Expert and Government Review Comments on the IPCC WGIII AR5 Second Order Draft – Chapter 10

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24076	10					This can be moved and implemented in the introduction part to 10.4 and can be excluded or referred in the faq	Rejected as FAQs are a dedicated structural element
24082	10					Improve table structure, use graphics to visualize potentials	Accepted
24081	10					Improve table structure, use graphics to visualize potentials	Editorial
24083	10					Are the benefits and risks ordered? Explain this in the table text.	Section redrafted
24086	10					Explain how thee figure work. You only explain what is in the pyramid but not how those are collaborating	Accepted. More clarifying text has been added.
25473	10					delete the references which are "under review"; you can save one page by deleting these	Rejected, al references will be published in time for publication of the chapter
23053	10					In general, Chapter 10 is not consistent with its treatment of the waste/wastewater sector emissions. Please use a consistent strategy throughout Chapter 10 in the final revisions. In some cases, e.g. (chap 10 p15 line 10: “Direct GHG emissions from industry and waste/wastewater represented 18.4% of global GHG emissions in 2010”), the numbers are combined, even though the waste total is quite a small portion of the total. If the chapter is titled “industry”, and waste is considered part of that chapter, it would seem that, in most cases, the totals represent totals for “industry”. It is currently unclear if the new section at the end of the chapter on “waste” will be fully integrated into the chapter. Some suggestions for shortening this new section are included below.	Considered . Figure 10.1 and 10.2 added and introduction revised substantially. Emissions from waste/wastewater are now provided separately and not combined with other values.
35418	10					This pyramid it's an interpretation of the Waste Hierarchy from energy perspective. In Europe there is increasing evidence that landfilling of pre-treated and stabilised MSW features better than most incineration options -with or without heat recovery- ref: Balinger, 2011, Climate Change Impacts of Residual Waste Treatment. Also in the US there is evidence that with proper waste management MRBT (mechanical and biological recovery plant) with biological stabilisation features better than incineration from an economic but also climate perspective (Morris J., Lombardi E., Favoino E. 2013. What to do with the "leftovers of zero waste). The most updated reference to the Waste Hierarchy is the one provided by the World Bank in their latest report on waste: What a waste - A Global Review of Solid Waste Management. 2012. As it says in this report, in figure 14, where i clearly makes a distinction between the different treatment options according to their environmental impact. Finally, incinerators in developing countries are not common, and generally not successful because of high capital, technical, and operation costs, high moisture content in the waste, and high percentage of inerts. Reference: World Bank, What a waste - A Global Review of Solid Waste Management. 2012. Furthermore, the waste-to-energy projects generally conflict with the informal sector, limiting waste pickers’ access to recyclable materials and negatively impacting their livelihood. Reference: UNEP, 2010. Waste and climate change. Global trends and strategy framework.	Accepted. The text was also modified to indicate that the Hierarchy provides general guidance and that communities may opt for different priorities depending on economics and local conditions.

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35476	10					This pyramid it's an interpretation of the Waste Hierarchy from an nergy perspective. In Europe there is increasing evidence that landfilling of pre-treated and stabilised MSW features better than most incineration options -with or without heat recovery- ref: Balinger, 2011, Climate Change Impactes of Residual Waste Treatment. Also in the US there is evidence that with proper waste management MRBT (mechanical and biological recovery plant) with biological stabilisation features better than incineration from an economic but also climate perspective (Morris J., Lombardi E., Favoino E. 2013. What to do with the "leftovers of zero waste). The most updated reference to the Waste HIerarchy is the one provided by the World Bank in their latest report on waste: What a waste - A Global Review of Solid Waste Management. 2012. As it says in this report, in figure 14, where i clearly makes a distinction between the different treatment options according to their enviornmental impact. Finally, incinerators in developing countries are not common, and generally not successful because of high capital, technical, and operation costs, high moisture content in the waste, and high percentage of inerts. Reference: World Bank, What a waste - A Global Review of Solid Waste Management. 2012. Furthermore, the waste-to-energy projects generally conflict with the informal sector, limiting waste pickers' access to recyclable materials and negatively impacting their livelihood. Reference: UNEP, 2010. Waste and climate change. Global trends and strategy framework.	same as above
31210	10					In terms of "Reducing overall demand for product services", cross-reference shoul be taken. For example, "5.6.3 Infrastructure choices & lock in" ... Transport is a case in point. Air, rail and road transport systems all rely on a supporting infrastructure, and compete for distances in the range of 1500km. Of these options, railways have lowest emissions, but they require substantial infrastructure investments. Similarly, for urban transport, public transport requires substantial infrastructure investments in order to provide mobility with relatively low emission intensities.	Rejected, this is a very good point, but due to severe space constraints we are not able to include the aspect in the chapter
19165	10					Genetal comment. Only formal industries are mentioned. Fuelwood and charcoal production are important rural industries. It is usually low-income people who gather and collect wood for sale or turn it into charcoal for sale. These people need help. However, in several countries they are harassed by authorities. There are many informal industries from brick and tile manufacture, lime burning, tobacco curing, tea drying etc. All this industries could do with technical help, market information and a positive attitude by governments.	These are relevant for energy sector chapter 7. some examples relevant for Industry sector but literature on informal sector and relevant texts for this chapter are just not available. See some consideratinos in box 10.1
34802	10					Nitrous oxide emissions contributes significantly from wastewater treatment depending upon the total nitrogen content of wastewater and effluent being discharged into riverine, estuarine and ocean water and aerobic/ anaerobic wastewater treatment technologies used; and it needs to be incorporated into the document.	Accepted. These emissions will be better described in the text
34803	10					Significant amount of methane and nitrous oxide emissions occurs from wastewater in the wastewater or sewerage network and when wastewater is discharged from the wastewater network into the riverine, estuarine and ocean water during dry or stormweather overflows, which is going to happen more frequently under changing climate.	Almost duplicate of 34802
32292	10					What are the messages that this figure tell?	Accepted: paragraph modified to further describe messages

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26886	10					The graph and assumptions in this paragraph should be treated very carefully. The pyramid follows an energy hierarchy and not a waste management hierarchy. In Europe there is increasing evidence that landfilling of pre-treated and stabilised MSW features better than most incineration options -with or without heat recovery- ref: Balinger, 2011, Climate Change Impactes of Residual Waste Treatment. Also in the US there is evidence that with proper waste management MRBT (mechanical and biological recovery plant) with biological stabilisation features better than incineration from an economic but also climate perspective (Morris J., Lombardi E., Favoino E. 2013. What to do with the "leftovers of zero waste). Finally, in the global south in places with high moisture and involvement of informal recyclers from a climate and social perspective incineration performs worst than landfilling Ref: Chintan, 2009, Cooling Agents. An examination of the role of the informal recycling sector in mitigating climate change.	same as above
30134	10					Row 1 (Energy efficiency): Is "Low cost alternative" the same as "Reducing energy input costs"? If not, please explain.	Yes
30135	10					Row 2 (Emissions efficiency etc): What does "new opportunity for using non-conventional power" refer to? Please explain. Why is "reduced trade deficit" in this box? I think it should be moved to the previous row (Energy efficiency). And what does "affordability with more waste recycling" mean? That seems to go better in the next row (material efficiency)?	Accepted
30136	10					Row 2, Social. Why is "competing demand of scarce land" in this box? Does it refer to the space needed for CCS plant? Please clarify.	New table does not include CCS
30137	10					Row 2, Environmental. Employment opportunity does not belong here. However, you should add that there will be negative environmental impacts associated with the increased fuel demand to power the CCS process.	New table does not include CCS
30138	10					Row 2, Other. I do not think that technology transfer, new skill development, institutional reform or fuel price policy are negative benefits. They may be policy needs, but that is a different thing altogether. Suggest they are deleted from this box.	Accepted
30139	10					Row 3 (Material efficiency): What does "reduced displacement from reduced demand for landfill sites" mean? I would just say "reduced demand for landfill sites". In "Other" I would delete "Investment and knowledge sharing of new innovation" as I don't think this is a dis-benefit.	Accepted
30140	10					Row 4 (Product demand reduction): I don't think any of the points in "Other" belong here: they are policy needs, not dis-benefits, and should be deleted.	Accepted
30141	10					Row 5 (Non-CO2 GHGs): None of the points in the first box are valid co-benefits or disbenefits. Suggest replace with just "- Increase in manufacturing costs for PV panels and flat screen TVs" (if this is what you mean).	Accepted

