga oil operations in California) . Other mitigation options not discussed include switching to cleaner fuels for mining trucks, electrification of mines, etc	Noted - however mining is not a priority sector, because its total energy use is relatively low. Potentially we could expand figure 10.2 to demonstrate this.
11135	10	34		34		Word "strong" is not an appropriate definition	Accepted - changed to "GHGs with high GWP". But table 10.6 has been removed from SOD
11136	10	34		34		Under "Chemicals" should include HFC-23 in section on non-energy emissions	Accepted - But table 10.6 has been removed from SOD
17521	10	34		34		Column 1: Explain "Pure 'Kaya'"; What does the heading "Industry Kaya" mean? Columns 2-4: Activity is not a good label for these 3 columns -- many of the entries are not activities. Column 3, Chemicals row: "more intense use" is NOT equivalent to more efficient use. Increased intensity means more materials per dollar output.	Accepted - But table 10.6 has been removed from SOD
10149	10	34				First row "sector-wide", column "material input/output": Put biomass-based feedstock as last option in brackets and add "sustainable". Row "Chemicals": Column "products/services": add as first issue "cooperation with costumers to develop complete solutions", column "material input/product": delete bio-based materials and add as first issue "development of improved materials", column "energy/material": delete current entry and substitute by "increase energy efficiency of processes (steam cracking, ammonia, chlorine production etc.), integration of several chemical plants in a verbund site", column "emissions/energy": delete and write instead "CHP, renewable power, fuel switch from coal to gas/waste".	Accepted - But table 10.6 has been removed from SOD
18533	10	34				This table is very useful! The order is the only puzzling bit - i.e. why does it vary with the order of options presented in 10.4.1? I.e. why wouldn't energy intensity appear in the left-most column?	Accepted - But table 10.6 has been removed from SOD

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
10017	10	34				<p>"Heat pump" should be mentioned not only in food and beverages sector but also in other industrial sectors. There are many cases where heat pump technology is applied in industrial sectors, as described in (IEA/OECD, 2010, page65-83) and (UNIDO, page38, Fig14). In addition, the column of "GHG INTENSITY" should explain that CCS has problems such as high cost, difficulties in site selection, and difficulties in public acceptance, as shown in (Finkenrath, 2011, page7), (Rubin, 2007, page4447, Table3), and (Zobacka, 2012, Abstract).</p> <p><Reference> [1] IEA/OECD Heat Pump Centre (2010). Special Task: Case Studies. Available at: http://www.heatpumpcentre.org/en/projects/specialtasks/casestudies/Documents/Case%20Studies%20report.pdf [2] UNIDO. Renewable Energy in Industrial Applications: An assessment of the 2050 potential. [3] Finkenrath, M (2011). Cost and Performance of Carbon Dioxide Capture from Power Generation, International Energy Agency. [4] Rubin, E.S., C. Chen & A.B. Rao (2007). Cost and performance of fossil fuel power plants with CO2 capture and storage. Energy Policy 35, 4444–4454. [5] Zobacka, M.D. & S.M. Gorelick (2012). Earthquake triggering and large-scale geologic storage of carbon dioxide. Available at: http://www.pnas.org/content/early/2012/06/13/1202473109.abstract</p>	See response to comment 12345
12351	10	34	2			The cells "GHG intensity", "emissions/energy" regarding Non-ferrous metals is empty. PFC-reduction from aluminium production is an important option here, since PFCs from aluminium production can be reduced substantially by process control. Fuel-switching is also important for non-ferrous metals. Fuel-switching can lead to reductions from aluminium production by substituting fossile fuel used for casting. Fuel-switching is also relevant for other non-ferrous metals like silicomanganese, silicon and ferromanganese.	See response to comment 12349. Table 10.6 has been removed.
15896	10	34	2			Simplify table 10.6. Some repetition between sectors	Noted - but table 10.6 has been removed in SOD
9305	10	34	2	34		Reader may confuse cement with concrete. Cement-row in this table shows that a Production/service-column is "concrete" performance but other columns are "cement" characteristics such as Energy intensity and GHG intensity. Therefore, in order to align with column of other sectors in the Table, I would strongly suggest to leave "blank" in the cell instead of concrete characteristics.	Taken into account - new text added to 10.4.2.2 to clarify this "Concrete is formed by mixing specific proportions of cement, water, sand and aggregates. Almost all cement is used in this form to construct buildings and infrastructure (van Oss & Padovani, 2002)" [Ref: Oss HG, Padovani AC. "Cement Manufacture and the Environment: Part I: Chemistry and Technology". Journal of Industrial Ecology. 2002;6(1):89–105.]
7110	10	35	17			There is a whole book dedicated to mitigation in tourism: Gössling, S. 2010, Carbon Management in Tourism, Routledge.	Taken into account
17522	10	35	21	35	22	Define/explain acronyms - WTTC, ETC, UNWTD.	Accepted - acronyms now defined
7111	10	35	22			if this is a quote, " are missing plus page number in reference (Scott et al. 2010)	Accepted

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
16158	10	35	25	35	26	Sentence is not clear. Does the target put a burden on other sectors? Or the opposite?	Noted - the idea is that "the current emission targets" proposed by the stakeholders (stated above) would increase the effort needed in other sectors.
5220	10	35	26	35	26	As Scott et al. 2010 show, by 2050, the burden cannot be taken up by other sectors because it exceeds the target emission level avoiding dangerous climate change. It seems important to mention this at this place. Also, this is the place to put emphasis on the fact that by reducing demand in some small subsectors of tourism (long haul, cruises) effective emission reduction may be reached with a minimum of damage to then sector. and may be refer to Peeters, P. M., & Dubois, G. (2010). Tourism travel under climate change mitigation constraints. Journal of Transport Geography, 18, 447–457.	Accepted - text modified "some research and found using the current target would put in additional unstirred unsustainable burden on other sectors of the economy, why some authors also point that by reducing demand in some small subsectors of tourism (long haul, cruises) effective emission reduction may be reached with a minimum of damage to the sector Peeters, P. M., & Dubois, G. (2010)
17523	10	35	30	35	30	Use consistent terminology. Is "industry" a sector or is it composed of sectors? Does "industry" refer only to manufacturing or is it used more broadly? This a problem throughout the chapter.	Taken into account - the revised introduction (10.1) aims to define the various terms
17524	10	35	37	35	37	The phrase "or reuse of waste or byproducts" is redundant as that is a defining characteristics of symbiosis and eco-industrial networks. Change "or" to "i.e." or "e.g."	Accepted - but sentence no longer in SOD
10150	10	35	42	36	29	The example of chemical industrial parks (so called chemical "Verbund Sites") should be related. These have been proven to reduce energy and resources consumption and reduce the risks, costs and emissions from chemicals transportation for a long time already. (Source: see comment 16)	Noted - however due to very limited space we cannot address many specific examples
9075	10	35	27	38	2	10.5 Infrastructure and systemic perspectives can be deleted due to limitations on the nos of pages	Rejected: the structure of the sectoral chapters is defined by the IPCC plenary. Moreover, this section is very important to underline mitigation options through industry cooperation which is increasingly realized in practice.
17525	10	36	10	36	11	Additional reference - Brazil: Ferrer, G. S. Cortezia, and J. M. Neumann. 2012 Green City: Enviornmental and Social Responsibility in an Industrial Cluster. Journal of Industrial Ecology 16:1: 142-152.	Noted: We have updated this section and unfortunately do not have more room for adding this reference.
8290	10	36	13			Reference Ghosh and Roy 2011 is not listed in the References section. There are other references missing (e.g. Geng et al)	Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
17528	10	36	25	36	29	Indicate the period of time that is encompassed by this statement.	Accepted - text revised. The Chinese case is from 2002 to 2005, while the Japanese case is from 1997 to 2006

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
5021	10	36	30	36	36	It is widely recognised that the by-product slags from brast furnace for steelmaking replaces cement clinker, which need to use massive energy to produce, thus replacing klinker by BF slags can reduce CO2 emission in a massive scale.	Noted - We have very limited space to introduce every details in our draft and here the cement case is just one example. We believe that one sentence for one example is enough here. See section 10.4 for use of blast furnace slags for cement clinker replacment.
15920	10	36	31	36	50	burning of municipal waste can have air pollution impacts if not controlled	Noted - waste and waste handling are dealt with in section 10.13
16159	10	36	44	36	48	Very long sentence, could be split for clarity	Editorial - copyedit to be completed prior to publication
15919	10	36	9	36	11	there are SME clusters in US too: IT in California, biotech in Boston, energy in Houston, etc	Noted: Due to space limits, we have shortened our introduction on SMEs, but with a strong focus on industrial symbiosis.
8004	10	36	30	36	36	It is widely recognised and reported quantitatively that cement clinker can be replaced by the blast furnce slags and it makes eliminating CO2 emissions from CaCO3 cracking and saving energy for cement kiln.	Noted - We have very limited space to introduce every details in our draft and here the cement case is just one example. We believe that one sentence for one example is enough here. See section 10.4 for use of blast furnace slags for cement clinker replacment.
17529	10	37	1	37	7	Better wording: "The reuse of materials recovered from urban infrastructure..." While term "urban mining" is unfortunately used inconsistently, the appropriate usage refers to recovering materials from in-use stocks (either actively used stocks or dormant stocks). That is, it does not refer to recycling of discards. See Klinglmair, M. and J. Fellner. 2010. Urban mining in times of raw material shortage: Exemplified by copper management in Austria during World War I. Journal of Industrial Ecology 14(4): 666-679. The wording in this paragraph should be more precise if the intention is to describe urban mining rather than just recycling.	Accepted
10151	10	37	21		23	Change sentence to: "These materials cause GHG emissions at the time of manufacturing, but the avoidance of emissions in the use phase is larger by factors between 1:2 (polymers for packaging) and 1:230 (materials for thermal insulation of buildings)."	Rejected - no reference provided
10152	10	37	23		28	Delete these sentences and write instead: " To unlock the full innovation potential for GHG emission mitigation and in order to avoid counterproductive actions, full value chain analyses are required on product as well as on corporate level. Standards and best practices for this are evolving." (Source: The Greenhouse Gas Protocol, http://www.ghgprotocol.org/)	Accepted - text revised partly based on suggestion
16160	10	37	29	37	38	Suggestion : note that recent building standards such as in France or Switzerland do take into accounr the embodied emissions, called here "grey energy".	Accepted - but due to space limitations only a limited number of examples kept
17530	10	37	47	37	48	it is not true that "the quality of many metals is maintained SOLELY through addition of pure primary materials" Effective sorting plays an important role as well. The sentence should be reworded.	Accepted and will add this point (in Final Draft)

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
3865	10	37	7	37	8	Do we really need large scale bioenergy production to significantly mitigate climate change. See Pacca and Moreira, 2011 - Pacca, S. and J. R. Moreira, 2011. A Biorefinery for Mobility? Environ Sci Technol. 2011 Nov 15;45(22):9498-505.	Noted - while we consider bioenergy important, it is discussed in Chapter 7 (Energy).
10018	10	37	8	37	15	This paragraph should be deleted totally or explain that CCS is costly and has technical uncertainty, even if CO2 sources and sinks were clustered. CCS has problems such as high cost, difficulties in site selection, and difficulties in public acceptance, as shown in (Finkenrath, 2011, page39) and (Zobacka, 2012, Abstract). These literatures are listed in the No47 line of this table.	Accepted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
5020	10	37	16	37	38	One example of the necessity for cross sectoral implications is shown by WorldAutoSteel project. Fuel efficiency policy of automobiles usually only focus on tail-pipe emissions. In this study (by University of California Davis), total lifecycle emission from automobiles can be saved more by using advanced high-strength steel and innovative design/forming technologies, even though tail-pipe emission shows slightly higher emission as compared with other materials such as Aluminium. Social level mitigation can only be achieved such a cross-sectoral life-cycle analysis. See following: http://www.worldautosteel.org/life-cycle-thinking/greenhouse-gas-materials-comparison-model/	Accepted
10153	10	38	11			Substitute "cement" by "materials" as a large variety of materials (including speciality chemicals) is used for building embankments	Accepted
8291	10	38	15	38	19	Repeating sentences	Editorial - copyedit to be completed prior to publication
10205	10	38	15	38	19	These two sentences can be combined	Editorial - copyedit to be completed prior to publication
5697	10	38	20	38	27	An example of temperature increase feedback on tourism adaptation should be mentioned here. I suggest: "An increase in summer tourism activities is already observed in alpine areas during hot temperature episodes (Serquet and Rebetez, 2011) whereas winter activities may disappear due to more frequent rain instead of snow (Serquet et al., 2011)." Serquet G, Rebetez M 2011. Relationship between tourism demand in the Swiss Alps and hot summer air temperatures associated with climate change. Clim. Change 108 (1-2): 291-300. Serquet G, Marty C, Dulex JP, Rebetez M, 2011. Seasonal trends and temperature dependence of the snowfall/precipitation day ratio in Switzerland. Geophys. Res. Lett. 38, L07703, doi:10.1029/2011GL046976	Rejected - the section deals with the potential impacts of climate change and adaptation measures on mitigation options for the sector, not with the impact of climate change on adaptation. The remark may be relevant to tourism discussion in WG2
7098	10	38	23	38	23	References missing in reference list - I am however doubtful they adequately confirm the point made about desalination. "induces growing demand" - of what?	Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved. That segment of text no longer appears in SOD.
7099	10	38	24	38	26	Another example is... - unsubstantiated, not sure "pilgrimage" makes sense in this sentence? Handmer et al. 2012 - not in references. A comprehensive volume on tourism and climate change interactions is Scott, D., Hall, C.M. and Gössling, S. 2012. Tourism and Climate Change, Routledge.	Accepted
17531	10	38	24	38	25	Is snowmaking really used to maintain pilgrimages?	Accepted
10206	10	38	25	38	27	Unclear and not specific enough	Accepted
17532	10	38	31	38	33	This sentence is garbled.	Editorial - copyedit to be completed prior to publication
8292	10	38	40			underStand	Editorial - copyedit to be completed prior to publication
9536	10	38	46			Please, clarify here as probability of an 80% chance is different from that 278% (mean 54%) in Chapter 1. (AR5 FOD, p.22 L13)	Accepted - text has been revised thoroughly in SOD and will be further improved in Final Draft