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26984	10					This pyramid it's an interpretation of the Waste Hierarchy from an nergy perspective. In Europe there is increasing evidence that landfilling of pre-treated and stabilised MSW features better than most incineration options -with or without heat recovery- ref: Balinger, 2011, Climate Change Impactes of Residual Waste Treatment. Also in the US there is evidence that with proper waste management MRBT (mechanical and biological recovery plant) with biological stabilisation features better than incineration from an economic but also climate perspective (Morris J., Lombardi E., Favoino E. 2013. What to do with the "leftovers of zero waste). The most updated reference to the Waste HIerarchy is the one provided by the World Bank in their latest report on waste: What a waste - A Global Review of Solid Waste Management. 2012. As it says in this report, in figure 14, where i clearly makes a distinction between the different treatment options according to their enviornmental impact. Finally, incinerators in developing countries are not common, and generally not successful because of high capital, technical, and operation costs, high moisture content in the waste, and high percentage of inerts. Reference: World Bank, What a waste - A Global Review of Solid Waste Management. 2012. Furthermore, the waste-to-energy projects generally conflict with the informal sector, limiting waste pickers' access to recyclable materials and negatively impacting their livelihood. Reference: UNEP, 2010. Waste and climate change. Global trends and strategy framework.	same as above
20319	10					While, the SOD has significantly imporved since the FOD, I am still surprised to see the section on tourism and on waste management included in the industry chapter. These would be logic places to cut, in order to meet the intended length. The waste management may have closer connection to industry, but in fact emissions of waste management are the key part of this section, and not emissions mitigated due to recycling or reuse. Having these in the industry chapter really communicates hard and is not in line with how the sector has been defined in the past. This will generate a lot of trouble down the road.	Comment part 1 -On tourism : We are taking out graph related to tourism. And have now kept the example in box. Some other reviewers have apprecaited the example of tourism so we have tried to balance alternative reviewers comments using expert judgement of the author team and decision of plenary of IPCC. comment part 2-On waste: please see the response to comment 23053. Waste appendix was included as per decision of IPCC plenary. Final Draft attempts to improve the link between industry and waste management (see text immediately following Figure 10.2
20362	10					This table provides calorific values for energy carriers; not materials. Delete?	Accepted. Table is deleted.
20360	10					This figure lacks one important step in the hierarchy, and that is Re-use of the product (e.g. Swithcing to a refillable bottle, instead of a bottle used once). The figure is a good example of my comment 40, as it really focuses on waste management technologies. Also anaerobic composting should read anaerobic digestion. The residue from a digester can be processed in a composting plant to provide compost. I would replaxe this figure and include re-use in it, especially with the attention given to material efficiency in the current report.	Accepted. The Figure has been revised.
24087	10					Focus on Mitigation. To reduce the total chapter and increase readability include chapter 10.6, 10.9, 10.10, 10.11 in 10.4 but in a much more compact format. Focus on 10.4 and 10.7 and keep information sector wise as much as possible.	Rejected as the chapter outline was set by IPCC plenary and is the same for all end-use chapters, to increase coherence
20636	10					Cut by 30%.	Text has been shortened where possible

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20637	10					Cut by 30%.	Text has been shortened where possible
20359	10					As the AR4 and this report show, we still lack good estimates of potentials for energy efficiency and GHG emission mitigation in a bottom-up way. Therefore, the discussionalso in this chapter in section 10.7 remained rather superficial, as no major new studies have been done in over 10 years.	Accepted - knowledge gaps section highlights this
20638	10					Cut by 30%.	Rejected - the section increased as a result of guidance that the chapter received from the Chairs
20628	10					Cut by 30%.	Partially accepted. We will look for ways to shorten this section, if possible.
25983	10					this section could be drastically reduced, as it shows current stats and not long term views. Keep table 10.1	Rejected. This section is on "new developments in emissions trends and drivers" not on long term views.
20629	10					Cut by 30%.	Partially accepted. We will look for ways to shorten this section, if possible.
20329	10					The mining sector is not clearly defined. Does this include the coal, oil & gas mining?	Accepted. Footnote 3 (now footnote 9) amended to say "Discussion of extraction of energy carriers (e.g. coal, oll, and natural gas) takes place in Chapter 7."
24068	10					Add a summery of low hanging fruit mitigation percentage in all sectors described to give the reader a fast overview of the most important sectors. E.g. Cement 0.4Gt, CO2eq, Iron and steel 1.2Gt CO2eq	Noted: Comment 37467 recommended some summary tables - and I think the earlier comment was better phrased. The idea that there are "low hanging fruit" is unfamiliar to me - given that around one third of the costs of steel and cememt production is for energy purchasing, I think it's unlikely that any of the remaining fruit are particularly low hung. The two figures for steel and cement are given without references, so I assume these are examples of numbers and units, rather than proposed mitigation options.
20630	10					Cut by 30%.	Rejected, the section is already extremely limited

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20335	10					The structure of discussion for each of the sub-sections (sectors) varies. A consistent approach would be better. The structure of the cement section (10.4.2) is an excellent example to organise these sections.	Rejected: This comment was given to us after the FOD, as a result of which we restructured all these sections to mirror 10.4.2. In the SOD, the structure of, for example 10.4.1 is identical to that of 10.4.2 so I think the reviewer may have become confused between different versions.
24069	10					Reduce nr of specific case example. Try to generalize the most important case results and remove the rest. It is hard for the reader to understand what is the most important for this sector. Refer instead to that "there are plenty of specific small improvements to implement, If implemented in the hole sector they could potentially reduce emission by .. Gt CO2eq"	Noted: Other reviewers have asked for specific examples, and to my taste the balance here is about right. Abatement potentials for most of the examples are given as percentages, which seems the appropriate way to report them, and doesn't therefore require further scaling.
24071	10					Reduce nr of specific case example. Try to generalize the most important case results and remove the rest. It is hard for the reader to understand what is the most important for this sector. Refer instead to that "there are plenty of specific small improvements to implement, If implemented in the hole sector they could potentially reduce emission by .. Gt CO2eq"	See response to 24069
20338	10					Process integration is not discussed, while this may offer large potentials.	Noted: however the reveiwer does not provide references to any peer-reviewed literature to help us assess the potential of process integration.
24073	10					Reduce nr of specific case example. Try to generalize the most important case results and remove the rest. It is hard for the reader to understand what is the most important for this sector. Refer instead to that "there are plenty of specific small improvements to implement, If implemented in the hole sector they could potentially reduce emission by .. Gt CO2eq"	See response to 24069.
20347	10					This section needs some attention. It starts with saying that dairy is so important, and then states that in the US meat processing, wet corn milling and fruit & vegetables are key. On what is this earlier statement based? Also, for dairy, check the paper by Ramirez et al. of a few years ago.	Thanks - I've restructured the section included the Ramirez paper, and the more recent LBNL best practice survey, of which the reviewer was a co-author.
20348	10					This section is not organised very well. Technology examples seems very random, and the information as well. Better structure this section and then report the relevant information.	See response to 20347
20350	10					Mining sector is never really well defined. What is included? It seems to exclude coal, oil & gas, while these are responsible for the largest share of mining energy use and emissions. Are they treated elsewhere?	Taken into account: definition of what's included has now been added immediatley following figure 10.2

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20631	10					Cut by 30%.	Reject, cooperation aspects becomes more and more important globally, is still not very well known as an option and should be refelcted sufficiently.
20352	10					While this is a good option, benefits will be strongly determined by local conditions. This may need some discussion. There is a growing body of literature on this. Note that in the current text, the discussion mainly focuses on resources, and not on energy (or GHG) emissions. Focus the discussion on GHG impacts, which can lead to a much shorter section. Also the distinction between meso and macro-level is rather artificial, and the example used from Sweden in section 10.5.2 is actually collaboration on the meso-level...	First part- accepted but unfortunately reviewer provides no literature examples. Second part: this section is one of the most relevant place in the chapter to raise the the discussion on synergies between resource efficiency and mitigation. Third part Rejected. Swedish case is collaboration between industry and local government, which is typical cross-sectoral. Interms of the distinction between meso and macro, the introduction to 10.5 covers this
24078	10					Built on happy stories. Those needs to be generalized or reduced to a couple of important stories.	We believe that the current cases can better reflect the most recent progress and should be kept
24079	10					Reduce number of examples of best practices, or generalize the examples. Decrease this section.	Section has been somewhat reduced
20632	10					Cut by 30%.	Rejected, section is already limited extremely
24080	10					This chapter should focus more on the good diagrams of costs and potential. Reduce all text that is not explaining those tables and introduce them earlier. Reduce number of small case examples in the section	Section redrafted
20633	10					Cut by 30%.	Rejected - section redrafted
34431	10					This section would benefit from the inclusion of figures that show option-specific mitigation potentials for the different subsectors.	Section redrafted
20353	10					I think this section can be strengthened, especially using some of the references added above, and those that are already cited before in the text. Also, align the size of the sections/paragraphs with the importance to the contribution to the overall potential.	Section redrafted
20356	10					Where is industrial CHP in the discussion of potentials?	Section redrafted, several mentions of cogeneration now included
30200	10					Major part of this section can be summarized and transferred to 10.4 Mitigation.	Section redrafted
20634	10					Cut by 30%.	Text has been revised
20635	10					Cut by 30%.	Text has been shortened where possible

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20357	10					This section needs to be organized better. In the TAR a framework for barriers analysis has been given which could be used to structure this discussion. SMEs may need some special attention, and some of the new references in this area are already included. See also: 1. A. Trianni, E. Cagno, E. Worrell, and G. Pugliese. Empirical investigation of energy efficiency barriers in Italian manufacturing SMEs. Energy 49: 444-458 (2013). Note that GHG emissions from SMEs may be limited, but still considerable potentials exist.	Rejected: framework used follows the same logic as for the other end-use chapter to improve reader consistency
23681	10					David Allaway, Oregon Dept Environmental Quality in the US has done extensive work on source reduction- pre consumer waste- as a critical component of MSW reduction-	Noted, unfortuantely not enough space to cover all the literature. Some specific examples of references would have helped.
23688	10					How about a discussion of decentralized systems? Composting toilets, urine diversion and reuse are all appropriate technologies for areas with poor or no existing infrastructure. Local or individual systems have the potential for large scale emissions reductions and resource recovery. See for example a recent paper by Dodane et al 2012	Accepted, descentralized systems have been addressed in section 10.14.3.3
35282	10	0				For industrial sector, technology transfer is a main obstacle to mitigation. However, the importance of technology transfer is not mentioned in this chapter. Low-carbon technology will bring significant environmental and carbon mitigation effects; but it is usually not economically attractive due to its high cost.. The existing mechanisms are not incentive or effective to promote fast transfer and application of low-carbon technologies, which currently is a key challenge for mitigation in industrial sector. It is suggested to add more discussion on technology transfer in industrial sector including obstacles. In addition, when referring to results from scenario studies, the underlying assumption shall be provided and clarified. It is suggested to use the following sentence to refer to scenario studies: “Scenario studies by author (year) showed that there is a possibility that (the quoted text), at the assumption of …; or tag those quoted text with ‘low confidence’ or ‘low evidence’”	Accept partially. Barrier section addresses some of it . Revised cost and potential section shows low cost options and high cost options. Technlogy transfer issue in general is taken care of by chapters 13 and 16. Accept comment on scenario assumptions, have tried to make sure cases are defined and referenced (but the way suggested is too simple and would take too much space)
35347	10	0				Dubois, Ghislain, Jean-Paul Ceron , (2006).Tourism and its Interactions with Climate Change; Journal of Sustainable Tourism ; Volume 14, Issue 4, 2006 ; 399-415; DOI:10.2167/jost539.0	Thank you, these references are relevant and could be added…just as well as others. We tried to select the references the most adapted to the text and not to overload it with references
35348	10	0				Scott, Daniel (2011). Why sustainable tourism must address climate change. Journal of Sustainable Tourism. Volume: 19 Issue: 1; 17-34 Article Number: PII 931119693 DOI: 10.1080/09669582.2010.539694.	see 35347
35349	10	0				Weaver, David (2011). Can sustainable tourism survive climate change? Journal of Sustainable Tourism , Volume 19, Issue 1, 2011; 5-15; DOI:10.1080/09669582.2010.536242	see 35347
30942	10	0				The chapter could be shortened by reducing repetitiveness. For example, essentially the same information on GHG emissions is provided on p. 4 (2), 10, and 15 (FAQ 10.1).	Agree that the information is repeated, but that it because it is in 3 different formats: chapter text, chapter executive summary, and a FAQ. It should not be deleted from the text, but we have tried to shorten it in the executive summary and FAQ

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30943	10	0				While information on the benefits of emission reduction is useful, more attention could be given throughout the chapter to the cost of mitigation. For example, it is important to know when the environmental benefits of co-location of related industries in eco-industrial parks are accompanied by benefits to profitability of the companies involved and when such co-location might instead result in additional costs. In the same way, it is important to spell out any negative consequences to product duality (performance, durability, etc.) that may result from decisions to change to low-emission inputs. A related issue is that, while best available technology (BAT) provides an upper bound for emission reductions, the approach over time of an industrial sector to the emission levels dictated by BAT can never be instantaneous. Again, discussions of technical feasibility can be enhanced by adding some consideration of economic feasibility.	Accept partially. New Cost and potential section (10.7) is being thoroughly revised. The expected material in the comment goes beyond existing knowledge so some mention made in knowledge gap section. Benefits of co-location of industries addressed in 10.5, Reviewer does not suggest any references regadring negative consequences on products characteristics by changing to low emission inputs, or time needed for the sector for the adoption of BATs.
30944	10	0				Fuel switching is repeatedly recommended as a means of mitigating emissions. There are clear technical and economic limits to this that you could consider mentioning.	Already covered in 10.9.2; no specific suggestion given
33261	10	0				The integration of the concepts and definitions of the framing chapters 2, 3, and 4, could be improved to increase coherence and consistency across all chapters of the report. Especially, you may want to discuss the link from mitigation to sustainable development in more detail.	Care has been taken while redrafting
33262	10	0				Please avoid prescriptive language. You carefully need to avoid phrasing that could be mistaken for advocacy. This should be kept in mind when revisiting individual sections.	Accepted
20821	10	0				In general, I suggest the authors to take inspiration from the following document edited by the EEA: "Waste opportunities — Past and future climate benefits from better municipal waste management in Europe" (http://www.eea.europa.eu/publications/waste-opportunities-84-past-and)	The new rewritten waste appendix and section 10.4 do mention opportunities and challenges of MSW management
24721	10	0				Suggested reference: the Australian 'energy efficiency exchange' website. Citation - Australian Government Department of Resources, Energy and Tourism (2013). Energy Efficiency Exchange website. URL: www.eex.gov.au The Energy Efficiency Exchange is a joint initiative of the Australian, state and territory governments administered by the Department of Resources, Energy and Tourism. It aims to support the development and implementation of energy management and energy efficiency strategies by providing quality information from respected national and international sources in one location. It includes a range of recently researched and thoroughly referenced material looking at significant energy efficiency potential. In many areas, it seems to go beyond existing resources in this chapter in identifying innovative mitigation/energy efficiency strategies.	Noted, with thanks. The chapter (as all of AR5) aims to rely as much as possible on independently reviewed literature. Unfortunately the comment is not specific enough as to what areas could benefit from the use of this reference. Benchmarking initiatives are covered in policy section (10.11)
24722	10	0				Most modelling presented in chapter 7 and the results used in chapter 10 are in terms of energy emissions. In the absence of individual country data presented, it is not clear which country's 'emissions factors' were used while translating 'energy use' to emissions in the model. It may be noted that the emissions factors change by the quality of the energy resource used. Accordingly, it is recommended to have an annex listing country emissions by major sector.	Each model makes its own assumptions and approximations, please see Chapter 6 for details
24723	10	0				Given the contribution industry makes to global emissions and emissions growth, there may be merit in inclusion of a more detailed discussion about the barriers to adoption of low emissions technologies for industry in this chapter. Barriers to uptake of renewable energy in the mining sector have been the focus of recent research in Australia. See: http://www.ret.gov.au/energy/clean/acre/studies/pages/studies.aspx	Barriers covered in 10.9; did not find relevant reference in suggested website. A source on energy efficiency for mining from this organisation is used in section 10.4.7

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25338	10	0				The chapter has 398 references, out of which 92 are from the chapter authors only.	All IPCC authors are selected because they are experts in the field . So this is not unnatural. Any new suggested reading could have gotten due respect.
25339	10	0				Out of these 398 references, only 29 (8%) are on developing countries. It is suggested that a more balanced approach could be adopted.	Partially Accept. Author team is also aware of this. But appropriate information was unavaialble . Some suggested references could have helped the author team .
25340	10	0				A quick check on the total universe of articles in peer-reviewed journals since AR4 (2007) indicates that there are almost 410000 in journals of Science Direct, 99000 in Francis & Taylor, 124000 in Springer, 31000 in Sage, 577000 in Wiley and 50000 in Jastor , totaling to around 1293000 articles in all. The chapter has captured almost 0.03% of existing literature. However literature cited from journals other than climate change and energy domains are not many in this chapter. Developmental issues and their linakges with energy sector are also captured in many articles in reputed journals. It is suggested that this lack of coverage may be looked into.	Partially accepted - author team will try to increase coverage of literature since AR4 but has to focus on the most relvant new findings in ist assessment
25341	10	0				Out of total 1293000 articles mentioned as above, almost 102000 (8%) are on developing countries and issues related to them. It indicates that there is a large enough pool to pick up articles on developing countries to be cited in this chapter, especially when the chapter talks about more industrial expansion occuring in developing countries and emerging economies, it is suggested to provide a higher representation of articles from these countries.	Partially accepted. However, the author team is bound by the outline approved in the plenary and cannot include content intended beyond that is agreed upon.
25343	10	0				The introduction says that the work discusses the trends in activity and emissions, options for mitigation (technology, practices, and behavioural aspects), mitigation potential of these options , and costs, benefits, risks and barriers to their deployment and industry-specific policy measures. Then it is logical to use time series data to analyse energy consumption in various manufacturing industries which will provide information on changing energy mix, outputs which result in changing energy and emission intensities. But, this is not what is presented here.	The comment asks that we present "time series data to analyse energy consumption in various manufacturing industries which will provide information on changing energy mix, outputs which result in changing energy and emission intensities". We do present time series data on energy consumption for manufacturing as a whole in Table 10.3 (now Table 10.2), but not for various manufacturing industries due to lack of space. However, each manufacturing industry is discussed further in Section 10.4. Due to space constraints, we do not include information on the changing energy mix and outputs for each manufacturing industry. Some information on energy and emissions intensities is provided in Section 10.4 for each sector covered there.

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25344	10	0				The Tables and Figures that are presented just provide numbers without any analysis. For example, Table 1 provides information on the output of various industrial sub sectors between 2005 and 2011. The immediate question is its relevance or lack of it. If the authors provide information on the changing energy use (different types), then we can find out the decrease in energy intensities (GJ/unit of output). Similarly, Figure 1 shows the changing emissions (1971--2010) without any input on the industrial data. If the entire data are given, we can ascertain which country is doing better in term of energy intensity and emissions.	Partially accepted. There is discussion of the significance of the information in Table 1 ("Over the last decade the world has witnessed decreasing industrial activity in developed countries with a major downturn in industrial production due to the economic recession in 2009 along with significant increases in industrial activity of some developing countries..."). It is not possible to relate energy use (from the IEA statistics) to the production values shown in Table 10.1 because the IEA statistics do not provide energy use in the same categories. For example, the IEA statistics provide energy use for "Non-metallic minerals such as glass, ceramic, cement, etc." so it is not possible to map the energy use to the production of specific products such as cement. Some discussion of energy intensities is provided for individual manufacturing sectors in Section 10.4. The data for Figure 1 is currently presented by major emissions sources and could also be presented by major world regions (but currently this is not included due to space constraints). Even with this information, it would still not be possible to "ascertain which country is doing better in terms of energy intensity and emissions" because 1) energy intensity would still not be presented and 2) information is not presented on the country-level.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25345	10	0				Similarly, Table 2 provides information on primary and final energy, and carbon emissions. Based on the information given one can find out the conversion efficiencies (from primary to final) and emission intensities. Surprisingly the definition of primary and final energy provided by the authors are not correct. Primary energy is the one which is obtained from nature while the final energy is the one that enters into the device. The same is the case with all the Tables and Figures. Also, some data are from 2005 to 2010 while some are for 1970 to 2010 and so on. There is no consistency.	Table 2 (or more accurately 10.2) provides production values, not energy values. If the comment is regarding Table 10.3, I am not sure what "definition of primary and final energy" the comment refers to. If it is the definition on page 11, footnote 4, then I disagree with the comment and believe that the definition is correct. However, I also agree with the gist of the comment that says "primary energy is the one that is obtained from nature" (e.g. coal, natural gas, solar power, etc.) and "the final energy is the one that enters the device" (e.g. electricity). The explanation in footnote 4 described how we convert final energy (e.g. electricity) to its primary energy equivalent, so perhaps that is the cause of the confusion. A new footnote has been added that says The Glossary explains: “Primary energy is the energy stored in natural resources (e.g. coal, crude oil, natural gas, uranium, and renewable sources. Primary energy is transformed into secondary energy by cleaning (natural gas), refining (crude oil to oil products) or by conversion into electricity or heat. When the secondary energy is delivered at the end-use facilities it is called final energy (e.g. electricity at the wall outlet), where it becomes usable energy in supplying services (e.g. light)." In addition, footnote 4 (now footnote 5) has been modified to say "In order to calculate primary energy for non-fossil fuel (hydro, other renewables, nuclear), we followed the direct equivalent method (see description of this method under
25346	10	0				Similarly, Table 2 provides information on primary and final energy, and carbon emissions. Based on the information given one can find out the conversion efficiencies (from primary to final) and emission intensities. Surprisingly the definition of primary and final energy provided by the authors are not correct. Primary energy is the one which is obtained from nature while the final energy is the one that enters into the device. The same is the case with all the Tables and Figures. Also, some data are from 2005 to 2010 while some are for 1970 to 2010 and so on. There is no consistency.	no response required - duplicate of 25345