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6750	10	38	7	38	13	This part is very speculative and lacks trust. Rewrite, add source or leave out.	Noted - we have made it clearer in the SOD that there is no literature to back up the statements
18536	10	38				This is admittedly a very difficult section, but seems to be in a much more preliminary state than the preceding sections. It would need more effort to assure 1) a clear step-wise development from the AR4 (clarifying differences in approach and methodology where relevant, and also what has changed since the AR4) and 2) adherence to agreements in Wellington (e.g. discussion of historical cost trends, and presentation of figures in terms of \$/GJ or \$/CO2-eq where possible).	Accepted - text has been revised thoroughly in SOD and will be further improved in Final Draft
18537	10	38				Please note that all costs should be presented in terms of 2010US\$, as agreed for use across the AR5.	Accepted
13062	10	38	28	40	10	On the Costs & Potentials issues it is difficult for the reader to access the bigger picture of the cost & potential information. Each sector has its own approach to costs and potentials, which is appropriate as each sector has its own unique qualities and considerations. Nonetheless, the information that will be most relevant to take-away for policy-makers is overarching cost information that brings these different pieces together. To help policy-makers access this information, it should be important to highlighting market realization, but also the policy aspects of cost (by policy it is meant institutional frameworks and/or market frameworks and/or capacity building arrangements, etc...). In both developing and developed countries policy can have a strong impact on cost. Simply looking across the costs & potentials sections of the sector chapters, the reader could miss this message, although the information on policies and measures is there in the chapter. Therefore it could be important to make sure that these informations are put in perspective appropriately.	Accepted - text has been revised thoroughly in SOD and will be further improved in Final Draft
17533	10	39	10	39	10	What former IEA report? Provide a reference.	Accepted - energy Technology Transitions for Industry IEA 2009.
10154	10	39	15		16	Unclear what is meant. It is assumed that the sentence refers to the source quoted on page 86, line 21/22, and in this source table 1.4. on page 34 is summarized. A clearer statement would be: "Two sectors (Iron and steel and Chemical and petrochemical) contribute more than 80% to the total industry CO2 emissions reductions potential by 2020 of 969 MtCO2."	Accepted - text has been revised thoroughly in SOD and will be further improved in Final Draft
16161	10	39	18			Missing word in the sentence	Editorial - copyedit to be completed prior to publication
8293	10	39	18			China and ???	Editorial - copyedit to be completed prior to publication
3027	10	39	18			A word is missing in the sentence after "and": "Akashi, Hanaoka et al. 2011 also indicate that the largest potential for CO2 emissions savings for some energy intensive industries comes from China and."	Editorial - copyedit to be completed prior to publication
15921	10	39	19			"\$100/tCO2" --> need a reference for this	Accepted - text has been revised thoroughly in SOD and will be further improved in Final Draft
15922	10	39	22	39	24	unlikely that 60% can be achieved at negative cost because it would have been done. Should use more than McKinsey for cost references since McKinsey generally presents a very optimistic viewpoint.	Accepted - references other than McKinsey have been used in SOD version
17534	10	39	22	39	22	What is a MAC study?	Accepted - acronym now defined
10155	10	39	22			The quoted reference cannot be found on page 70 ff. Assuming that the McKinsey "Pathways to a low carbon economy" is referred to, the sentence should be clarified as follows: "MAC studies show that the highest potential within the industrial sector excluding power is in....."	Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved

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10632	10	39	22	39	24	The sentences; "MAC studies also show the highest potential is in chemicals, followed by iron and steel and cement: 2, 1.5 and 0.9 GtCO ₂ /year respectively. 60% of this potential can be achieved at negative costs or at a cost less than 20 euro/tCO ₂ (McKinsey Company 2009)." should be replaced with the following sentences; "MAC studies also show the highest potential is in iron and steel, followed by chemicals and cement: 2.4, 1.9 and 1.0 GtCO ₂ /year respectively. 75% of this potential can be achieved at negative costs or at a cost less than 20 euro/tCO ₂ (McKinsey Company 2010)." Revised report is published by McKinsey in 2010 as follows; (See pages 8 and 9 of the revised report) http://solutions.mckinsey.com/climatedesk/default/en-us/Files/wp211154643/ImpactOfTheFinancialCrisisOnCarbonEconomics_GHGcostcurveV2.1.pdf	Accepted - text has been changed. Section has been revised thoroughly in SOD and will be further improved in Final Draft
15268	10	39	31	39	35	The importance in the mitigation evaluation for each sector of whole value chain like LCA(Ref: A. Gunasekaran, A. Spalanzan, Int. J. Production Economics 140, 35-47(2012)) will be very important and should be noted here.	Taken into account in "gaps in knowledge" section (10.12)
17535	10	39	32	39	33	What is non renewable biomass?	Accepted - Non renewable biomass referred to wood and biomass from deforestation.
17536	10	39	43	39	44	See also Masanet, E. 2010. Energy benefits of electronic controls at small and medium sized U.S. manufacturers. Journal of Industrial Ecology 14(5): 696-702.	Accepted, reference has been used.
16162	10	39	48			This paragraph should mention the horizon of saving, and clarify if the goals.	Accepted - text has been changed. Section has been revised thoroughly in SOD and will be further improved in Final Draft
4558	10	39	48			The statement that future "enhancement of potentials in the same direction may be expensive" is not based on references	Accepted - Section has been revised thoroughly in SOD and will be further improved in Final Draft
16163	10	40	5	40	7	In the case of cement, radical technology such as Novacement, is a possibility with a bigger jump in efficiency without CCS.	Accepted - alternatives to cement now mentioned in several instances in the chapter
16164	10	41		42		Table 10.7 is not very clear, it does not help assessing the different scales of potential both in share and in absolute.	Accepted - Section has been revised thoroughly in SOD and will be further improved in Final Draft
6607	10	41		41		Delete "Increased recycling and use of scrap" from Steel. Increased recycling and use of scrap are not referred in original reference (ETP2012).	Accepted - Section has been revised thoroughly in SOD and will be further improved in Final Draft
10019	10	41		42		"Heat pump" should be included in each industrial sector. There are many cases where heat pump technology is applied in industrial sectors, as described in (IEA/OECD, 2010, page65-83) and (UNIDO, page38, Fig14). In addition, the column of "CO ₂ intensity" should explain that CCS has problems such as high cost, difficulties in site selection, and difficulties in public acceptance, as shown in (Finkenrath, 2011, page7), (Rubin, 2007, page4447, Table3), and (Zobacka, 2012, Abstract). These literatures are listed in the No47 line of this table.	A) accepted - heat pumps now mentioned. B) CCS-related text has been shortened in chapter 10 and discussion is now concentrated in chapter 7 (Energy)
15897	10	41	1			streamline table 10.7. might include challenges. Also, add mitigation costs (\$/tonne CO ₂)	Accepted - Section has been revised thoroughly in SOD and will be further improved in Final Draft

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18538	10	41	1			A lot of the information here is the same as presented in Table 10.6. It may be useful to focus mitigation options in Table 10.6 (cutting them from this table), and focus this table on costs and potentials as was done in the AR4 (table 7.8 page 474-475).	Taken into account - Table 10.6 no longer appears in SOD
18539	10	41	1			A reader would expect indicators for chemicals, pulp&paper, and aluminum as is done for cement and steel.	Accepted - included in SOD
11004	10	41				Heat pumps should be also added as one of the measures to reduce energy and CO2.	Accepted - heat pumps mentioned in SoD
10156	10	42				N2O abatement opportunities (large and cheap!!) are missing. Or the headline of the table has to be changed to "CO2 mitigation options: costs and potentials". The problem with bio-based raw materials has been discussed in the above comments.	Accepted - non-CO2 gases now considered in costs and potentials section of SOD
18555	10	42				It's very useful that the structure reflects the mitigation options presented earlier in the chapter. Despite this similar structure, the last point (non-CO2 GHG) doesn't appear in that master structure, so the reader is left wondering why it then appears here.	Accepted -- sentence added to explain contribution of Non-CO2 emissions to process emissions at start on subsection on non-CO2 emissions
18556	10	42				The barriers introduced early in the section (technological, institutional, legal, cultural and financial) are useful, but aren't implemented clearly in the subsequent sub-sections, especially in 10.9.1.4, 10.9.1.5 and 10.9.2.	Accepted -- barrier categories are explicitly assigned to identified barriers in table 10.9
16165	10	43				Is behaviour change so risky if price signals and regulations are in place? See for example the average ration of fish or meat in the plates of Europeans, in marked decrease in ten years.	Noted
7516	10	43		43		Degree of Risk of CCS is very high mainly because of public acceptance and how to pass it's high cost to the customer.	Noted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
18553	10	43				This section failed to adhere to the agreement in Wellington to structure the discussion along the four categories 1) socio-economic effects; 2) environmental and health effects; 3) technological risks; and 4) public perception. The current structure should be amended accordingly. This would also help to better align the sub-sections with what is presented in Table 10.8.	Accepted - structure amended in agreement with Vigo Accord
15888	10	43	1			Co-benefits discussion would benefit from more quantitative examples	Accepted - section has been revised
12013	10	43	1			It should be clearly stated that uncertainty of future, which derives from future market structures, demand and government regulations to name a few, makes any options risky. Even energy efficiency measures are not well explored due to uncertainties.	Taken into account
12035	10	44	13			"On the other hand...." is not a relevant statement to follow the spill-over issues. At least, "public" needs to be clearly defined. The spill-over effects can be easily underestimated as various factors influences investment decisions. Quantatively, it is necessary to analyze changes embedded CO2 associated with export/import of goods. As sated earlier in the chapter, the shift from industrialised to developing countires is quite significant. As the competition becomes more global and the economic situation uncertain in the future long term investment decisions have become more difficult, failing to explore large amount of efficiency improvement potentials.	Noted - trade-related issues are discussed in chapter 14
17539	10	44	15	44	22	Claims on such a controversial topic should be very carefully supported with multiple references!	Taken into account

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10020	10	44	15	44	19	<p>This part should be deleted totally or revised to explain that CO2 leakage caused by the implementation of the ETS happened actually through transfer of industry from one country to others. Market mechanisms at least under Kyoto-like international scheme, where the condition of all countries' meaningful participation is not met, does not work well. This information is described in (Rosendahl, 2011, abstract), (Aichele, 2012, page336), and (Peters, 2011, page1).</p> <p><Reference> [1] Rosendahl, K.E. & J. Strand (2011). Carbon Leakage from the Clean Development Mechanism. Energy Journal, Volume 32, Number 4. [2] Aichele, R. & G. Felbermayr (2012). Kyoto and the carbon footprint of nations. Journal of Environmental Economics and Management, Volume 63, Issue 3, pp. 336-354. [3] Peters, G.P., J.C. Minx, C.L. Weber, & O. Edenhofer (2011). Growth in emission transfers via international trade from 1990 to 2008. Proceedings of the National Academy of Sciences. DOI: 10.1073/pnas.1006388108.</p>	Noted - ETS discussed in chapter 15
17540	10	44	23	44	31	This paragraph needs a segue (from the previous paragraph) and also needs context. Does it belong in this section?	Accepted
18554	10	44	23	44	31	Note in Wellington it was agreed to avoid the term trade-off - this paragraph has made trade-off a focus.	Taken into account
15923	10	44	27			Chemical industry is also emerging at large user of biomass for biochem since much more value added and higher returns on products	Noted
5221	10	44	27	44	28	<p>One important blockage in the scientific discussion of tourism's reduction of emissions (by reducing long haul trips) is the assumed adverse impact of this on the economies of the least developed countries. From a paper under review we wrote, it may be learned that this effect is limited to a special kind of LDC's: small, remote islands. In general other LDC's economies do suffer from increased distances travelled - or may gain from a reduction - in tourism because they will lose part of their neighbour country tourism, without an increase of long haul to fully compensate for this. Overall it appears that the impact is neutral to both LDC's and nonLDC in terms of total trips and for scenarios where travel distances are limited to up to only 1500 km one-way (theoretically of course). Mention of the conflict development of poor countries and long haul tourism can be found in: Gössling, S., Peeters, P., & Scott, D. (2008). Consequences of climate policy for international tourist arrivals in developing countries. Third World Quarterly, 29, 873-901. Peeters, P. (2009). Pro-poor tourism, climate change and sustainable development. Tourism Recreation Research, 34, 203-205.</p>	Noted. Due to re-organisation of SOD text the text on tourism in this section has been deleted (cf. Response to comment 2279)
3028	10	44	27			<p>Please note that chemicals from biorefineries not mandatorily compete with fuels, heat and power produced in those industrial facilities. Chemicals and biopolymers can improve the profitability of biorefineries and, hence, increase the competitiveness of fuels produced in it. Interestingly, this is the case for sugar cane distilleries, which produce sugar, ethanol (fuel and solvent) and heat and power from biomass. The co-production of various energy and non-energy goods increases the profitability of the facility. This is scope economy is found in multi-products plants, such as petroleum refineries (the classical example). Therefore, I don't think that biorefineries are good examples of potential competition between biomass applications, as stressed in the report.</p>	Noted
16166	10	44	28			The conflict between development and mitigation should be described.	Rejected - it is not for industry chapter to describe it in full, see framing chapters for this.
15924	10	44	28	44	31	tradeoffs btw GHG mitigation/energy efficiency and production, environment, safety, reliability are very common and generally GHGs come last...	Noted