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25347	10	0				If the focus is on manufacturing industries, then we should start with their share in total energy over the years. Also, the change in fuel mix. How does it change in various countries? Then we have to focus on the output (both value added as well as physical output) and then the intensities (energy and emissions). Once we observe changes, the next question is to find out the reasons. Is it due to changing fuel mix or substitution of efficient technologies in place of inefficient ones (technology effect) or change in process (for example, in cement industry change to dry process from wet process). In the present study, the first table provides information on output, the second is on emissions, and the next is on some sub-categories.	Partially accepted. Sentence added: "Manufacturing is responsible for about 98% of total direct CO2 emissions from the industrial sector (IEA, 2012b; c)." It is not possible to discuss the change in fuel mix in various countries due to space limitations, although perhaps some information on this could be added in the sector-specific discussions in section 10.4. New text added on economic energy intensity trends. Information on manufacuturing intensity trends using physical output is more difficult to obtain for all countries due to lack of reporting on physical production levels that directly correspond to the energy data categories. Even so, there are some discussions of physical energy intensity trends provided in Section 10.4. It is difficult to make general statements about the reasons for the changes in intensities across manufacturing sectors and across countries. The type of decomposition described in the comment is not available for all countries, regions, or manufacturing sectors.
25348	10	0				There is some information on the saving potential. They are only estimates from IEA. If we really wish to decrease energy use, we should know the energy use for each service/process. For example, consider energy use by motors in textiles. If we know the energy used by motors, then, we can estimate the energy savings through the replacement of inefficient motors with efficient ones and the related cost of savings too. Without any specific information, giving some broad, off-repeated suggestions, we cannot achieve the required savings.	The Costs and Potentials subsection has been extensively redrafted, and so have the corresponding messages in the Executive Summary.
25349	10	0				Many studies from India, China and other countries show reductions in energy intensities (Jeferson et al, 2002, “What is Driving China's Decline in Energy Intensity”, Resource and Energy Economics, 26(1), pp.77–97; and B S Reddy and Binay K Ray, 2011, Understanding industrial energy use: Physical energy intensity changes in Indian manufacturing sector, , Energy Policy, 39 (11), pp 7234–7243). Instead of providing some hypothetical figures, the figures from such studies should have been highlighted.	Rejected. Both references do not cover recent developments (the Indian paper covers 1991-2005 and the China paper covers 1997-1999). Sub-sector specific trends in energy intensity are discussed in Section 10.4.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25350	10	0				The focus on “tourism” sector is surprising. The authors mix the transport sector with tourism. Why this should come in industry-focus sectors.Many international travels are not for tourism purpose, they include business too. We do not have an estimation of the amount of energy used for “tourism-specific” travel.	The UNWTO definition of tourism we abide by includes business travel and the statistics too
25351	10	0				Material efficiency and emission efficiency needs to be defined and intrepreted. Any material used in a device and the device efficiency is taken into consideration.	Included in revised draft
25352	10	0				The following references might be useful Wolfgang Eichhammer and Wilhelm Mannsbart, 1997. “Industrial energy Efficiency indicators for a European Cross-country comparison of energy efficiency in the manufacturing industry”, Energy Policy, 25(7-9), pp.759-772. Taylor Michael, 2006. “Energy efficiency and CO2 reduction opportunities in the Global Cement Industry”,IEA-WBCSD cement industry workshop, IEA, Paris. Shahid, K.M., 2001. “Environment Friendly Waste Paper. Special report. A publication on World Pulp, Paper and Allied Industry”. Phylipsen G.J.M, Blok K. and Worrell E., 1997. “International comparisons of energy efficiency methodologies for the manufacturing industry”, Energy Policy, 23(7-9), pp.715-725. Nelsson, LJ,Larso, ED, Gilbreath,K.R and Gupta, A., 1995. “Energy efficiency and the pulp and paper industry”, American Council for an Energy-Efficient Economy, Berkeley Ca,USA. Nanduri M., 1998. “An assessment of energy intensity indicators and their role as policy - making tools”, Report No 232, School of resource and environmental management, Simon Fraser University. Miketa, 2001. “Analysis of energy intensity developments in manufacturing sectors in industrialized and developing countries”, Energy policy, 29, pp.769-775. Liaskas K., Mavrotas G., Mandaraka M., Diakoulaki D., 2000. “,Decomposition of industrial CO2 emission - the case studies of European Union”, Energy Economics, 22, pp.383-394.	Rejected, where possible we try to focus in the assessment on references published after AR4 (i.e. Post 2007)
25353	10	0				No new or innovative policy measure has been suggested which revolutionises energy/climate scenario in manufacturing industry. The focus should have been on co-benefits which provide economic benefits to the consumer and climate benefits to the society. But it has remained as a footnote. One should keep in mind that different stakeholders play different roles in influencing the energy technology choice. They have interdependent influence. All the stakeholders and their decisions, describe the whole socio-technical structure and the processes that occur. For any policy measure to succeed, one should know and understand this socio-technical structure.	Agree with general spirit of the comment. Text in the chapter reflects what is available in literature. See revised co-benefits section.
37456	10	0				Add narrative and empirical foundations for greater ambition. Chapter 1 notes that "Existing models suggest it is very unlikely that the goal of stabilizing warming at 2 degrees at least cost is practically feasible unless international cooperation that involves all countries were to begin almost immediately and a wide array of cost-effective low emission technologies were available." Explicit discussion of the industry role in using and producing these "cost-effective low emissions technologies" can help to introduce and support a more ambitious agenda.	Partially accepted. Revised cost ad potential section would shows the scopes for indutry sector within the limitations of the knowledge existing in accessible and peer reviewed domain.
37457	10	0				The authors should consider adding narrative and empirical foundations for greater ambition. Chapter 1 notes that "Existing models suggest it is very unlikely that the goal of stabilizing warming at 2 degrees at least cost is practically feasible unless international cooperation that involves all countries were to begin almost immediately and a wide array of cost-effective low emission technologies were available." Explicit discussion of the industry role in using and producing these "cost-effective low emissions technologies" can help to introduce and support a more ambitious agenda.	See 37456

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37458	10	0				The authors should summarize existing and needed information on the five mitigation options (energy efficiency, emissions efficiency, material efficiency, product usage characteristics, and demand reduction). Given that understanding is more advanced in some of industry mitigation areas than others, a figure or table including examples would help to bring these ideas together and highlight areas for further research.	Partially accept. Authors welcome the comment but page limitations do not allow us to add any further table . Careful reading through the chapter is able to convey the desired message. Some revisions will be tried in knowledge gap section
37459	10	0				The authors should further integrate the AR5 chapters. Cross-sector and adaptation effects on industry mitigation are well discussed in the Second Order Draft. Additional integration may be helpful, for example, to supplement co-benefits of mitigation discussion with climate modeling findings on the costs of inaction. Given manufacturing companies' frequent reluctance to embrace and support climate policy in many countries a more integrated industry chapter could help to create political capital.	Rejected; comment refers to general motivation of industrial companies to support climate policies as they do not reflect cost of inaction. This is more a general point and not only specific for industry stakeholders, but for households as well (at least partly). Should be addressed in one of the framing or integrative chapters of AR5