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15462	10	44	33	45	6	One significant technical risk that has not been widely addressed is security concerning technologies related to the smart grid. In spite of their potential to greatly enhance transmission and distribution efficiency, so-called smart technologies are vulnerable due to their large reliance on software controls, that are prone to cyber hacking. These need to be addressed so that residents will be assured to their security but also their privacy. See ref: http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=5452993&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpis%2Fabs_all.jsp%3Farnumber%3D5452993	Rejected - not relevant to industry chapter, see Energy chapter for this.
12629	10	44	45	44	47	CCS is commercially available today in certain circumstances in industrial applications - see the Sleipner and Snohvit projects and Weyburn Project. CCS may not necessarily have any greater risks and uncertainties than other technologies.	Noted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
12672	10	44	45	44	47	CCS is commercially available today in certain circumstances in industrial applications - see the Sleipner and Snohvit projects and Weyburn Project. CCS may not necessarily have any greater risks and uncertainties than other technologies.	Noted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
16167	10	44	45	45	6	This paragraph with a sober assessment of CCS is on point. But does it not contradict the more lenient parts on CCS in chapter 7?	Noted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
12352	10	44	45	44	46	All of the (individual) components of integrated CCS Systems exist and are in use today in different sectors. The risk is probably not a technological risk, but an economic risk. The current knowledge of CCS and the challenges related to it, is thoroughly described in the Energy Chapter (chapter 7, page 31, line 5 to 7) and should be the basis also for the description in the Industry chapter (as it provides a more updated view).	Noted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
11783	10	44	45	45	6	These are reasonable.	Noted
6763	10	44	45		6	Good description. It's very important.	Noted
10667	10	44	45	45	6	Support this statement.	Noted
6608	10	44	46	44	47	Important- Should not be deleted.	Noted
12353	10	44	49	45	1	A lot of work on storage capacity in the North Sea has been undertaken (Norway/UK) since 2007. Please include some of these later studies. E.g. CO2 Storage Atlas. www.npd.no (2012)	Noted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
17538	10	44	7	44	7	"despite being the most costly option" for what? GHG mitigation?	Accepted - sentence has been clarified
17980	10	44	8	44	22	Since spill-over effects might play a less important role in this section than agreed in Wellington, this paragraph might be shortened. If it was to be kept, additional literature would have to be added to substantiate the claims made.	noted
6752	10	45	1	45	6	Last part in this section is too speculative without references.	Noted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
17542	10	45	19	45	21	Why does regional variation lead to public acceptance??	Accepted - sentence deleted
12354	10	45	2	45	5	The description of geology (challenges) comes out too negative. This is a matter of careful selection of suitable storage sites. It may not be problems with regard to occupying underground space if depleted gas reservoirs are used for storage, or if storage sites are offshore.	Noted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)

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6753	10	45	22	45	35	This has been discussed. Keep discussion of CCS on one place in one section to avoid writing the same information multiple times.	Accepted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
16168	10	45	22	45	35	Very interesting part.	Noted
9284	10	45	22	45	24	<p>The following statement seems subjective and unsubstantiated: "Industrial CCS does not provide environmental co-benefits, moreover for many people the technology is connected with safety risks. Given the halting of several research projects for CCS due to local opposition, public concerns for safety are often seen as a future barrier to this technology."</p> <p>Industrial CCS can permanently prevent anthropogenically produced CO₂ from being released to atmosphere which in itself bestows multiple environmental co-benefits (in regards to climate change, bio-diversity, more sustainable production processes). The statement should either more accurately reference what aspect of CCS public opinion seems to be uncertain or it should be deleted. For example, it is mostly the storage aspect (not the capture or transport) and is dependant on the specifics of each storage location (both in terms of national regulations, geological site characterisation and proximity to urban centres). For instance, in the Netherlands it refers to on-shore storage (not off-shore storage). And in many other parts of the world, regulations in place that ensure compliance with a high level of environmental integrity and occupational health and safety outcomes.</p> <p>Indeed, the recent acceptance of CCS as an eligible project activity in the United Nations Framework Convention on Climate Change's (UNFCCC) Clean Development Mechanism (CDM) demonstrates that CCS related abatement is easily institutionalised and rewarded within market mechanisms, and is also consistent with the notion of sustainable and equitable development in developing countries.</p>	Accepted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
15925	10	45	22	45	35	CCS is well covered in Chap. 7 - might coordinate to avoid duplication since CCS for powergen is similar to CCS for industry	Accepted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
17543	10	45	30	45	35	These two sentences appear to be contradictory. The first sentence refers to less favorable public acceptance with increased information provision. The second sentence states "In line with this..." and points to value of public engagement. Clarification is needed.	Accepted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
17544	10	45	36	45	39	150 conflicts over what period?	Noted - will be checked
12630	10	45	4	45	6	As described in the IPCC CCS Special report, CO ₂ stored in a properly selected and characterised geological formation will not have any of the risks described here at a high level.	Noted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
12673	10	45	4	45	6	As described in the IPCC CCS Special report, CO ₂ stored in a properly selected and characterised geological formation will not have any of the risks described here at a high level.	comment is duplicate of 12630

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9915	10	45	42			<p>An analysis of 104 empirical studies of innovation to change showed the following barriers, that could refine and structure the discussion of barriers:</p> <p>Issues of resourcing (76%), for instance, “not enough resources” (Post and Altman 1994), “lack of adequate resources such as time and staff” (Adams and McNicholas 2007), limited or no budgeting (e.g. Harris 2000 and Anumba et al. 2006), access to capital and lack of time (Rohdin and Thollander 2006).</p> <p>Issues of capabilities (75%), for instance, “low technology literacy” (Stewart, Mohamed and Marosszeky 2004), “ill-equipped in terms of training and expertise” (Whitaker 1987), “employees are not trained” (Tamimi and Sebastianelli 1998), “lack of understanding” (Waldron 2005), “lack of technical skills” (Rohdin and Thollander 2006), “lack of skill, knowledge and expertise” (Kirkland and Thompson 1999), etc.</p> <p>Issues of communication (64%), for instance, “communication barriers” (Heide, Grønhaug and Johannessen 2002), “communication overload and distortion” (Allen 2002), “lack of communication within the team” (Attaran and Nguyen 1999), “lack of communication among those sharing responsibility for different aspects” (Kunda and Brooks 2000), “poor communication practices that damaged employee commitment to projects” (Jacobs et al. 2006), “tension among departments arising from the incompatibility of actual or desired responses” (Aggarwal 2003), etc.</p> <p>Issues of organizational structure (62%), for instance, bureaucracy (e.g. Molinsky 1999; Borins 2000; Abdul-Hadi, Al-Sudairi and Alqahtani 2005), “salary structure” (Al-Qirim 2007), “complexity, centralization, and formalization”(e.g. Allen 2002), “rigid organizational boundaries” (Butler 2006), “departmental fortresses” (Cicmil 1999), and organizational structure (e.g. Scarbrough and Lannon 1988; McGaughey and Snyder 1994; Yauch and Steudel 2002).</p> <p>Abdul-Hadi, N., Al-Sudairi, A. und Alqahtani, S. (2005): Prioritizing barriers to successful business process re-engineering (BPR) efforts in Saudi Arabian construction industry, In: Construction Management & Economics, Vol. 23, Nr. 3, S. 305-315.</p> <p>Adams, C.A. und McNicholas, P. (2007): Making a difference: Sustainability reporting, accountability and organisational change, In: Accounting, Auditing and Accountability Journal, Vol. 20, Nr. 3, S. 382-402.</p> <p>Aggarwal, N. (2003): Organizational Barriers to Market Orientation, In: Journal of Management Research, Vol. 3, Nr. 2, S. 87-97.</p> <p>Allen, R.Y.W. (2002): Assessing the impediments to organizational change: A view of community policing, In: Journal of Criminal Justice, Vol. 30, Nr. 6, S. 511-517.</p> <p>Al-Qirim, N. (2007): The adoption and diffusion of E-commerce in developing countries: The case of an NGO in Jordan, In: Information Technology for Development, Vol. 13, Nr. 2, S. 107-131.</p> <p>Anumba, C.E.H., et al. (2006): Understanding structural and cultural impediments to ICT system integration: A GIS-based case study, In: Engineering Construction & Architectural Management, Vol. 13, Nr. 6, S. 616-633.</p> <p>Attaran, M. und Nguyen, T.T. (1999): Design and implementation of self-directed process teams, In: Management Decision, Vol. 37, Nr. 7, S. 553-561.</p> <p>Borins, S. (2000): What Border? Public Management Innovation in the United States and Canada, In: Journal of Policy Analysis and Management, Vol. 19, Nr. 1, S. 46-74.</p> <p>Butler, J.C. (2006): Ten Lessons Learned: Data Warehouse Development Project, California Department of Fish and Game. In: CrossTalk: The Journal of Defense Software Engineering, Vol. 19, Nr. 10, S. 16-20.</p>	Accepted -- the barriers highlighted in the comment are contained in the general types of barriers outlined at the start of 10.9; while the references suggested address barriers to business and industry generally, they are mostly not specific to mitigation of GHGs and therefore are not useful in this section.
12631	10	45	7	45	35	Of the 35+ CCS projects operating today there are many more projects that have had neutral to positive public support than have negative.	Noted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
12674	10	45	7	45	35	Of the 35+ CCS projects operating today there are many more projects that have had neutral to positive public support than have negative.	comment is duplicate of 12631
17541	10	45	8	45	8	In what way are the impacts asymmetric?	Accepted - text revised