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37460	10	0				Additional References the authors should consider citing include: (1) Brandt AR, Farrell AE. 2007. "Scraping the bottom of the barrel: greenhouse gas emission consequences of a transition to low-quality and synthetic petroleum resources," Climatic Change, October 2007, Volume 84, Issue 3-4, pp. 241-263. (2) Brown, M.A., R. Jackson, M. Cox, R. Cortes, B. Deitchman, and M.V. Lapsa. 2011. "Making Industry Part of the Climate Solution: Policy Options to Promote Energy Efficiency." Oak Ridge National Laboratory (ORNL) Report 2010/78. Available online at: http://info.ornl.gov/sites/publications/Files/Pub23821.pdf. (3) Hedman, B. 2010. "Effect of a 30 Percent Investment Tax Credit on the Economic Market Potential for Combined Heat and Power." Available online at: http://www.uschpa.org/files/public/USCHPA%20WADE_ITC_Report_FINAL%20v4.pdf. 4) National Academy of Sciences (NAS). 2010. "Real Prospects for Energy Efficiency in the United States." Available online at: http://www.nap.edu/catalog.php?record_id=12621. (5) Shipley, A., A. Hampson, B. Hedman, P. Garland, and P. Bautista. 2008. "Combined Heat and Power: Effective Strategies for a Sustainable Future," Oak Ridge National Laboratory (ORNL) Report 2008/224. Available online at: http://info.ornl.gov/sites/publications/files/Pub13655.pdf. [This is already included in the Second Order Draft references, but a more explicit CHP discussion section could be useful.] (6) Williams JH, DeBenedictis A, Ghanadan R, Mahone A, Moore J, Morrow WR III, Price S, Torn MS. 2012. "The Technology Path to Deep Greenhouse Gas Emissions Cuts by 2050: The Pivotal Role of Electricity" Science 335, 53 (2012); DOI: 10.1126/science.1208365. (7) Xu TF, Sathaye J, and Kramer KJ. 2012. "Bottom-up Representation of Industrial Energy Efficiency Technologies in Integrated Assessment Models for the U.S. Pulp and Paper Sector," Lawrence Berkley National Laboratory (LBNL) Report 5801E.	Noted gratefully: Many thanks for suggesting these extra refereces - all of which I've read: (1) is irrelevant to this chapter as it focuses on alternatives to petrol; (2) includes seven policy options that support the adoption fo energy efficienc options, and could belong in several different sector chapters. If in this chapter, it's been used in 10.11; (3) this is really a lobbying/marketing report about CHP - it hasn't been peer reviewed and is unreasonably positive. We've included references to the related IEA reports elsewhere - which are I think slightly more balanced; (4) The estimates of best practice potential of energy efficiency in this document (14-22% by 2030) were very helpful - and I've added those to the opening of 10.4;(5) like (3) is a very optimistic statement about CHP - it fails to define the conditions when CHP is or is not beneficial, so creates a very rosy picture; (6) was a good read - it's interesting to me how such analyses have to be re-done by each country, before that country's readers get the same message - many similar studies have been performed in the UK - notably David MacKay's "Sustainable Energy: without the hot air" - which is much more sanguine than Williams et al. about the difficulty of generating all the electricity they claim to need; (7) this and other LBL reports have been considered in the drafting of section 10.7. Thanks again for taking the time to make these suggestions.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37461	10	0				Additional FAQ s the authors might consider adding include: 1. What's the role of combined heat and power (CHP) in past and future industry emissions mitigation? [While CHP is mentioned in the draft, one section could helpfully summarize remaining potential (cf. Shipley, et al. (2008), Hedman (2010), and Brown et al (2011)). If not a FAQ this could perhaps be covered in a section 10.4 paragraph/box.] 2. How does development American shale gas and unconventional oil impact industry emissions? [Low cost natural gas is contributing to an intermittent revival of American manufacturing. What are the cross-sector effects (e.g., Dutch disease for the US?) and climate impacts (see for example Brandt and Farrell, 2007)?] 3. Given existing commercial technologies and practices, what's the aggregate global potential for near term emissions mitigation? [The draft currently summarizes relevant IEA information in section 10.7.1 and scenarios in section 10.10, but I believe earlier summary information could be usefully highlighted in a FAQ that would also set up the comparison with Transport and Buildings sectors. Also, Gt CO2 mitigation potential estimates could usefully complement the cost data in figure 10.5]	Taken into account, however the AR5 working group on FAQs issued guidance requesting that we keep the original FAQs. The first proposed FAQ is rather specific but more info on CHP has been added to the chapter as appropriate. The second proposed FAQ looks like it would better fit the energy chapter, the third suggested FAQ shuold be covered in FAQ 10.2 (and if not it is covered in the Executive Summary and sections 10.7 and 10.10)
37462	10	0				There are several places that discuss "negative abatement cost" (notably Paragraph 11 of the Executive Summary page 5 line 23). At some point in the chapter this should be explained in the specific context of the industrial sector. (many possible citations, including Sathaye et al)	Accepted - the term has been used as little as possible in the revised costs and potentials section, and the assumptions (e.g. Discount rates) have been made explicit in most instances.
37463	10	0				The use of "material efficiency" is particularly useful in showing one of the key levers that can be pulled to reduce energy and emissions intensities. It would be particularly useful to show a table that compares, for example, the energy and emissions intensities of primary vs. secondary materials, especially metals (e.g. secondary Al is an order of magnitude less energy intensive than primary Al) to demonstrate the potential of greater recycling rates, and hence the importance of developing technologies that can increase recycling rates (e.g. recycle friendly alloys (RFAs)).	Taken into account: in fact, in the way that we are using the phrase, recycling is not part of "material efficiency" as it doesn't lead to any change in demand for materials; rather it is a strategy to create material with less energy - so fits under "energy efficiency." Table 2 in a paper by Gutwoski, Allwood et al, just accepted in "Annual Review of Environment" provides this data - but it must be presented with caveats - that the true energy of recyling is usually much greater than the figure for simply melting a pile of scrap metal, and unfortunately due to space limitations we cannot include it
37464	10	0				The treatment of CHP is uneven in Chapter 10. If there is a more even treatment in Chapter 7 (Energy Systems) or Chapter 9 (Building), a cross-reference may be helpful. Otherwise, a more robust discussion of CHP in the energy efficiency and emissions efficiency sections as well as in the introduction ot the varous industry sectors would be very helpful in provinding a more even treatment.	Accepted: a cross-reference to section 7.5.1 has been added to the introduction to 10.4
37465	10	0				The role of natural gas would benefit from a more even treatment specifically with the change in the natural gas market in the last few years and its impact on industrial project economics. If this is cross-referenced in Chapter 7, a cross-reference would be helpful.	Taken into account: a cross reference to chapter 7 has been added

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37466	10	0				Reference: IEA, thorugh its CHP/DHC Collaborative has issued several focused studies on CHP. It would be helpful to include them. Http://www.iea.org/chp There were eleven country-focused studies done in 2007, and then in subsequent years. An update is planned for next year.	Noted: again, this matters with the above discussion - I downloaded three IEA reports on this - thanks for the suggestions - and have made use of them in the introduction to 10.4
37467	10	0				Additional tables would be useful: 1. Key industrial sector energy use and GHG emission mitigation on a worldwide and regional basis (Table 10.1 does that partially for GHGs and Table 10.3 does that for region but no sectors for energy use and GHGs. 2) Leading industrial cross-cutting energy efficiency opportunities by sector with a range of energy savings potential. (US DOE has analyzed that CHP, boiler efficiency improvement, waste heat recovery, motor systems, etc. are the most significant energy efficiency opportunities in industry. This is mentioned sproradically throughout the chapter.) 3) Leading sector process energy efficiency improvement oppotunities. (There is a reference that should be consulted: McKinsey report at this web address: http://www.mckinsey.com/client_service/electric_power_and_natural_gas/latest_thinking/unlocking_energy_efficiency_in_the_us_economy) 4) Associated GHG mitigation opportunities by cross-cutting and process efficiency sector related to industrial energy efficiency. 5) GHG mitigation from non-energy efficiency actions: material efficiency, fuel switching, etc. This set of information would help national program planners and policy makers to prioritize program plans and resources.	Regarding 1) The reviewer asks about mitigation but these two tables are about emissions. The final version of the chapter provides two figures showing historical 1970-2010 emissions by source and by region. The final version also provides a new table that provides GHG emissions by region and for the world for 1990, 2005, and 2010. Regarding comment 2): This is not possible for the entire world because the leading opportunities depend upon country-specific situations. Regarding comment 3): same issue - the suggested report is about the US. The industrial sector in the US is significantly different from that in developing countries, for example, so it is not possible to make such broad statements. Regarding comments 4) and 5): refer to Section 10.4 and Section 10.7.
37468	10	0				Industrial emissions alone represent around one third of overall global GHG emissions. Steel and cement account for nearly one half of all emissions from manufacturing. Can the authors please define *explicitly* what is included in the "industrial" sector and what is included in the "manufacturing" sector? At times it reads as if the terms "manufacturing sector" and "industrial sector" are interchangeable (as in the above sentences) and at other times it appears industrial includes manufacturing, waste, mining, etc. Explicit definitions at the outset would help, and it is recommended that after the definitions are made the authors go through the chapter to ensure that these terms are always used consistent with their definitions. Same goes for the terms "sector" and "subsector." For example, is chemicals an industry, a sector, or a subsector?	Accepted - revised introduction now clearer in this regard
19193	10	1		92		General Comment: To help reduce the number of surplus pages in Chapter 10, Industry; suggest reducing the text used to describe energy efficiency, which is in many different sections of the chapter.	Taken into account when editing the final version
19197	10	1		92		General Comment: Excellent descriptions of the non-CO2, high-global warming potential gases (refrigerants, etc.).	Noted, thanks