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17983	10	45	22	45	35	Please provide a cross-reference to and liaise with Chapter 7 to bring the different discussions of CCS impacts across chapters (5, 6, 7, and 11) together.	Accepted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
16169	10	45				Many parts in this section are repeating the previous ones. Maybe the plan of the chapter could be modified to give the same information without coming back to the same topics, and thus saving pages.	Accepted -- redundancy reduced
17545	10	46	14	46	19	These statements are familiar platitudes and could be cut for length.	Accepted -- deleted
8294	10	46	35	46	36	Rohdin compiled barriers reported access to capital - needs to be reworded - unclear	Accepted -- reworded
9537	10	46	39	47	8	Please, move to other related chapter as this is general idea of CHP, rather than a specific industry sector. (CHP – whether applied in industry, in buildings or integrated with DHC networks – offers policy makers a very significant opportunity to achieve a number of energy and environmental goal s at relatively low cost compared to alternatives. (Cogeneration and district energy, 2009, IEA, p31)	Noted -- this section only deals with barriers to industrial use of CHP
10021	10	46	39	46	42	This part should be deleted or revised to explain that the energy efficiency of cogeneration depends on heat demand and that its efficiency would be low if heat is not utilized effectively. This claim is shown in (Pedro, 2012, page82). In addition, this part should also explain the huge potential of "heat pump technology", as described in (IEA, 2011, page16) and (IEA/OECD, 2010, page65-83). <Reference> [1] Pedro J. Mago, Amanda D. Smith (2012). Evaluation of the potential emissions reductions from the use of CHP systems in different commercial buildings, Building and Environment 53, 74-82 [2] IEA (2011). Technology Roadmap: Energy-efficient Buildings: Heating and Cooling Equipment. Available at: http://www.iea.org/papers/2011/buildings_roadmap.pdf [3] IEA/OECD Heat Pump Centre (2010). Special Task: Case Studies. Available at: http://www.heatpumpcentre.org/en/projects/specialtasks/casestudies/Documents/Case%20Studies%20report.pdf	Rejected -- CHP in industry raises specific barriers not generally common to other energy efficiency options; this section is not on technology options and other heat pump comments are considered replies associated with 10.4; literature given focuses mainly on CHP in buildings not industry
17985	10	46	25	46	26	Please use the term "barriers" but not "issues". The meaning of these terms differ in the AR4 Glossary and this difference might be kept in the AR5 Glossary.	Accepted -- barriers replace issues
3029	10	47	1			I am not very comfortable with the idea of considering the Clean Air Act (or other command and control policies for local pollutants) as a barrier to industrial CHP. Local pollutants regulation is a requirement of societies and should not be removed as a barrier to mitigate GHG emissions.	Accepted -- reference to the CAA removed
10022	10	47	19	47	21	This part should be deleted totally. Carbon pricing and international emission trading do not always result in reducing CO2 emission. In addition, CO2 leakage caused by the implementation of the ETS happened actually through transfer of industry from one country to others. Market mechanisms at least under Kyoto-like international scheme, where the condition of all countries' meaningful participation is not met, does not work well, as shown in (Rosendahl, 2011, abstract), (Aichele, 2012, page336), and (Peters, 2011, page1). These literatures are listed in the No50 line of this table. Even if there are not carbon pricing and international emission trading, CCS has problems such as high cost, difficulties in site selection, and difficulties in public acceptance, as shown in (Finkenrath, 2011, page39) and (Zobacka, 2012, Abstract). These literatures are listed in the No47 line of this table.	Accepted -- chapter 7 referred to on barriers to power decarbonisation
9542	10	47	21			Please, provide information of reference, IEA 2009c.	Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12355	10	47	25	47	25	Regulatory and permitting uncertainties should not be regarded as a barrier. IEA 2007 is an old reference. EU Directive 2009/31/EC has now been implemented in most EU countries and can be applied world wide.	Accepted -- deleted and Ch7 referred to
9538	10	47	3	47	8	Please, reconsider here as CHP is one of mature technologies without a cost gap. (ETP 2010, IEA, p50)	Rejected -- CHP is not economic in all cases due to market barriers
12036	10	47	32			3R is important means in general to save resources and reduce CO2 emissions. However, specific cases need to be assessed with LCA standpoints to prove if they are indeed contributing to CO2 emission reductions as compared to alternatives. Durable materials may be recycled less frequent than short life products but may have more environmental advantage as they require less energy and resources from LCA aspects. It must be noted that downgrade of quality frequently happens in recycling. Even for aluminum cans, roughly 30 percents cannot be returned for use to cans but to be sent to diecast or other applications.	Accepted -- aluminum recycling example removed
6754	10	47	36	47	37	"reduce, re-use, recycle" concept should be included early in the chapter. This is important concepts.	Accepted -- topic covered in 10.4.
17546	10	47	42	47	45	But Allwood and Cullen debunk this oft-stated optimistic claim. See p. 21, Allwood, J. M., J. M. Cullen, and M. A. Carruth. 2012. Sustainable materials with both eyes open. England: UIT Cambridge Ltd. □	Accepted -- sentence deleted
12014	10	47	42	47	45	This kind of statement often misleads readers to believe recycling can be done endlessly. Actually, in almost all cases, downgrade of quality is inevitable even in aluminium products. It is true that some 95% of aluminium products are recycled, however, due to the quality downgrade only 65% of aluminium cans can be recycled to cans. It is important to recognize that longer use, or reuse is usually more energy and resource efficient than recycling. http://www.alumi-can.or.jp/data_0101.html	Accepted -- sentence deleted
8295	10	47	22	47	31	paragraph on CCS seems to be a repetition of what has been already said about CCS in sections 10.8.2 and 10.8.3	Accepted -- redundancy reduced
17986	10	47	22	47	23	Please provide a cross-reference to and liaise with Chapter 7 to bring the different discussions of CCS impacts across chapters (5, 6, 7, and 11) together.	Accepted -- redundancy reduced and Ch7 referred to
16171	10	48	16	48	19	This sentence gives no clear direction, it is "either" "or", maybe to be removed.	Accepted -- sentence simplified
7107	10	48	34			Sentence does not make sense - "first", delete? See also how sentence follows up	Accepted -- section deleted
7108	10	48	38			I cannot see that Gössling et al. (2009) makes the claim that tourists are attracted by the behaviour of a minority of hypermobile tourists. The text outlines, though, that an increasing number of people move towards highly mobile lifestyles.	Accepted -- section deleted
17547	10	48	38	48	39	Not clear what "are ATTRACTED by the behaviour of a minority of hypermobile tourists" means.	Accepted -- section deleted
7109	10	48	43	48	45	"Should large-scale mitigation emerge..." how does this sentence refer to the previous one, and what is meant by large-scale mitigation? "Serious" (in political or scientific terms) mitigation, with concomitant consequences for transport? Or technology-based mitigation - which is not what I can read out of Becken (2005), or see substantiated by this reference?	Accepted -- section deleted
5222	10	48	45	48	45	There is a contradiction here with statements in chapter 8, page 8, line 16-20, and also logically; developing countries have to develop their infrastructure anyway and 'only' have to dedicate their investment to more sustainable modes like rail. So the funds are there and I do not see the limitation due to funds (invest less in road and more in rail). opportunities are therefore much better for developing countries that do not suffer from very high sunk cost in current infrastructure. To some extent countries like India still depend mainly on more sustainable transport, but need to invest in improving this and less in new unsustainable transport infrastructures like airports.	Accepted -- section deleted
16170	10	48				Key section to be retained, even in case of limited space.	Accepted -- section retained
17987	10	48	4	48	19	Although this subscribes to some substantial critique of current business models and the way of life of many people, it is presented in a rather factual language and does not provide many references to substantiate the claims made. Please reword and/or provide more references.	Accepted -- value judgements removed

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7721	10	48	20	48	30	The description in this section is too old and not worth reading in 2014. The update could be done by asking TEAP experts based upon the 2010 TEAP Assessment Report as well as the 2011 and 2012 TEAP Progress Report to the Montreal Protocol.	Accepted -- TEAP 2010 reference added (as UNEP, 2010) for HCFC replacement
11137	10	48	21	48	30	Consumption control of HFC use should be added (see USA/Canada/Mexico proposals/papers published under Montreal Protocol)	Noted -- comment suggest a policy recommendation
11138	10	49				Control of HFCs should be added to non-CO2 GHGs; Physical box	Accepted: control of HFCs is added
9539	10	49				Please, check categories on the table as Cogeneration and CCS seem to be strange relative to other elements. Check also whether emissions efficiency is similar to emissions reduction.	Accepted -- cogen included in efficiency column and CCS included in emission eff column
17548	10	49				In the column "Non-CO2 GHGs", lower cost technology for PFC emission reduction is listed as a barrier. Shouldn't this be the lack of lower cost technology? Also this point is repeated in the last row.	Accepted -- suggested text added
10023	10	49				According to the structure of the main text, "Cogeneration" should be mentioned in "Energy Efficiency". And "CO2 capture, utilization and storage" should be mentioned in "Emission Efficiency". "Heat Pump" should be considered in the same categorization as cogeneration with information of its huge potential, as described in (IEA, 2011, page16) and (IEA/OECD, 2010, page65-83). These literatures are listed in the No51 line of this table.	Accepted -- cogen included in efficiency column and CCS included in emission eff column
15898	10	49	1			simplify table 10.9	Accepted -- table columns reduced to reflect sections
18525	10	5				It is surprising that there is so little on costs and potentials in the Executive Summary. One would expect the results of that section to be one of the major outputs of the chapter.	Accepted - the text on costs and potentials in the ES have been extended on the basis of the new section 10.7
6719	10	5	2	7	7	In order to make it fast and easy for the reader place cross-references for the statements.	Rejected - in ES usually no cross-references are included
2259	10	5	2	5	4	There is no evidence that emissions of greenhouse gases have any harmful effect on the climate. This information is thus not a cause for concern so the whole Chapter is unnecessary. It is also surprising that while the supposed, unproven theory relies on changes in the atmospheric concentration of greenhouse gases, you seem here to be exclusively concerned with emissions, which are not necessarily related to concentrations	Not specifically relevant for the industry chapter, general concern for the report
15875	10	5	23	5	27	Rather than saying that best practices are within 25-30% of technical limit (efficient Pareto frontier), you should look at gap between actual energy use and best practice. This is more usefulness to industry and policy makers in order to make real near-term gains. Also regional variations (OECD vs. developing nations, where developing nations = over 75% of industrial production, p.11) need to be considered.	Accepted - this is now explicitly mentioned in point 3 of the Executive Summary and across the sections (e.g. 10.4, 10.7). Moreover the differences across sectors and countries are now highlighted.
4539	10	5	23	5	27	The claim of 25-30% and the approaching of technical limits is based on a few sectors. It cannot be generalized to all industry, not even energy-intensive industries. This is an example of a blanket statement, that in the body of the chapter is only backed up with a few selective references.	Accepted, cf. Comment 15875
12341	10	5	28	5	34	In the last sentence, options beyond energy efficiency is mentioned. CCS should be added to the last sentence (line 33 and 34) to reflect the huge potential of CCS in line with the other options mentioned.	Rejected - CCS still included under point 9 "Long-term step-change options". CCS is nevertheless considered within the group of "emissions efficiency" mitigation options (see main text).
12006	10	5	28	5	34	Contribution of industry sector as providers of goods to be used in other sectors to save or generate energy should be mentioned. Many of the materials for the purpose tend to be energy intensive, e.g. carbon fibers, and silicon.	Accepted: this important aspect is now reflected in point 8 of the ES

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
10796	10	5	3	5	9	Are these numbers right? 0.83 in year 1990 grew to 11.00 in 2009?	Accepted - typo
15876	10	5	35	5	41	Material efficiency / demand – the chapter discussed the final end state for emerging nations (will China = Japan or US?) and the willingness and practicality of nations to choose end states based on emissions footprint (eating meat, car size, etc). There are several references in text to car sharing, lower meat consumptions, etc. Rather than sending a message of top down regulation of behaviour, perhaps the chapter should discuss Environmental valuation, namely including the cost of externalities (e.g., cost of emissions, waste, water use, climate change adaptation, etc) in product prices. Then, choices would be governed by simple supply-demand curves (e.g., see Worley-Parsons EcoNomics model, by Paul Hardisty, as a practical example of this)	Noted - the chapter tries to outline the full range of options (please see revised 10.1 text, equation and figure); regulation of consumption patterns as an policy instrument is not mentioned in the chapter. We acknowledge importance of internalisation of environmental costs but this is covered in framing and policy chapters of the report
7525	10	5	35	5	34	"Material Efficiency" is a current continuing advance rather than "an additional promising and largely unexplored option". The use of high-tensile steel for car is a good example. In the context, business as usual scenarios (BAUs) of material demand include a certain "Material Efficiency" progress. Future material service and "Material Efficiency" are uncertain; however, additional "Material Efficiency" is less controllable. As a result, "Low agreement" is appropriate.	a) Accepted - wording changed. b) Noted. see revised Executive Summary for the considerations on BAU and model projections regarding material efficiency: "The models running future long-term scenarios also envisage rising production rate of materials (...). But material flows and opportunities for material efficiency to mitigate emissions, however, are poorly represented in the models."
2278	10	5	35	5	41	Wording could be interpreted differently. Although the idea of using materials longer, sharing products, etc. "using less new material" could also mean using lighter weight new materials such as increased use of advanced high strength steels to replace standard steels resulting in lighter weight products - primarily automotive industry to increase gas mileage. This is also important because making new materials from stronger materials makes them smaller - using less materials (less GHGs). Assuming new materials have similar embodied GHG	Accepted - the various dimensions of material efficiency are explained in the introduction to section 10.4 (space constraints do not allow detailed explanation in executive summary)
10199	10	5	35	5	41	Especially I. 37-39: what about reduced consumption? This would results in reduced energy and material use, reduced energy emissions, reduced waste disposal and increased health	Accepted - SOD very clearly mentions this in ES (point 7), introduction and throughout text
17173	10	5	41	5	42	The text says, 'While spatial planning can influence energy use and emissions, there are limited quantitative assessments of the emissions savings through spatial planning strategies'. Due to the very different urban contexts (city size, geographical setting, affluence level, dominant culture, social cohesion/segregation etc.), it should not at all be an aim to develop general figures for savings potentials. Rather, examples form different cities could be mentioned, leaving it up to the users of the information to assess whether the context of the example is sufficiently similar to the planning context at hand. (See Næss, 2004 and Næss & Strand, 2012 for more elaborate discussion.)	This comment has been addressed to Ch.10 by error and is meant as a comment to Ch.12. Please see Comment ID 19006 for the answer by the Ch.12 author team
6751	10	5	42	5	42	This is the first time CCS is declared but not out written. The abbreviation is written out in page 44 row 45	Accepted - copyedit to be completed prior to publication
16135	10	5	42	5	44	There are several radical process options in the pipeline, such as the innovative cement processes at the pilot stage. These options do have difficulties in implementation to replace the existing stock of plants. But in this major case, there is no CCS involved. The point 8 should be broadened in this respect.	Accepted - text revised (see point 9 of ES)