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25996	10	1				List of authors has none or only few experts with field experience in industry; most are academics.	One CA is closely linked to industry, Academia/reserachers work closely with industry for many years as can be evident from the profile.
24305	10	1	1	92	1	Chater 10 incorrectly quoted many scanerio study results without their built-in assumptions. We suggest those quoted text shall be rewrited like: Scenario studies by author (year) showed that there is a possiblity that (the quoted text), at assumption of …; or tag those quoted text with "low confidence" or "low evidence"	Noted, but due to severe space constraints section can not describe all relevant assumptions, this will partly be done in chapter 6. In chapter 10 we have to concentrate on categorizing the scenarios. revised section tries to make sure cases are defined and referenced (but the way suggested is too simple and would take too much space)
31544	10	1	1	92	1	Chater 10 incorrectly quoted many scanerio study results without their built-in assumptions. We suggest those quoted text shall be rewrited like: Scenario studies by author (year) showed that there is a possiblity that (the quoted text), at assumption of …; or tag those quoted text with "low confidence" or "low evidence"	duplicate of 24305
33279	10	10	12	10	12	Text states total direct GHG emissions for industry and waste/wastewater as 9.2 GtCO2e in 2010. Figure 10.2 shows 9.1 Gt.	Accepted - Text and figures are now aligned. Total direct and indirect GHG emissions for industry and waste/wastewater are 14.86 GtCO2
37506	10	10	17			SF6 and PFC numbers should be confirmed. Only source of SF6 is from magnesium; PFCs from aluminum. Would expect numbers to be reversed, i.e. PFC proportionally higher than SF6. Given very high growth in electronics industry use of NF3 could it be included?	Taken into account - It should be noted that there is an on going discussion about Non CO2 data sources (see SOD page 13, line 1 to 15). Two specific issues mentioned in the comment are clarified in Tables 10.4 and 10.5: there are more sources than the ones mentioned in the comment. Note that Non CO2 emissions (including NF3) were small in 2010 (Table 10.2) but are expected to be very significant in 2030 (Table 10.6)

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37507	10	10	17			There is an increase between 2008 to 2009 and 2009 to 2010 but this seems counter intuitive in light of the economic downturn in 2009. Can the authors clarify?	Accepted - Based on revised data now used in this chapter, GHG emissions decline between 2008 and 2009, but grow again between 2009 and 2010. The economic downturn was experienced differently in the various regions of the world, with some regions affected less than others. Also, China pursued a large economic stimulus program during this period focused on infrastructure development. Looking at the RCF5 emissions shows that the OECD1990, EIT, and LAM regions experienced a decline in emissions between 2008 and 2009 (with increases between 2009 and 2010), but that the ASIA and MAF regions did not experience a decline in emissions between 2008 and 2009
37505	10	10	4	10	21	This page discusses direct emissions from industry, and shows them in Figure 10.2. Indirect is defined in section 10.3 as emissions from fuels used to generate and deliver electricity. However, it is confusing that the chart includes "Indirect N2O emissions from industry;" what is this (it is not defined)? Further, the paragraph staring on line 13 describes the direct emissions shown in the chart (including N2O), so is the use of the word "indirect" on the chart simply an grammatical error?	Accepted: "Indirect" has been removed from the label of the figure.
20328	10	10	5		12	This is the reason that waste should be a separate chapter! Do you mean direct GHG emissions from the buildings and transport sectors?	Partially accepted. We cannot have waste in a separate chapter. The sentence changed to read "…larger than the direct GHG emissions from either the buidings or transport end-use sectors".
19647	10	10		11		In Table 10.2 and Figure 10.2 the Sectors "Landfill and waste incineration" is misnamed. The numbers must refer only to "Landfill": landfill gas CH4/CO2 = 1/1 and methane is 25 times more potent in mass than CO2. Moreover, Waste-to-Energy plants' stack gas does not contain any methane. Therefore, this Sector should be called only "Landfill", in both Table and Figure 10.2	Rejected. Emission data is based on EDGAR (JRC/PBL, 2012) emission data, see Annex II.7 (SOD) respective Annex II.8 (Final Draft). "Landfill & waste incineration" aggregates emissions from emission categories "Solid waste disposal on land (6A)" for CH4, "Waste incineration (6C)" for CO2, CH4 and N2O and "Other waste handling (6D)" for CH4, N2O. Emissions are provided for all gases in CO2-eq.

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33278	10	10	4			The section starts with an emission chart, but could make use of more figures: stacked area chart showing long-term historical GHG emission trends by sector, stacked area charts by region and stacked bar chart showing GHG emission trends by sector and region. It could also display a driver or activity data chart.	Taken into account - we now have a figure by source and a figure by regions (RCP5).
32537	10	1031				The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	A sentence on this page makes reference to "life cycle of paper production" but not to the term LCA. The references provided are not relevant to this chapter.

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32538	10	1037				The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	A sentence on this page makes reference to "life cycle perspective" but not to the term LCA. The references provided are not relevant to this chapter.

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32539	10	1080				The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	A reference on this page contains the terms life-cycle or LCA, but as these are part of the title of the articler or of the journal they cannot be changed. The references provided are not relevant for the industry chapter

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32540	10	1084				The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	A reference on this page contains the terms life-cycle or LCA, but as these are part of the title of the articler or of the journal they cannot be changed. The references provided are not relevant for the industry chapter

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32541	10	1089				The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	A reference on this page contains the terms life-cycle or LCA, but as these are part of the title of the articler or of the journal they cannot be changed. The references provided are not relevant for the industry chapter

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32542	10	1094				The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	A reference on this page contains the terms life-cycle or LCA, but as these are part of the title of the articler or of the journal they cannot be changed. The references provided are not relevant for the industry chapter

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32543	10	1098				The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardused by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are: -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkhamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy	A reference on this page contains the terms life-cycle or LCA, but as these are part of the title of the articler or of the journal they cannot be changed. The references provided are not relevant for the industry chapter
37508	10	11	1			Table has as many as six significant digits listed, which is more precision than the underlying data permit. The authors should consider using fewer digits, and the same number of digits througout the table.	Rejected. The data are only presented using two significant digits, which is acceptable since the data are provided in million tons. There must be confusion between the use of a comma (,) and a decimal point (.).
37511	10	11	13	11	13	Are not emissions from "non-fossil fuel sources" still energy-related emissions, and thus, shouldn't they be listed under item 1?	Accepted

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31684	10	11	15	11	15	The term 'site energy' is used herein contrast to 'primary energy'. The use of 'Delivered energy', a more widely recognised term in this context, should be considered.	Partially accepted. A new footnote has been added to define the terms based on the Glossary: "The Glossary explains: “Primary energy is the energy stored in natural resources (e.g. coal, crude oil, natural gas, uranium, and renewable sources. Primary energy is transformed into secondary energy by cleaning (natural gas), refining (crude oil to oil products) or by conversion into electricity or heat. When the secondary energy is delivered at the end-use facilities it is called final energy (e.g. electricity at the wall outlet), where it becomes usable energy in supplying services (e.g. light)."
37512	10	11	17	11	17	IEA is an agency - not a study.	Accepted, sentence changed.
37513	10	11	22	11	22	The term "industrial products" is used here, and elsewhere the term "industrial commodities" is used; such terminology should be harmonized if at all possible (and/or defined).	Accepted - we have tried to harmonise to the use of "industrial products" throughout the chapter
37514	10	11	23	11	23	Petroleum refining is an extremely energy intensive industry.	Petroleum refining is not included in this chapter. Added to definition in section 10.1.
37515	10	11	25	11	25	At some point, energy intensive industries as identified by the IPCC should be clearly described and enumerated.	AR4 and AR5 make clear distinctions as to what is included in each sectoral chapter. Petroleum refining and solid fuel manufacturing is covered in the energy chapter of AR5. It is possible that some literature includes these sectors under industry along with others, but this cannot be used as a criterion for exclusion.
37509	10	11	6	11	7	Mining and quarrying, which is included in "other industries" in IEA data" It's not clear why the mention of IEA data here is relevant. Is it because IEA data were used to construct the "other industries" data in Figure 10.2? Probably better, then, to just state "mining and quarrying, which is included in "other industries" in Figure 10.2" for clarity.	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37510	10	11	11			The section "10.3.2 Manufacturing" would benefit if it started with a definition of manufacturing (that would echo a definition that should also be on page 7 associated with Figure 10.1).	Accepted. Sentence added: Manufacturing is a sub-set of industry that includes production of all products (e.g. steel, cement, machinery, textiles), except for energy products, and does not include energy used for construction.
30517	10	11	20	11	25	Several industries have direct conections with AFOLU net emissions, e.g. pulp and paper, iron and steel and other potential biomaterials or biofuels. Although this is not the AFOLU chapter, a cross-reference footnote mentioning the potential net GHG removals or net emissions resulting from changes in carbon stocks associated with these industries could give readers a better perspective of the industries' overal emission profile.	Accpeted - a forward reference has been added in section 10.4: "The emissions consequences of forestry associated with paper production is discussed in chapter 11". For biomass-related effects of other industrial sectors, the reader is probably going to check the biomass annex in the Energy chapter.
37517	10	12	10	12	11	Emissions from feedstock uses of fuels at the waste disposal stage are not always accounted for in emissions statistics, given that data on waste imports/exports and ultimate disposition are not consistently compiled or reliable. See the following paper, and the references it cites, for more information: Masanet, E., and J. Sathaye (2009). "Challenges and Opportunities in Accounting for Non-Energy Use CO2 Emissions." Climatic Change, Volume 95, Numbers 3-4.	Accepted. Text revised to say: These emissions should be accounted for in the waste disposal industry's emissions, although data on waste imports/exports and ultimate disposition are not consistently compiled or reliable (Masanet and Sathaye, 2009)."
35284	10	12	14	12	21	Taiwan is not a sovereign state. It is suggested to delete Taiwan.	Accepted - Taiwan removed and subsumed under China
37518	10	12	14			This table has as many as seven significant digits listed, which is more precision than the underlying data permit. The authors should consider using fewer digits, and the same number of digits throughout the table.	Rejected. The data are only presented using two significant digits, which is acceptable since the data are provided in million tons. There must be confusion between the use of a comma (,) and a decimal point (.).
37519	10	12	14			The caption for table should have the words "and construction" added and hence should read: "Table 10.3: Manufacturing and construction final energy...." More broadly, though, why does this table include construction? This is the first time construction is mentioned as part of the manufacturing sector. See my earlier comment about the strong need for the authors to define what they consider the "industrial" sectors and the "manufacturing" sectors explicitly. It would probably be best to leave construction out of this table so that the reader can compare these data to other data in this chapter, which are just focused on manufacturing.	Noted - This table actually covers all of industry and has been renamed (and relocated). A definition of industry has been added to Section 10.1
37520	10	12	14			The note states "industry" but does not use the word manufacturing. As mentioned in previous comments, the definitions of these should be stated and use of the terms harmonized.	Accepted. Note changed to say "Includes energy and non-energy use"