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12342	10	5	42	5	44	All of the (individual) components of integrated CCS Systems exist and are in use today in different sectors. The risk is probably not a technological risk, but an economic risk. The current knowledge of CCS and the challenges related to it, is thoroughly described in the Energy Chapter (chapter 7, page 31, line 5 to 7) and should be the basis also for the description in the Industry chapter (as it provides a more updated view).	Accepted - CCS-related text in chapter 10 has been shortened and revised, with stronger focus on industry-specific aspects and more cross-references to chapter 7.
12007	10	5	45	6	2	Emissions from Chemical sectors are expected to increase to supply goods for energy saving and renewables energy generations, which much more than offsets the increased emissions in the chemical sectors. ICCA report, July 2009	Accepted - important aspect which is included in the ES (point 8) and in section 10.5
8439	10	5	8	5	8	the 1990 data is clearly wrong (see Figure 5.2.3)	Accepted - typo
14409	10	5	8			Is "0.83" a typo? Looks far too small.	Accepted - typo
15874	10	5	8			0.83GtCO2 should probably read 8.3Gt? or 7.9Gt (table 10.2). Make sure data in ES are consistent with rest of text!	Accepted - typo
10132	10	5	8			0.83 GtCO2 energy-related emissions in 1990 for manufacturing must be a typo. On page 14, line 21 the primary energy use in the manufacturing industry is described as 129 EJ in 1990, which does not fit with the aforementioned CO2 emissions for 1990. A second figure showing the development in process emissions from chemical reactions should be shown as well.	Accepted - typo
12005	10	5	8	5	8	Is 0.83Gt CO2 in 1990 correct?	Accepted - typo
11128	10	5	7	5	7	Electricity is also produced on site through CHP	Rejected - this is considered as part of "from fossil fuels"
12947	10	5	29	5	30	Expected increase in emissions not given a date (should be 2050 I think)	Accepted - dates for all projections now given
12948	10	5	43	5	44	Other reason for slowness of CCS development: lack of sufficiently high CO2 price/lack of economic model to support it commercially.	Noted - but CCS-related text in chapter 10 has been shortened and revised, with stronger focus on industry-specific aspects and more cross-references to chapter 7.
17549	10	50				Remove original caption. Very hard to read in black & white.	Noted - but figure no longer appears in SOD
4284	10	50				Chapter 10.10.1 One general comment. I am fully missing energy audit as a policy. Normally, energy audits are the first step in successful adoption of energy management practices and are the most common means of promoting energy efficiency in industrial SMEs and non-energy efficient companies but are also mandatory components in e.g. LTAs or VAs. Please note that the success of the Learning networks you refer to is 1) energy audits and two 2) the actual network where industry respondents meet and discuss their improvements and ideas for future such.	Accepted
4285	10	50				Chapter 10.10.1 I am also missing the fact that energy management may not only be regarded to include technical measures. This comment holds for the whole chapter. Please see Thollander and Palm (2012) (Improving Energy Efficiency in Industrial Energy Systems - An Interdisciplinary Perspective on Barriers, Energy Audits, Energy Management, Policies, and Programs, Chapter 8 (and chapter 6), ISBN 978-1-4471-4161-7) where it is shown in Figure 4, chapter 8, that energy management could contribute to significantly higher energy efficiency potentials. Please also see Backlund, S., Thollander P, Palm, J., Ottosson, M., 2012. Extending the energy efficiency gap. Accepted for publication in Energy Policy holding the same line of arguments.	Accepted - we didn't get the book till just after submission but will consider it for final draft
15891	10	50	13			can't read this fig.	Noted - but figure no longer appears in SOD
17550	10	50	14	50	15	Add "in IEA +5" to caption	Noted - but figure no longer appears in SOD

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15926	10	50	19	50	28	Might state which policies work best and describe how they work (what kind of incentives?)	Rejected - the factors that work best are described, for space reasons the specific instruments cannot be described in detail. The comment is not specific about what aspect of VAs would need to be expanded.
4282	10	50	19			Please note that Voluntary agreements (VA) may also be referred to as LTA (Long-term agreements). I suggest a footnote here clarifying this. Your ref to Rezessy and Bertoldi 2011 refers to LTAs. Please also include ref to the Swedish Scheme (Stenqvist and Nilsson, 2011 from the Journal Energy Efficiency).	a) Rejected - term is widely understandable. B) accepted
18557	10	50				Please make sure that any policy category that is introduced matches the framework presented in Chapter 3.	Accepted - the framework agreed in cross-cut discussions was used
18558	10	50				A reader sorely misses a synthesis of the subsections on policy, clearly answering the question: "which policies are the most important for each mitigation option in industry?". The answer to this question would eventually be brought into the Technical Summary and SPM.	Taken into account - statement with caveats and synthesis now included at the end of the section.
15889	10	50	1			Sectorial policies section could be shortened and could highlight/focus on examples of which policies are more successful	Taken into account when revising the section
7116	10	51	24			".. Institutions like OECD and UNEP consequently are calling" - why is there no reference to OECD and UNEP here, rather than to Dubois? Wrong references? Check even subsequent section, where the same references appear to have been used.	Accepted - there was a problem with the references in the last paragraphs of section 10.10. References now correct in the text that has been kept.
10024	10	51	3	51	4	This part should be deleted completely. Cap & trade schemes have not been effective to reduce GHG emissions and enhance energy efficiency in energy-intensive industry. CO2 leakage caused by the implementation of the ETS happened actually through transfer of industry from one country to others. Market mechanisms at least under Kyoto-like international scheme, where the condition of all countries' meaningful participation is not met, does not work well, as shown in (Rosendahl, 2011, abstract), (Aichele, 2012, page336), and (Peters, 2011, page1). These literatures are listed in the No50 line of this table.	Accepted - EU ETS discussed in Chapter 15
17551	10	51	33	51		Paragraph is in past tense. Are the programs over?	Rejected - past tense only used to say that a review has been made
4564	10	51	33	51	39	I do not think energy management standards are mandatory in many of the countries quoted; certainly not in The Netherlands.	Accepted - text revised
4283	10	51	35			Same here, the Swedish program is missing, e.g Nilsson and Stenqvist, 2011 (in Energy Efficiency)	Taken into account
10283	10	51	9	51	17	The main reason that the carbon leakage did not observed in EU ETS is low carbon prices in the market due to economic crisis etc. It cannot be insisted that ETS scheme or ETS with free allowances have small impacts on carbon leakages. The draft descriptions will mislead readers, and should be revised.	Accepted - text revised
11139	10	51	9	51	17	This is clearly an over-simplification of the carbon leakage scenario in EU. Studies by both Climate Strategies and The Carbon Trust demonstrate that there are sector specific impacts.	Accepted - text revised
4563	10	51	9	51	17	The discussion on ETS is extremely selective and provides really wrong insights. A wide body of literature is available around the EU-ETS, which is not used. Generally, the conclusion is that ETS had had little to no effect until now due to over-allocation in Period I and the crisis in Period II. The current section seems to suggest the opposite....	Accepted - text revised

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9306	10	51	5	51	8	Basically, EU-EST is only "regional" policy. Therefore, this paragraph should be moved to right place in 13.6.1.1 on page 32. Furthermore, since there is no reference of (Jochem and Gruber 2007) in Reference between page 70 and 106, I would suggest to delete it.	Rejected: the sectorial policy section has to rely on specific examples for sector specific policies, but should also build the bridge to the more overarching policy instumenst discussed in chapter 13-15. The EU ETS is a very good bridge building example which high relevance particularly for the industry sector in the EU. Moreover: due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
9307	10	51	9	51	17	This is wrong analysis. Small effect of ETS on carbon leakage results mainly from shrinkage of European market due to Lehman shock or European finance crisis. It cannot be said that the scheme of ETS itself has no impact on carbon leakages even if free allowances are implemented. Furthermore, it is seen that most of such studies based on ER20-30/tCO2 suggest small impact on carbon leakage under free allocation. Therefore, it should be stated that the current carbon price in the EU-ETS is lower than its prerequisite of ER20-30/tCO2. In addition, since there are no references of (Reinaud 2008) and (Clo 2010) in Reference between page 70 and 106, I would suggest to delete both references.	Accepted. Moreover: due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
12632	10	52	21	52	23	CCS legal and regulatory frameworks have been put in place in Australia and many parts of Europe and USA. I therefore do not feel signling out regulatory uncerntainy as an issue solely for CCS is appropraite. Please see the IEA CCS Model Regulatory Framework and IEA CCS Legal and Regulatory Review for references. CCS is also now included in the CDM as of COP 17 in Durban.	Accepted (moreover CCS-related text in the industry chapter has been shortened to avoid overlaps with chapter 7)
12675	10	52	21	52	23	CCS legal and regulatory frameworks have been put in place in Australia and many parts of Europe and USA. I therefore do not feel signling out regulatory uncerntainy as an issue solely for CCS is appropraite. Please see the IEA CCS Model Regulatory Framework and IEA CCS Legal and Regulatory Review for references. CCS is also now included in the CDM as of COP 17 in Durban.	comment is in duplicate, see reply in 12632
10025	10	52	4	52	8	This part should be deleted completely because it is not necessary to adopt cap & trade scheme for non-CO2 GHG, considering successful example of capturing SF6 in Japanese power industry. Such Japanese examples is shown in (Nishimura, 2008, abstract). <Reference> [1] Nishimura et al (2008) . Mitigation of Non-CO2 Greenhouse Gases(Y07012) . Available at: http://criepi.denken.or.jp/jp/kenkikaku/report/detail/Y07012.html	Taken into account as an example, but case reviewer gives is for power industry which is not within our scope. Text does not say that inclusion in the cap & trade system is a must, but more an option.
7100	10	53	17	53	21	References (Anderson and Newell 2004, etc.) - these appear to be misplaced, as the text refers to OECD and UNEP (2011), which is the review of tourism-related climate change policies. The sentence "Policies may vary..." does not make sense?	Editorial - copyedit to be completed prior to publication
8296	10	53	20			... according TO the forms ..	Editorial - copyedit to be completed prior to publication
8297	10	53	38	53	42	Sentence too long and unclear	Editorial - copyedit to be completed prior to publication
8298	10	53	43			results in the table ARE derived	Editorial - copyedit to be completed prior to publication

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17552	10	54	15	54	15	The word "both" doesn't make sense.	Editorial - copyedit to be completed prior to publication
8300	10	54	15			changing prices haVE on ?both? Energy service demand	Editorial - copyedit to be completed prior to publication
5223	10	54	18	54	21	It is true that global scenarios are currently not available for tourism in the context of climate change mitigation (there are some for adaptation, e.g. Ciscar, J.-C., Iglesias, A., Feyen, L., Szabo, L. s., Van Regemorter, D., Amelung, B., Nicholls, R., Watkiss, P., Christensen, O. B., Dankers, R., Garrote, L., Goodess, C. M., Hunt, A., Moreno, A., Richards, J., & Soria, A. (2011). Physical and economic consequences of climate change in Europe. Proceedings of the National Academy of Sciences, 108, 2678-2683). However, for a PhD thesis I am now almost finished with a global tourism emission model that allows for doing scenarios up to 2100. Included are policy inputs for cost, infrastructure investments, transport system quality and technological development. having fully reviewed paper out on scenario runs is envisaged next year. Happy to help to this respect. Still, the UNWTO presented BAU scenario sets the scen for measures as does the Peeters et al., 2010 reference used earlier in this chapter.	Noted - section has changed significantly in SOD, tourism now framed differently in the chapter (see comment 2279. Will check if results of the phd have been published before FD submission
8299	10	54	4	54	7	Consider revising the wording, unclear.	Editorial - copyedit to be completed prior to publication
17553	10	55				Table is too faint to read and review.	Accepted - section has changed significantly in SOD and new figures are used
12015	10	55				Not readable and I can not understand what these graphs mean.	Accepted - section has changed significantly in SOD and new figures are used
8301	10	56	27			the 2DS scenario IS exploring	Editorial - copyedit to be completed prior to publication
6927	10	56	44	56	46	The statement "describing a pathway which tries to limit the rise in global average temperature to 4°C by 2050." is completely wrong; according to IEA ETP (http://www.iea.org/etp/explore/) it should rather be something along the lines of: limit the LONG-TERM RISE in global average temperature to 4°C which requires significant ADDITIONAL CUTS IN EMISSIONS in the period after 2050additional cuts in emissions in the period after 2050. The 4DS scenario is described as follows on the IEA ETP website: "The 4°C Scenario (4DS) takes into account recent pledges made by countries to limit emissions and step up efforts to improve energy efficiency. It serves as the primary benchmark in ETP 2012 when comparisons are made between scenarios. Projecting a long-term temperature rise of 4°C, the 4DS is already an ambitious scenario that requires significant changes in policy and technologies. Moreover, capping the temperature increase at 4°C requires significant additional cuts in emissions in the period after 2050." Please make sure to cross-check the accuracy of other scenario descriptions in your Chapter with the original source(s).	Accepted - text has been revised
16172	10	57				Tables 10.11, 10.12, 10.13 give a misleading idea that "all scenarios are alike". This choice remove part of the point of the last sections in the chapter, i.e. there is room for manoeuver in more systemic or radical changes. For example, individual energies remain nearly the same. Historically, though, entire branches have switched fuels or adopted technologies in rather short periods, phasing in or out fuels, for example the sugar industries. If the benefits of recycling is rewarded, even paper or glass may change fast. In all, the scenarios illustrate that the "absence" of radical technology implementation will limit the change in energy consumption patterns of industries. It is not helpful.	Noted - section has changed significantly in SOD and new figures are used