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22098	10	12	6	12	9	The share of non-energy use of fossil fuels has grown from 20 to 24% between 2000-2009. The emissions impact of this increase is not clear and must be reviewed.	Noted - The next sentence (Fossil fuels used as raw materials/feedstocks in the chemical industry cause emissions at the end of their life-span in the disposal phase) partially explains that the fossil fuels used as feedstocks still have emissions at the end of their life-span.
37516	10	12	9	12	11	This sentence mentions emissions at end-of-life, but does not describe what types of emissions (and should). This depends on whether products are incinerated (e.g. waste to energy plant), or landfilled (where they could stay bound and not released to atmosphere). And sentence would better describe issue if it ended with "...if they are not recycled/recovered."	Accepted. Clarified to say CO2 emissions. Other portion of comment accepted and text changed.
24313	10	12	14	12	21	Taiwan is not a sovereign state. Taiwan shall be changed to “Taiwan Province of China ”.	Accepted - Taiwan removed and subsumed under China
31552	10	12	14	12	21	Taiwan is not a sovereign state. Taiwan shall be changed to “Taiwan Province of China ”.	Accepted - Taiwan removed and subsumed under China
37521	10	13	12	13	12	The acronym EDGAR should be all capitals, and should probably also be described: Emissions Database for Global Atmospheric Research (EDGAR) since it is the first reference in this chapter (depending on how the report in its entirety is handling acronyms)	Editorial (TSU will advise during copy-editing)
37522	10	13	16			Does this table contain data for just the United States (as implied by the US EPA as the source) or for the globe? Please be explicit about the region to which the data refer.	Accepted - the table and source have been changed
27843	10	13	16	13	17	Link "EPA,2012" does not work. The headline is unclear. Please add "... for industrial manufacture", otherwise "commercial refrigeration" is missing. (s. Article "High increase of global F-gas emissions until 2050", Greenhouse Gas Measurement and management, 1, 2011, page 85-92). Please clarify.	Accepted - the table and source have been changed
37523	10	13	18			Does this table contain data for just the United States (as implied by the US EPA as the source) or for the globe? Please be explicit about the region to which the data refer.	See 37522
37524	10	13	18			Can NF3 be added given importance to electronics industry?	Rejected. This section reflects the trend up to 2010, and NF3 emissions are very small up to now. However, section 10.4 mentions their future importance.
33280	10	14	10	15	6	The box on LDC provides a good overview but is not well integrated in the chapter flow.	Accepted - an introduction inserted
24738	10	14	17	14	19	MVA appears to be manufacturing value added (or market value added for manufacturing). Clarify whether the MVA figure should be interpreted as applying to the whole economy or to manufacturing.	Accepted - applies to manufacturing
37525	10	14	20	14	20	Which sectors in LDC have seen growth? Can we predict the growth pattern of sectors as countries start to become more developed?	Rejected. Share of manufacturing GDP is not longer a meassure of development. China has the largest share and OECD countries have reduced their share
22099	10	14	26	14	34	If the LDC cannot escape the circle of low-technology production then they will nto gain access to better technology since it will remain unaffordable. This may keep their emissions relatively low but will not improve their livelihood.	Accepeted. Technology transfer is included in last paragraph

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37526	10	14	26	14	27	"Developed and developing countries are changing their IS, from low technology to medium and high technology products, but LDCs remain highly concentrated in low technology products (LTP)." (p.14, lines 26-27). What's the definition of "low technology products"?	Accepted, now explained in text - It is a category used by UNIDO and refers to the level of technology utilization in production (low technology products mean ore intensive labour).
37527	10	14	28	14	28	The authors should consider using the word "fraction" instead of "participation"	Accepted
29667	10	14	36	14	39	Language like 'exceptional' and 'outstanding' in the context of extractive industries is technically correct but may be misconstrued as glorifying those industries. For clarity, I prpose the following alternative language: "The case of Bangladesh stands out in terms of industrial development... The cases of Angola, Equatorial Guinea, and Sudan are significant as they represent 49% of total FDI (foreign direct investments) received by LDCs in the last decade, in particular Angola with 33% (UNCTAD, 2011)."	Accepted. The paragraph is no longer included
37528	10	15	10	15	25	This paragraph seems out of place. Please review and revise as appropriate.	Rejected - this was an FAQ box
37529	10	15	16	15	16	Previously on page 13 it was described that there are differences in estimates of non-CO2 GHGs from EDGAR and USEPA; which data are chosen to come up with these percentages (and why)?	Accepted, FAQ 10.1 now consistent with section 10.3
24739	10	15	31	15	42	The point that industry is approaching thermodynamic limits applies only for the major energy consuming processes such as larger steam or gas turbines for power generation, or large, custom-designed furnaces, and only when used at the optimal load. There are typically significant inefficiencies for systems such as compressed air, pumping and fans, commination systems etc., many of which are due to part-load operation. However, there are also design compromises such as selection of lower cost, standardised components, efficiency and cost trade-offs for heat transfer equipment, undersized piping etc. The importance of these smaller 'auxiliary' systems should not be underestimated. Suggest replace the sentence from lines 38-42 with: 'As a result, energy intensities in best practice are approaching technical limits for the major processes when operating at designed loads. However, many options for efficiency improvement still remain, particularly for variable or part load operation, auxiliary equipment and improved heat recovery - making use of the heat that cannot be converted into work. There is still significant potential to reduce the gap between actual energy use and the best practice in many industries and in most countries.' Suggested citation: Department of Resources, Energy and Tourism, (2012), Supplementary Guidance for Electricity Generators: Measurement, data analysis and opportunity evaluation, Canberra]+J42	Accepted: The proposed edit is a good one, with the only caveat that it fails to give a sense of scale. Yes, there are more opportunities for relative efficiency improvements in auxiliary systems, but the absolute efficiency of the industrial system depends primarily on the most energy intensive processes. New wording has been chosen for the FD in light of this and other comments. The additional reference is not required for this statement, and the comment about "heat recovery" has been toned down, because of the second law of thermodynamics.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37530	10	15	32	15	42	The barriers to energy efficiency are not confined to "chemical reactions" that are limited to "thermodynamic limits." There are other limits to energy efficiency besides theoretical limits. Organizational barriers, financial barriers, and so on. Furthermore, its not really clear what the point of this paragraph is. If the point is to discuss potential for increasing energy efficiency and its potential for reducing GHG emissions, then this paragraph should be re-drafted. The paragraph is not particularly clear and only contains citation. If the focus is on defining "best in class", best practice, etc, then there should also be a discussion on industrial sector benchmarking. Energy Performance Benchmarking can be used identify the range of energy performance within an industrial sector, determine a benchmark for operational energy efficiency, and provide information that can drive an industrial sector to improve its performance. See the following references: Gale A. Boyd, (2008) "Estimating Plant Level Manufacturing Energy Efficiency with Stochastic Frontier Regression", The Energy Journal , Vol 29, No. 2, pp 23 44, (2008) Boyd, Gale A., E. Dutrow and W. Tunnessen (2008) "The Evolution of the Energy Star Industrial Energy Performance Indicator for Benchmarking Plant Level Manufacturing Energy Use." Journal of Cleaner Production, Volume16, Issue 6, pp 709 â€“ 715 April 2008	Taken into account: an additional citation has been added to underline the key point of the paragraph, that energy intensities in best practice are approaching technical limits. The two papers cited here arise from a statistical study, with no reference to specific technologies, and according to their own specification aim "to answer the hypothetical but very practical question, 'How would my plant compare to everyone else in my industry, if all other plants were similar to mine?'" For the energy intensive industries, this question is completely hypothetical - and the reason that the World Steel Association is unable to publish "average" process intensities for steel plant is precisely because each plant is unique.
24740	10	15	37	15	39	Suggest it is contradictory to say that options for energy improvement remains and that energy intensity in best practice approaches theoretical limits. Energy intensities in best practice for the major items of equipment, such as steam turbines for thermal generation at the design load tend to approach theoretical limits. However, many of the auxiliary (supporting) systems may not be optimised to the same degree and may affect performance of the major components when working at different loads. For example, cooling water pumps and boiler fans are unlikely to be optimised at fluctuating loads and both affect efficiency. Also, suggest the text should point out that few plants approach best practice.	See 24739
20330	10	15	37		42	Do you mean the last 4 decades? The last decade has not shown any real progress, except in China. Note that this is a different conclusion than in the SPM on technical limits.	Accepted: "four decades"
37531	10	15	40	15	42	Does best practice consider cost effectiveness? Also, how does this size of the gap vary from developed to less developed countries?	Taken into account: see 33287
37532	10	15	43	15	45	These are opportunities for reducing industrial energy-related emissions, not all industrial emissions, which includes process-related emissions, non-energy CO2 emissions, etc. Also, this sentence is incomplete.	Accepted: "In industry, energy efficiency opportunities…." and the closing bracket has been added.
20331	10	15	43			I assume you want to distinguish process emissions from cross-cutting systems. Please use this wording to be in line with the literature.	Noted: I think this comment arises from the confusion about process emissions addressed by comment 37532
37533	10	15	45	15	45	See also page 15, line 2. Opportunities related to heat management also include improved heat transfer between hot and cold fluids, not just hot and cold gases and fuels. By omitting fluids, the authors have left out much of the heat transfer that occurs in the petroleum, chemicals, and food industries.	Accepted: "hot and cold gases and fluids"
29668	10	15	8			This FAQ does not significantly contribute material to the chapter. Anyone reading to this point in a 60+ page document is obviously committed to reading it in full and does not need an FAQ to compile facts from earlier sections of the report. Should delete this section.	Noted - FAQ not deleted but edited