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8302	10	57				Additional Investment needs are zero for the 4DS scenario?	Rejected - comment unclear, no discussion about investment at this place in the text
15892	10	57	1			add production values for each industry sector (e.g., tonnes/yr), and their intensity (e.g., J/tonne) forecasts	Noted - section has changed significantly in SOD and new figures are used
15893	10	57	6			add production values for each industry sector (e.g., tonnes/yr), and their intensity (e.g., J/tonne) forecasts	Noted - section has changed significantly in SOD and new figures are used
15894	10	57	8			add production values for each industry sector (e.g., tonnes/yr), and their intensity (e.g., J/tonne) forecasts	Noted - section has changed significantly in SOD and new figures are used
6756	10	58	31	58	31	Could not carbon taxes for aircrafts together with investments in railways be added here.	Taken into consideration - policy section addresses the instrument of carbon taxes
7113	10	58	33	58	36	Please clarify sentence.	Editorial - copyedit to be completed prior to publication
8303	10	58	35			"what" instead of "how"	Editorial - copyedit to be completed prior to publication
7114	10	58	39			how can emissions from air transport and accommodation triple at 130% projected growth, please clarify.	Accepted - text has been revised
6755	10	58	7	58	27	State the risks with the different solution, especially has the CCS technology been criticised earlier in the report, e.g. page 45, however here it is put forward as high potential solution. No doubt about that, however it feels strange for the reader.	Taken into account - overlaps with chapter 7 (Energy) on the topic of CCS have been removed from the text where possible
7517	10	58	13	58	14	80% with CCS is overstated. For example, IEA(ETO2012) predict one third of CO2 emission even in 2deg.C scenario, even in 2050.	Accepted - text has been revised
16173	10	59				This figure is excellent because it includes both projections and potentials.	Noted, thanks.
17554	10	59				X-axis labels have misspellings.	Editorial - copyedit to be completed prior to publication
7101	10	59	2			Reference is UNWTO, UNWTO and WMO (2008), see also line 8, same page, as well as throughout text	Accepted
17555	10	59	25	59	25	38% seems very high, but the references can't be checked because they aren't in the reference list. Also 38% in what year?	Taken into account. Due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
8304	10	59	4	59	6	move "CO2 emissions" to after "reduction", i.e. reduction in CO2 emissions	Editorial - copyedit to be completed prior to publication
18559	10	59				A lot of the information presented here may be better placed in 10.8. A more thorough, focused discussion of the differences between the IAM community results and BU studies on industry will need to be developed and expanded in this section.	Accepted - section has been revised
7518	10	59	24	60	2	It is not clear what is the definition of "Green job" of sttel industry. New technology is able to be developed to reduce CO2 emission to produce steel by exinting "large global stel producers". Since breakthrough technology development requires huge financial resorces and long research and development activity at which no return can be expected for rather long period. Only challenging large company can bear such development work.	Accepted: text has been revised, thisstatement no longer appears in the revised discussion of employment impacts (end of section 10.10.2)

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7115	10	6	12			Please add: "...significant mitigation measures for the tourism sector can only be achieved through changes in demand and lifestyle".	Noted - see point 7 of new ES. Nature of discussion on tourism has changed, cf. Response to comment 2279.
15760	10	6	13		16	Seems like this would require incredible coordination across many different industries and individual companies. Might be possible were govts have a strong hand in industrial development; much more difficult in places like the U.S.	Accepted - complexities of industrial cooperation should be better acknowledged in barriers section 10.9, but point kept in ES (backed by section 10.5 in main text)
4791	10	6	17	6	19	It could be different for other sectors. For instance regarding energy, hydropower plant with reservoirs, in addition to generate power, will also provide other benefits such as water storage and for instance flood control, navigation irrigation, etc.	The example does not concern industry, comment is mostly relevant for chapter 7
8818	10	6	24	6	26	It would be more specific to say that the short term payback promoted by speculative capital make mitigation with substantial but longer term paybacks make financing mitigation investment difficult to obtain in the absence of legislative requirements.	Accepted - text revised (see point 17 of ES)
15878	10	6	24	6	30	Additional Barriers to add: <ul style="list-style-type: none"> o Volatile energy prices (high prices favour efficiency, low ones do not) o Infrastructure Lockin (long life of facilities (30-50 years) limits new builds, tradeoffs between brownfield retrofits vs. green-field new builds) o Economics (NPV, hurdle rates, use of high discount rate vs. lower "social" discount rates, how to value long term opex savings) o capital allocation – tradeoffs between more production (making money), efficiency (saving money), and reliability and safety issues 	Taken into account - some of these barriers could be mentioned in section 10.9, although in most cases they are dealt with in the general framing and policy chapters of the report (including the Finance chapter). The paragraph in the ES is only a list of selected examples
11045	10	6	25	6	26	Not only new and additional approach and review the existing finance mechanism is needed as well. Please see Aaron Atteridge, Clarisse Kehler Siebert, Richard J. T. Klein (2009) Bilateral Finance Institutions and Climate Change - Stockholm Environment Institute, Working Paper - 2009 Environment Institute, Working Paper - 2009 ...	Taken into account - however due to space restriction a more in-depth discussion can be found in the finance chapter of the AR5
12343	10	6	27	6	28	(Lack of) public acceptance regarding CCS can be managed by information and should not be regarded as a real obstacle. Consider to delete.	Accepted - removed from point 17 of revised ES
15877	10	6	3	6	5	Should include oil & gas upstream and refining, coal mining in this category since these industries have adopted many best practices and improved energy efficiency substantially. Chap. 7 only addresses these industries very superficially.	Rejected - those industries are dealt with in the energy chapter (chapter 7)
12008	10	6	35	6	35	What "complementary policies" mean here to address what issues? The term should be clearly defined.	Accepted - sentence removed
16136	10	6	37	6	42	This finding that most scenarios involve an increase of energy demand from industry should be precised "in emerging countries" because it is misleading for developed country decision makers. In industrialised countries, demand is stable or decreasing.	Taken into account - longterm pathway discussion in the ES and main text (section 10.10) have been significantly revised in light of results from modelling exercise.
15880	10	6	37	6	42	Energy intensity (J/GDP) is not truly representative of sector energy performance or efficiency. You should use J/unit output instead (e.g., J/tonne product, J/barrel, etc). The cement section addresses this well, but others sections do not. Also need to mention/discuss structural (e.g., light vs heavy industry) vs. technical (really efficiency gains) components of J/GDP metric. Note that electrification might result in less CO2 for an industry but might also be less efficient if you include the losses and emissions in the power plant	Taken into account - longterm pathway discussion in the ES and main text (section 10.10) have been significantly revised in light of results from modelling exercise.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
17484	10	6	43	6	43	Awkward wording: "Technology oriented scenarios show possible future pathways describing that CO2 emissions	Editorial - copyedit to be completed prior to publication
6604	10	6	44	6	46	Delete the sentence. It might be misunderstood that IPCC encourages a specific scenario i.e. 2DS.	Taken into account - longterm pathway discussion in the ES and main text (section 10.10) have been significantly revised in light of results from modelling exercise.
15761	10	6	45		46	What is the likelihood/feasibility of achieving a 20% reduction?	Taken into account - longterm pathway discussion in the ES and main text (section 10.10) have been significantly revised in light of results from modelling exercise.
16898	10	6	7		12	Suggest deleting this -- people find great utility from tourism as indicated by their willingness to pay a fairly high amount to engage in it. Air travel is a fairly small wedge of total emissions. The value of a market based system is not only that it tends to reduce the lowest costs reductions first, it also delays or gives time to find out other ways to reduce emissions for activities we value the most. Perhaps another way to think of it is that emissions from some activities are highly valued -- travel being one of those. Not all sectors should reduce at the same rate or hit the same targets -- the menu laid out in this paper seems to suggest they should. This goes against the meaning of market based policies discussed in other parts of the report.	Noted - but scope of discussion on tourism has changed in SOD, cf. Response to comment 2279.
11129	10	6	24	6	30	Commercially availability of alternatives is still a barrier to HFC replacement	Accepted - this barrier is explicitly discussed in section 10.9.5. However the paragraph in the ES is only a list of selected examples.
12949	10	6	2	6	2	Not relevant and not necessarily true. Are Solar PV likely to be significant as a share of global industry emissions? Are solar PV production going to lead to an net increase in global emissions? Probably not. Not even necessarily in industry if they contribute to electrification of manufacturing.	Taken into account - Text has been revised to avoid a misunderstanding. However PV production is a source for non-CO2 emissions, maybe not the most important one, but as we try to address typical mitigation options and the challenges posed by new technologies, PV for the reader is a very well known and transparent example.
12950	10	6	4	6	5	Second sentence of paragraph not relevant or not clear enough	Taken into account - the sentence "Particularly many emerging economies typically produce more than they consume" (referring to extractive industries) is now explicitly backed in the text

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9540	10	60	13	60	16	Please, reflect the different view to job creation; the U.S. should expect a loss of at least 2.2 jobs on average, or about 9 jobs lost for every 4 created, to which we have to add those jobs that non-subsidized investments with the same resources would have created. (Study of the effect on employment of public aid to renewable energy sources, 2009)	Accepted - text revised in end of section 10.10.2. The text has been revised to to echo the different views held on the impacts that limited change policies would have on job creation. Various references have been cited.
12016	10	60	13	60	14	Explanation needs to be added to what kind of job creation policies with job support creat what kind of jobs by how many. In addition, it should be shown that what kind of jobs will disappear how many. Socially, the sensitivity is higher in areas where jobs will be lost and it is important to show what kind of policy measues can address the problem to what extent.	Accepted - text revised in end of section 10.10.2. Job support mechanisms that can help drive job creation have been provided together with citations.
10026	10	60	13	60	16	This part should be deleted totally or revised to explain that mitigation policies can rather lead deindustrialization. As a result, economic recession will be caused by inflation of energy cost, as described in (Rosendahl, 2011, abstract), (Aichele, 2012, page336), and (Peters, 2011, page1). These literatures are listed in the No50 line of this table.	Accepted - text revised in end of section 10.10.2. Job support mechanisms that can help drive job creation have been provided together with citations.
9377	10	60	13	60	16	It should also be written that climate change mitigation policies can cause a rise of energy prices and a hollowing out of manufacturing industry which leads to economic downturn. Employment creation is realized as a result of the policy tradeoff(Berndes and Hansson,2007).Thus mitigation policies are not always link to job creation.	Accepted - text revised in end of section 10.10.2. The text has been revised to capture the fact that only through job support mechanisms and policy trade-offs such as the maximization of employment creation and maximization of climate benefits can climate change policies be a driver for job creation.
17556	10	60	37	60	42	This sentence is convoluted and much too long!	Accepted
15872	10	61	23	61	26	missing a verb in this sentence	Editorial - copyedit to be completed prior to publication

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
17558	10	61	25	61	26	Verb missing	Editorial - copyedit to be completed prior to publication
15873	10	61	39			there are many other technologies other than heat pumps that could benefit from more R&D	Accepted - text revised
10027	10	61	39	61	39	This part should be kept in SOD and, if possible, should mention how much potential heat pump has at higher temperatures.	Accepted: however a specific discussion of the potential of single technologies is not possible due to space constraints
15871	10	61	4			In gaps section (10.12), there is lots of discussion on lack of data. Authors could leverage lifecycle analyses and databases (e.g., Simapro, GaBi) for more data. Also section could be streamlined and could discuss R&D needs in a bit more detail.	Rejected: space constraints do not allow comprehensive discussion
17557	10	61	5	61	7	What about the complexity of the interrelationships? Isn't that a key factor?	Accepted
7519	10	61	23	61	27	Very important issue with an appropriate explanation	Accepted
15269	10	61	17	61	22	I agree with the importance of the mitigation/emission assessment to attribute the environmental impacts of the each step of supply chain (furthermore, it may be able to include the emission/mitigation during its use.). Therefore, I think it is better to summarize the current state of "assessment method" including LCA, and input-output method somewhere in this chapter, to give some hints to the readers. Eventhough, it might not be a perfect solution, I believe that a sufficient evaluation method will enhance inter-sectional or cross border mitigation	Rejected: space constraints do not allow comprehensive discussion
17559	10	62	10	62	15	A discussion/explanation of carbon leakage doesn't belong in a list of gaps in knowledge	Accepted - text revised
8305	10	62	18			"potential energy efficiency improvement potential" - remove extra "potential"	Editorial - copyedit to be completed prior to publication
5224	10	62	31	62	31	Suggest to add the radiative forcing share here as well (between 5 and 12%, though numbers vary a bit depending on the source you choose).	Rejected: comment not clear (context to discussion at this place is missing)
12017	10	62	42	62	44	It should be mentioned that the goods which contribute GHG emissions reductions at end use tend to use energy intensive materials such as carbon fibres and silicon. Better quality products for longer use may need more energy to produce as compared with regular quality products. These imply that emissions at production may increase. Such an implication should be stated.	Taken into account in revision of chapter
8502	10	62	32	62	36	Option for mitigation of GHG emission from industry can consider action of raw materials substitution e.g from PVC plastic packaging to biomass plastic packaging which emit less CO2 in process and during end of cycle.	Taken into account in revision of chapter
17560	10	63				This figure should show disposal for (pre-consumer) industrial wastes along with post-consumer wastes.	Taken into account - but EDGAR database only contains data for post-consumer waste
17561	10	63	18	63	18	"Waste to wealth" (using a variety of labels) is hardly a new concept!! Henry Ford was prominent proponent. Authors in Victorian England were passionate about it. See Desrochers, P. 2000. Market processes and the closing of "industrial loops": A historical reappraisal. Journal of Industrial Ecology 4(1): 29-43.	Taken into account - text revised.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
18560	10	63				This section is recognizably at an early stage. It may nonetheless be worthwhile to consider restructuring it according to the AR4 model (with indirect and direct mitigation strategies). The sections on Waste from chapters 5 (5.7.5) and 12 (12.4.3.11) could be integrated directly into this text.	Taken into account. It is not possible to restructure the chapter to be similar to AR4 as space given to this section is limited compared to AR4. However, coordination has been done with other chapters to avoid redundancy and avoid inconsistencies.
18561	10	63				To save space Figures 10.13 and 10.14 could either be deleted or merged.	Accepted - figures have been merged
8354	10	63	3	69	26	Chapter 10 is about industry sector. Therefore it would be better than waste sector is moved to separate chapter like AR4 WG III or chapter 11 (AFOLU) in AR 5.	Rejected - It was decided to include the waste sector as a subsection to the industry at a late stage after the approval of the TOC by the IPCC plenary.
9076	10	63	3	69	26	10.14 Waste- suggest to be treated as a separate chapter	Rejected - It was decided to include the waste sector as a subsection to the industry at a late stage after the approval of the TOC by the IPCC plenary.
17563	10	64				Some discussion of the impact of waste prevention on GHG emissions should be included. U.S. Environmental Protection Agency and Office of Solid Waste and Emergency Response. 2009. Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices: U.S. Environmental Protection Agency. The statement about informal recovery is confusing. What about the involvement of the informal sector? Incineration: Co-combustion of what?	Taken into account - included under waste minimization
17562	10	64	5	64	6	This sort of statement should be supported with a reference.	Taken into account - text revised
8503	10	64	11	65		For waste handling activity, it good to mention types of storage container and GHG emission amount whenever it being disposed or incinerated. Especially during incineration, plastic container emit many types of GHG emission as well as other gases. As compare if the storage container made from the paper. This issue normally happen in incineration of Medical waste from hospital	Rejected - reference to emissions from waste handling in the table covers only the handling and transportation and not incineration. This table no longer appears in SOD.
8504	10	64	11	65		GHG emission form incineration process can be mitigated through segregating of waste material at source which in some part of the world the municipal waste is wet and it requires more fuel for complete combustion.	Taken into account - included under alternative waste treatment techniques.
17564	10	65				What region is represented in this figure?	Accepted - clarified that these are world emissions.
10797	10	66	17			Composting: please refer to the book "Guia para Elaboracao de Projetos MDL a partir de compostagem". Nogueira da Silva et al. Fundacao Banco do Brasil, 2010. Portuguese. Downloadable from www.fbb.org.br. The book is a guide on how villages and poor communities can reuse/recycle organic wastes from residences and hotels.	Taken into account. Discussion of composting added in the revised text.
16259	10	66	24	66	26	I cannot follow the reasoning that for metals, there are by definition no substitutes for the required chemical elements... The requirements are only in specific cases defined by the chemical elements themselves (e.g., alloy composition), but in principal by the required properties, and there are many examples of substitutions between individual metals or between metals and other materials (such as plastics).	Taken into account. Text deleted from waste section in SOD. See revised section 10.4 of SOD for considerations on material substitution

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
17565	10	66	7	66	12	The text in this section discusses what is usually referred to as waste valorization, i.e., treatment and reuse of bulk industrial wastes. It should be labeled as such and discussion added on other forms of recycling (municipal, industrial scrap, etc.) Also there should be some mention of chemical recycling of plastics.	Taken into account - This paragraph has changed in the SOD.
9309	10	66	17	66	19	The cement industry applies many kinds of co-processing technologies. (Susumu Sano, Makihiko Ichikawa, Takamiki Tamashige, Toshihiko Matsuto and Nobutoshi Tanaka, Journal of the Japan Society of Material Cycles and Waste Management, Vo1.13, No.3, p.140, 2002 "Environmental Load Assessment of Disposal and Utilization of MSW Incineration Ash and Waste Plastics") and (Hidetoshi YAMAMOTO, Yoshiaki TSUJI, and Takao HARA, Journal of the Japan Institute of Energy, 83, 272-280 (2004) "Mechanisms of Dechlorination and Fuel Characteristics of Char Formed in the Pyrolysis Process of Municipal Solid Waste (MSW)")	Rejected - References available only in Japanese and therefore could not be used.
9308	10	66	7	66	12	Please add following example and reference. Local municipal waste treatment in cement production (Susumu Sano, Akira Kato, Tomoyuki Iino, Nobuo Kasiwazaki, Toshihiko Matsuto and Nobutoshi Tanaka, Journal of the Japan Society of Material Cycles and Waste Management, Vol.16, No.5, pp.341, 2005 "Effects of CO2 Emissions from the Utilization of Municipal Solid Waste as Alternative Fuel and Raw Materials in Cement Production") and industrial wastes (Yugo Nomura, Kazuo Fujiwara, Makoto Takada, Satoshi Nakai and Masaaki Hosomi, Journal of the Japan Society of Material Cycles and Waste Management, Vol.17, No.5, p.360, 2006 "Detoxification of Fly Ash by Mechanochemical Treatment with Blast Furnace Slag and the Usability of the Residues as Cement Materials")	Rejected - References available only in Japanese and therefore could not be used.
2301	10	67	1	67	15	Redundant with earlier sections - almost word for word - eliminate	Accepted - redundancy removed
17566	10	67	12	67	12	"Liquid metal" is term used by Allwood and colleagues but is not otherwise in widespread use in this context.	Taken into account. Text deleted from waste section in SOD. See revised section 10.4 of SOD for more specific discussion
17568	10	67	12	67	12	The statement about post-consumer recycling of aluminum (20%) should have a reference and indicate date and region.	Taken into account. Text deleted from waste section in SOD. See revised section 10.4 of SOD for considerations on aluminium recycling
16260	10	67	12	67	15	A recent publication that discusses the downgrading of aluminium and assesses its potential consequences for the loss in energy saving: Modaresi and Müller 2012: The role of automobiles for the future of aluminium recycling. Environmental Science and Technology 46(16):8587-94. The authors demonstrate that without rapid development and penetration of post-consumer scrap sorting technologies, a large fraction of the aluminium scrap may not find markets in the near future, resulting in a scrap surplus and a corresponding loss in energy saving potential of 43-240 TWh/yr by 2050 .	Taken into account. Text deleted from waste section in SOD. See revised section 10.4 of SOD for considerations on aluminium

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
10159	10	67	16		23	<p>Delete paragraph and write instead: "All plastics are recyclable. Depending on the quality of the plastics waste one can differentiate three options for recycling, which are all beneficial according to the balance of costs and energy saving & GHG emission mitigation.</p> <p>1. Mechanical recycling Applicable to postconsumer waste or industrial waste which is homogeneous and clean. Examples are PVC (72% of all collected PVC waste from windows and 67% of used PVC pipes are recycled), industrial packaging films made from polyolefins, PET bottles (they are collected separately and either after grinding and washing recycled together with virgin material to bottles again or textiles are produced).</p> <p>2. Feedstock recycling Production of new raw materials by changing chemical structure of plastics waste through cracking, gasification or de-polymerisation. An example is the use of plastics for the blast-furnace process producing iron as additional reducing agent.</p> <p>(References J. AGUADO, D.P. SERRANO, G. SAN MIGUEL, "EUROPEAN TRENDS IN THE FEEDSTOCK RECYCLING OF PLASTIC WASTES" Global NEST Journal, Vol 9, No 1, pp 12-19, 2007)</p> <p>3. Energy recovery Since the energy content of 1 kg plastic equals 1 kg of oil incineration with heat recovery is used for the recycling of mixed or dirty plastics</p> <p>Globally there is large potential for increasing the recycling rate by diverting the 'calorie rich' plastics waste from landfill into the most sustainable recycling option."</p> <p>(References: Plastics Waste - Feedstock Recycling, Chemical Recycling and Incineration, A. Tukker Vol. 13, No 4, 2002 Rapra Review Reports Expert overviews, ISBN-13: 978-1859573310</p> <p>Consultic study 2012, "In 2012 Plastics waste in Germany was recovered as material for 42%, as feedstock 1% and for energy recovery for 56%" (http://www.consultic.de/files/pdf/consulticstudie_kunststoffverwertung_20120911.pdf)</p>	Taken into account. Text deleted from waste section in SOD. See revised section 10.4 of SOD for considerations on plastics recycling
17567	10	67	24	67	24	<p>Waste paper recycling is NOT recent. The most recent surge in interest dates to the mid-1990s. And of course waste paper recycling more generally is quite old.</p>	Taken into account. Text deleted from waste section in SOD. See revised section 10.4 of SOD for considerations on material substitution
10158	10	67	3		4	<p>Delete "plastics recycling is greatly inhibited by the wide variety of incompatible compositions" and exchange with: "for plastics recycling different possibilities are in practice depending on the cleanliness and conformity of the plastics waste".</p>	Taken into account. Text deleted from waste section in SOD. See revised section 10.4 of SOD for considerations on material substitution

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
17569	10	67	31	67	31	High substitution of what by what??	Accepted
5022	10	67	8	67	15	The global rate of recycling of steel is 83% and some specific steel use sector shows much higher recycle rate. Reality and future of the recycling of steel is described in detail in the following site of worldsteel association: http://www.worldsteel.org/publications/fact-sheets.html	Taken into account. Text deleted from waste section in SOD. See revised section 10.4 of SOD for considerations on steel recycling
8306	10	68	14	68	17	Consider revising the wording	Editorial - copyedit to be completed prior to publication
17571	10	68	18	68	23	The sentences on the Action Plan need a punchline, that is, indicate why the information is relevant in this section.	Accepted. A sentence to clarify the relevance to waste minimization has been added.
8307	10	68	18	68	26	this paragraph is not really about waste, maybe could be moved to section 10.4	Taken into account - we have clarified that these are policy initiatives that can minimize waste and encourages recycling
17570	10	68	6	68	7	Verb missing	Editorial - copyedit to be completed prior to publication
17572	10	69	12	69	13	Why is composting complementary to landfill gas recovery?? Most proponents of landfill gas development see composting as diverting sources of organic material that degrade to produce methane, i.e., a competitor.	Taken into account. These key messages have been revised as part of the section revision
17573	10	69	25	69	25	PAYT and landfill taxes are measures that are much more commonly used in developed rather than developing countries. Some distinction might be warranted here.	Taken into account. These key messages have been revised as part of the section revision
15882	10	7	1	7	4	50% GHG reduction from BAU with doubled demand implies a 75% reduction in energy intensity. This sounds ambitious. How feasible is that? Instead, the chapter should present a realistic range of expectations, not an optimistic, theoretical technical limit	Taken into account - longterm pathway discussion in the ES and main text (section 10.10) have been significantly revised in light of results from modelling exercise.
9300	10	7	1	7	4	There is no reference herewith. Basically, I have never seen any literature telling that a GHG emissions can be reduced by 50% compared to BAU although global demand of selected set of steel, cement, plastic, paper and aluminum is expected to double. Therefore, I would suggest to delete the paragraph.	Rejected: ES does not normally include references. Taken into account - longterm pathway discussion in the ES and main text (section 10.10) have been significantly revised in light of results from modelling exercise.
8266	10	7	15			repeating "Co-benefits"	Editorial - copyedit to be completed prior to publication
15281	10	7	15	7	15	remove one "co-benefits"	Editorial - copyedit to be completed prior to publication

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4540	10	7	31	7	37	It is strange to see the focus on rare earth metals and copper as a major issue in discussing mitigation efforts in mining. These are very small volumes, even in ore terms when compared to major other commodities. This focus is not warranted from the scope of this study. The analysis on mining included in this chapter lacks any depth.	Accepted - discussion of GHG emissions related with the provision of energy commodities is covered in the energy chapter. Some improvement in the representation of mining sector has been made in the SOD but given the fact that mining has very little energy share (cf. section 10.2) compared to the manufacturing processes we consider only those which are relevant for energy intensive manufacturing processes
15762	10	7	5		6	This is occurring because there is an economic driver. What is the practical limitation of what can be accomplished by re-using waste materials?	Accepted - text has been improved in light of new waste section
15883	10	7	5	7	7	Need to consider the energy intensity of waste reprocessing, and also cost curves for waste as a feedstock since even waste will follow laws of supply and demand	Accepted - text has been improved in light of new waste section
9301	10	7	5	7	7	I agree with this paragraph and would provide two of literatures and a website for your reference: (MORIMOTO, NGUYEN, CHIHARA, HONDA and YAMAMOTO; Journal of Life Cycle Assessment, Japan, Vol.2 No.4 October 2006 "Proposals for Classification and an Environmental Impact Evaluation Method for Eco-Services: Case study of Municipal Waste Treatment in Cement Production") and (Susumu Sano, Akira Kato, Tomoyuki Iino, Nobuo Kasiwazaki, Toshihiko Matsuo and Nobutoshi Tanaka, Journal of the Japan Society of Material Cycles and Waste Management, Vol.16, No.5, p.341, 2005 "Effects of CO2 Emissions from the Utilization of Municipal Solid Waste as Alternative Fuel and Raw Materials in Cement Production"), and (http://www.taiheiyo-cement.co.jp/english/env/env.html)	Noted
6605	10	7	15	7	15	Make a editorial modification -delete one of the "co-benefit."	Editorial - copyedit to be completed prior to publication
7717	10	7	25	7	26	Emissions of F-gases in industry mainly from refrigeration, car and home air conditioning and insulation gases for buildings are very important because these F-gases has high GWP values and there seem to have a great progress on the development of environmentally-friendly F-gases with much lower GWP, However I could not see any detailed description of these f-gases even in other chapter like Chapter 8 and 9.	Accepted. The comment in fact refers to other chapters. X-cut issue. Cross chapter coordination needed. This issue has been clarified during 3rd Lead Author Meeting. These sources will be considered in the relevant chapter (e.g. energy, buildings, transport).
15704	10	7	26	7	26	Chapter 8 covers transport and not Chapter 9.	Editorial - copyedit to be completed prior to publication
15705	10	7	38	7	42	Although this AR5 approach is more holistic, which is good, this framework inherently has double counting from other sectors such as transport. This was state in the TSU notes but this is a critical issues that will likely not be resolve with just a note or table.	Accepted - issue of double counting has been discussed among report authors as it is important for the whole report. The topic has been transferred to chapter 5
10157	10	70				Many of the references provided in the text could not be found in the reference section.	Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9408	10	70	106			Some journal informations were missing in reference even if these papers were reviewed in the text. Thus, reviewers cannot check whether contents were appropriately quated. For example, related to my paper, the following information was missing in reference. Akashi, O., Hanaoka, T., Matsuoka, Y., Kainuma, M. (2011) A projection for global CO2 emissions from the industrial sector through 2030 based on activity level and technology changes. Energy, 36(4):1855-1867, DOI: 10.1016/j.energy.2010.08.016	Accepted - due to an editorial problem chapter 10 had the reference list of a different chapter. This problem has now been resolved
12952	10	8				Step 6 (using waste to substitute for resources from extractive industries) missing from model design	Accepted - figure 10.1 has been modified
18515	10	8				The sixth point (by using waste to substitute resources) doesn't appear in the figure marked as a green number as the other options do. It is also not incorporated into the structure of Section 10.4. If it should be considered as a major option, may be useful to amend the figure and the structure of 10.4 accordingly.	Accepted - figure 10.1 has been modified, waste aspect is discussed in detail in a specific section 10.14
17486	10	8	18	8	19	Awkward wording: "Box 1 shows a Sankey diagram clearly delineating different sources of 19 anthropogenic emissions aims to resolve this confusion." Perhaps some words are missing.	Editorial - copyedit to be completed prior to publication
8267	10	8	18			Sentence: "Box 1 shows a Sankey diagram" unclear	Editorial - copyedit to be completed prior to publication
10203	10	8	21	10	11	Box 1.1 and Fig. 10.2 could preferentially be moved to a more general chapter since it is relevant for all sectors	Accepted - issue of double counting has been discussed among report authors as it is important for the whole report. The topic has been transferred to chapter 5
8268	10	8	24			Sentence "Using a Sankey diagram provides ..." unclear	Editorial - copyedit to be completed prior to publication
15901	10	8	9			Clarify fig. 10.1 (not clear what bottom flow box is for, also wrong chap. #'s in upper right corner)	Bottom box highlights trade-related issues. Presentation has been improved in SOD.
15706	10	8	22	8	25	Figure 10.2 is helpful presentation of the issues associated with attribution of emissions to sectors but it is not clear that groupings in figure 10.2 parallel the chapter of the AR5 WGII report. This figure would be much more useful at addressing double counting if the categories of the figure paralleled the chapters of the report. As an example, transport of food and people for leisure seems to be part of transport but these are not included in transport in Figure 10.2.	Accepted - issue of double counting has been discussed among report authors as it is important for the whole report. The topic has been transferred to chapter 5
18516	10	8				I would like to echo the sentiment from Washington that this text (including figure) would be useful in an early chapter, e.g. Chapter 5. On the Sankey Diagram, it would be very useful to try and include some kind of deliniation of what is covered in which chapters -> this would also help to guide the reader through the AR5.	Accepted - issue of double counting has been discussed among report authors as it is important for the whole report. The topic has been transferred to chapter 5
11153	10	887	26		27	The statement that communication and information channels play a major role for an evaluation of the technology by the public is unlikely to come from Pietzner et al, 2011. I suggest the author checks this reference.	Accepted
11154	10	887	27		28	The statement that there's no particular evidence on what the acceptance would be for the case of industrial applications of CCS is false. See comment 3 including a reference to an ancillary document including references on public acceptance of CCS related to real cases.	Accepted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
11155	10	887	30		33	The reference to de Best-Waldhober et al 2009 is incorrect in relation to the survey results from six European countries. The research in de BestWaldhober et al. 2009 concerned a comparison of six technologies, not countries. Possibly there's confusion with another report that did compare six countries: Desbarats, J., Upham, P., Riesch, H., Reiner, D., Brunsting, S., de Best-Waldhober, M., Duetschke, E., Oltra, C., Sala, R., McLachlan, C. (2010). Review of the public participation practices for CCS and non-CCS projects in Europe. NearCO2 report.	Accepted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
11156	10	887	33		35	An example of initiatives aiming to engage the public in a dialogue about the potential use of the technology within the context of other alternatives is the Large Group Process method used by CSIRO: Ashworth, P., Carr-Cornish, S., Boughen, N., Thambimuthu, K. (2009). Engaging the public on Carbon Dioxide Capture and Storage: Does a large group process work? Energy Procedia, 1, pp. 4765-4773.	Accepted - CCS discussion has been significantly reduced throughout the chapter and is now concentrated in chapter 7 (Energy)
11130	10	9				This figure may simplify for a superhuman, for me, it is impossible to understand	Noted - this valuable feedback will be used in completing the work of publishing this diagram. However, the position within the WG3 report will most likely be changed and the diagram included in one of the framing chapters (chapter 5)
8440	10	9				I suggest to invert this figure, putting consumer need on the left and then emission vector, transformation device, land-use, source and GHGs at the right	Rejected: figure follows the logical flow from the provision of primary energy carriers to the coverage of service demand. In any case this feedback has been forwarded to the authors of the framing chapter to which the diagram has now been transferred.
10133	10	9				This Sankey diagram misses the segmentation by industry, which is the governing segmentation in this chapter. The Sankey diagram from the World Resources Institute would be more helpful. (http://www.wri.org/publication/world-greenhouse-gas-emissions-in-2005 : World Greenhouse Gas Emissions in 2005 is a comprehensive view of global, anthropogenic greenhouse gas (GHG) emissions. The chart in this working paper is an updated version of the original chart, which appeared in Navigating the Numbers: Greenhouse Gas Data and International Climate Policy (WRI, 2005).)	Rejected: figure is displayed incorrect in the pdf, transport, building and industry are explicitly outlined in one of the columns and discussed in line 16-17. In any case, figure will be shifted to chapter 5 and modified
12953	10	9				Unless its a problem with my printer, certain important words do not seem to appear in the diagram e.g. Transport, Buildings, Manufacturing	Noted - this valuable feedback will be used in completing the work of publishing this diagram. However, the position within the WG3 report will most likely be changed and the diagram included in one of the framing chapters (chapter 5)

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15904	10	9	1			Sankey chart (fig. 10.2) is a good idea but is slightly confusing. It does a good job in showing where how the GHG emissions are allocated but does not show what the sources of these emissions are. It might be more useful to add a “standard” Sankey chart showing energy sources to the left, conversion steps in the middle (e.g., boilers, generators, compressors), and a breakdown of useful energy and wasted energy flows on the right to show where opportunity lies for improved efficiency (by minimizing waste energy, wasted product,...). The end users should also be more aligned with the traditional industry sectors (iron, steel, cement, food processing, ...) <ul style="list-style-type: none"> o The power of a Sankey is that it shows users which industries are the “heavy hitters” or contributors. So, food, construction, and heating are more important GHG emitters than lighting, communication, or tourism (another reason why I think it is not necessary to focus on this tourism) 	Rejected: figure is displayed incorrect in the pdf, transport, building and industry are explicitly outlined in one of the columns and discussed in line 16-17. In any case, figure will be shifted to chapter 5 and modified
7092	10	9	1	9	3	The large net sink due to forest growth and expansion should be noted., e.g. see Pan, Y., Birdsey, R., Fang, J., Houghton, R., Kauppi, P., Kurz, W., et al. (2011). A Large and Persistent Carbon Sink in the World's Forests. Science Vol. 333 , 988-993.	Rejected: figure focuses on emission and not mitigation options, discussion about the mitigation potential of forest growth is covered in chapter 11. In any case this feedback has been forwarded to the authors of the framing chapter to which the diagram has now been transferred.
4542	10	9	12			Billion? Please replace this with SI units (not sure if this 10^9 or 10^12)	Accepted - potentially confusing terms such as billion used only in a few instances now. Will be checked further as part of final copy-edit process.
9515	10	9	6	9	10	delete either sentence - These sentences are duplicated	Editorial - copyedit to be completed prior to publication
14260	10	9	6	9	11	The same sentence is duplicated.	Editorial - copyedit to be completed prior to publication
11782	10	9	9	9	11	Delete. Same as the before sentence.	Editorial - copyedit to be completed prior to publication
18517	10	9	9	9	11	This text is duplicated word-for-word with the preceding paragraph.	Editorial - copyedit to be completed prior to publication
10413	10	9				as the figure has not been published yet, the source of numerical values in this figure should be particularly	Noted - this valuable feedback will be used in completing the work of publishing this diagram. However, the position within the WG3 report will most likely be changed and the diagram included in one of the framing chapters (chapter 5)

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7718	10	9	1	9	4	This diagram intends to show all the anthropogenic GHGs but contribution of F-gases cannot be seen. Does it mean that f-gases are negligible small comparing other main 5 GHGs?	Noted - this valuable feedback will be used in completing the work of publishing this diagram. However, the position within the WG3 report will most likely be changed and the diagram included in one of the framing chapters (chapter 5)
10412	10	9	9	9	11	this paragraph repeats the content of the paragraph before it	Editorial - copyedit to be completed prior to publication
8857	10	p24		p25		section 10.4.2.1 iron and steel, 24-25, 2nd paragraph suggest to add the reference that analyzed cost effective energy efficiency measures and potentials in energy savings and carbon reduction: Xu, T., J. Sathaye, C. Galitsky. 2010. Development of Bottom-up Representation of Industrial Energy Efficiency Technologies in Integrated Assessment Models for the Iron and Steel Sector, Lawrence Berkeley National Laboratory Report to U.S. Environmental Protection Agency, Climate Economics Branch, Climate Change Division. LBNL-4314E.	Accepted - reference added (Worrel, E et al., 2010) (APP,2010),(Xu et al., 2010) Reference: Xu, T., J. Sathaye, C. Galitsky. 2010. Development of Bottom-up Representation of Industrial Energy Efficiency Technologies in Integrated Assessment Models for the Iron and Steel Sector, Lawrence Berkeley National Laboratory Report to U.S. Environmental Protection Agency, Climate Economics Branch, Climate Change Division. LBNL-4314E
8858	10	p26		p26		section 10.4.2.2 cement, 26-26, 3rd paragraph suggest to add newer reference that analyzed cost effective energy efficiency measures and potentials in energy savings and carbon reduction: Sathaye, J., T. Xu, C. Galitsky. 2010. Bottom-up Representation of Industrial Energy Efficiency Technologies in Integrated Assessment Models for the Cement Sector, Lawrence Berkeley National Laboratory Report to U.S. Environmental Protection Agency, Climate Economics Branch, Climate Change Division. LBNL-4395E.	Reference added. Contacted one of the authors to ask if the research has been published in a journal article.
8859	10	p29		p30		section 10.4.2.4 pulp and paper, pages 29-30, 1st paragraph suggest to add newer reference that analyzed cost effective energy efficiency measures and potentials in energy savings and carbon reduction: "Xu, T., J. Sathaye, K. Kramer. 2012. Development of Bottom-up Representation of Industrial Energy Efficiency Technologies in Integrated Assessment Models for the Pulp and Paper Sector, Lawrence Berkeley National Laboratory Report to U.S. Environmental Protection Agency, Climate Economics Branch, Climate Change Division. Lawrence Berkeley National Laboratory Report." On black liquor gasification, according to LBNL study (Kramer et al. 2009, page 107), potential disadvantages of gasification combined cycle systems include the energy investments required for achieving sufficient black liquor solids concentration and higher lime kiln and causticizer loads (and associated fuel inputs) compared to Tomlinson systems. Whether or not it's economical option depend on location and applications.	Noted - Cannot find the suggested reference from a quick search online. It could be evaluated and considered if it becomes accessible in the future. Taken into account - potential disadvantages of gasification have been added to the text.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8860	10	p31		p32		<p>Section 10.4.2.6 Page 31-32. The existing content seems too US-centric and shall be revised to cover more regions (ideally from global perspective). For example, dairy processing is among the most energy and carbon-emission intensive within global food processing industry. Xu and Flapper (2009, 2010) performed extensive analysis on global and regional dairy processing sector, and estimated that GHG emissions associated with energy use in the global dairy processing sector is responsible for over 128 million metric tonnes of CO2 emissions annually. Xu et al. (2009, 2012) identified cheese sector among the most carbon and energy intensive dairy processing, and developed a tool and recommendations for promoting mitigating strategies in the energy dairy processing sector. Supporting references are:</p> <p>Xu, T. and J. Flapper. 2010. Reduce Energy Use and Greenhouse Gas Emissions from Global Dairy Facilities. Energy Policy. Volume 39, Issue 1, January 2011, Pages 234-247. doi:10.1016/j.enpol.2010.09.037;</p> <p>Xu, T. and J. Flapper. 2009. Energy Use and Implications for Efficiency Strategies in Global Fluid-Milk Processing Industry. Energy Policy, Volume 37, Issue 12, December 2009, Pages 5334-5341.</p> <p>Xu, T., J. Flapper, and K. J. Kramer. 2009. Characterization of Energy Use and Performance of Global Cheese Processing. Energy - The International Journal, Volume 34, Issue 11, November 2009, Pages 1993-2000.</p> <p>Xu, T., J. Flapper, J. Ke, K. Kramer, J. Sathaye. 2012. Development of a Computer-based Benchmarking and Analytical Tool: Benchmarking and Energy & Water Savings Tool in Dairy Plants (BEST-Dairy). California Energy Commission, CEC 500-06-058, Lawrence Berkeley National Laboratory Report, LBNL-5679E.</p>	Accepted - sentence added "Dairy processing is among the most energy- and carbon-intensive activities within the global food production industry, with estimated annual emissions of over 128 MtCO2 (Xu and Flapper 2009; Xu and Flapper 2010). Within dairy processing, cheese production is the most energy intensive sector (Xu et al., 2009)"