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19781	10	15	8			consider for removal. An FAQ box should include more condensed information to be of value. This one just repeats the already condensed information found elsewhere in the chapter.	Accepted - this FAQ now improved
33281	10	15	8			The answer to the FAQ on contribution to emissions and changes is cut&pasted from previous text and therefore adds little value. Please consider a more reader friendly approach to FAQ text.	Accepted - this FAQ now improved
35397	10	15				The information provided in section 10.4 should be coherent with the table 4.8.1 in chapter 4, which outlined much of the content for this section. Following the rationale, a lot of information is missing. The most notorious absence is that in table 4.8.1., Column Industry, the row for Poverty Alleviation mentions the informal recycling sector, which is then not mentioned in Chapter 10, section 10.4. The informal recycling sector has shown to be very efficient in reaching high levels of recycling, up to 80% in Egypt. Moreover, the majority of the recycling in developing countries happens through the recycling sector; in Indian cities, the informal recycling sector recovers much of the dry, high calorific material from MSW (UNEP, Waste and Climate Change. Global Trends and Strategy Framework, 2010). Remarkable examples exist in India and Argentina (See 'On the road to zero waste. Successes and Lessons from Around the World, by GAIA Global Alliance for Incinerator Alternatives, 2012). Recently, the Recyclers Association of Bogotá, which has been informal for the last 30 years, has been recognised as an eligible tender to provide waste management services to the City of Bogotá. One of their main leaders, Nohra Padilla, has been rewarded by the 'green Nobel', the Goldman Environmental Prize 2013.	Taken into account: I have downloaded and read this UNEP report, and it adds little to section 10.4 - because the major technical options for mitigation depend on large scale changes to the way we handle few dominant materials
35451	10	15				The information provided in section 10.4 should be coherent with the table 4.8.1 in chapter 4, which outlined much of the content for this section. Following the rationale, a lot of information is missing. The most notorious absence is that in table 4.8.1., Column Industry, the row for Poverty Alleviation mentions the informal recycling sector, which is then not mentioned in Chapter 10, section 10.4. The informal recycling sector has shown to be very efficient in reaching high levels of recycling, up to 80% in Egypt. Moreover, the majority of the recycling in developing countries happens through the recycling sector; in Indian cities, the informal recycling sector recovers much of the dry, high calorific material from MSW (UNEP, Waste and Climate Change. Global Trends and Strategy Framework, 2010). Remarkable examples exist in India and Argentina (See 'On the road to zero waste. Successess and Lessons from Around the World, by GAIA Global Alliance for Incinerator Alternatives, 2012). Recently, the Recyclers Asociation of Bogotá, which has been informal for the last 30 years, has been recognised as an eligible tender to provide waste management services to the City of Bogotá. One of their main leaders, Nohra Padilla, has been rewarded by the 'green Nobel', the Goldman prize.	See 35397
26959	10	15				The information provided in section 10.4 should be coherent with the table 4.8.1 in chapter 4, which outlined much of the content for this section. Following the rationale, a lot of information is missing. The most notorious absence is that in table 4.8.1., Column Industry, the row for Poverty Alleviation mentions the informal recycling sector, which is then not mentioned in Chapter 10, section 10.4. The informal recycling sector has shown to be very efficient in reaching high levels of recycling, up to 80% in Egypt. Moreover, the majority of the recycling in developing countries happens through the recycling sector; in Indian cities, the informal recycling sector recovers much of the dry, high calorific material from MSW (UNEP, Waste and Climate Change. Global Trends and Strategy Framework, 2010). Remarkable examples exist in India and Argentina (See 'On the road to zero waste. Successess and Lessons from Around the World, by GAIA Global Alliance for Incinerator Alternatives, 2012). Recently, the Recyclers Asociation of Bogotá, which has been informal for the last 30 years, has been recognised as an eligible tender to provide waste management services to the City of Bogotá. One of their main leaders, Nohra Padilla, has been rewarded by the 'green Nobel', the Goldman prize.	See 35397
33282	10	15	30			The lead sentence of section 10.4 refers to figure 10.1 but discusses five, not six mitigation options. Please check	Accepted: Thank you - this was an error and is now resolved.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
33285	10	15	30			Behavioural aspects should be discussed, e.g. in food processing or textiles.	Accpeted: Thanks. The section on intensity of use has been rewritten to draw a distinction between consumable and durable products, and the opportunity for behaviour change to reduce demand for consumables.
33286	10	15	30			Please consider inserting a table of the high-level options in relation to their position in the Kaya identity, in order to facilitate consistency across the chapters. In the reference column, the subsections headings under which the respective options are discussed should be given.	See 37467
33287	10	15	30			The “Costs and potentials” and the “Co-benefits, risks and spill-overs” sections should be cross-referenced where appropriate.	Accepted: some cross-references now included
30270	10	16	10		18	several statements in this paragraph seem overly optimistic, heat pumps are not effective at high temperature and processes that are weather dependent for drying washing etc. are not attractive to manufacturing. Also when gas is mentioned should there be a comment about gas escaping from the wellhead and other processes?	Noted: I agree with the reviewer, but think that the paragraph uses the conditional tense correctly.
33844	10	16	12			Add: The production and use of shale gas in a number of countries will increase this change	Taken into account: this issue is central to chapter 7 so a cross reference has been added.
37535	10	16	13	16	13	"The use of wastes and biomass in industry is currently limited." What about the paper industry, which gets around half of its energy from biomass in the form of wood waste and lignin in black liquor? Also, lots of waste use in cement kilns around the world.	Taken into account: we were trying to avoid too much detail at this stage, and there's a danger that these two examples are greatly over hyped, however the sentence has been edited to: "The use of wastes and biomass for energy industry is currently limited, but forecast to grow (IEA, 2009b) although two specific examples are widely publicised: the cement industry can incinerate municipal waste and sewage sludge in kilns, providing ~17% of the thermal energy required by EU cement production in 2004 (IEA ESTAP, 2010). This releases emissions, albeit at a lower rate than coal combustion, and would have occurred anyway in municipal incinerators; the European paper industry reports that over 50% of its energy supply is from biomass (CEPI, 2011)."
24741	10	16	14	16	18	Given that cogeneration and heat recovery can also raise efficiency, perhaps the reference should be to 'appropriate use of heat pumps instead of boilers', noting that savings from primary energy are lower than they appear based on site energy.	Accepted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25752	10	16	14	16	16	This part should be kept in the final version report because heat pump technology has huge potential to reduce GHG emission from industrial sectors, as described in (IEA/OECD, 2010, page65-83) and (UNIDO, page38, Fig14). These literatures are listed in the No17 line of this table.	Noted.
35412	10	16	19		20	The use of organic waste as a compost for the agricultural sector can be a great contributor to climate change mitigation. First, this organic waste will be diverted from landfill or incinerators avoiding the corresponding emissions. Instead, it will be producing compost (from separately collected organic waste in MSW or from industrial agricultural activities), which can lock carbon in the soils for some years. Moreover the use of compost replaces chemical fertilizers (implying avoidance of GHG related to their production) reduces the use of pesticies (avoiding emissions associated with their production) and improves tilth and workability (less consumption of fuels). Literature: Favoino. E,. Hogg D,. 2008. There is further relevant literature showing the important benefits of reducing GHG emissions from landfills through home composting and centralised composting, as in: Andersen, J.K. et al., 2010. Greenhouse gas emissions from home composting of organic household waste. Waste management (New York, N.Y.), 30(12), pp.2475–82. Available at: http://www.ncbi.nlm.nih.gov/pubmed/20674324 [Accessed March 18, 2013]. In countries outside Europe, there are notable examples showing the potential of separating biodegradable waste at source. Organics can be used to make biogas in small-scale energy solutions for communities, as grassroots recyclers do in Mumbai (India). They also can be composted domestically or in large-scale facilities for application in agriculture as soil improver as practiced in Bali (Indonesia). However, an integrated program and coordination inter-department should be further developed to link the composting and fertilizer use in agriculture sector.	Taken into account in text on composting in post-consumer waste sub-section
35470	10	16	19		20	The use of organic waste as a compost for the agricultural sector can be a great contributor to climate change mitigation. First, this organic waste will be diverted from landfill or incinerators avoiding the corresponding emissions. Instead, it will be producing compost (from separately collected organic waste in MSW or from industrial agricultural activities), which can lock carbon in the soils for some years. Moreover the use of compost replaces chemical fertilizers (implying avoidance of GHG related to their production) reduces the use of pesticies (avoiding emissions associated with their production) and improves tilth and workability (less consumption of fuels). Literature: Favoino. E,. Hogg D,. 2008. There is further relevant literature showing the important benefits of reducing GHG emissions from landfills through home composting and centralised composting, as in: Andersen, J.K. et al., 2010. Greenhouse gas emissions from home composting of organic household waste. Waste management (New York, N.Y.), 30(12), pp.2475–82. Available at: http://www.ncbi.nlm.nih.gov/pubmed/20674324 [Accessed March 18, 2013]. In countries outside Europe, there are notable examples showing the potential of separating biodegradable waste at source. Organics can be used to make biogas in small-scale energy solutions for communities, as grassroots recyclers do in Mumbai (India). They also can be composted domestically or in large-scale facilities for application in agriculture as soil improver as practiced in Bali (Indonesia).	Duplicate of 35412
26880	10	16	19		20	From a climate perspective a big potential to reduce emissions is the use of organic waste as compost to be applied to agricultural sector. Compost (from separately collected organic waste in MSW or from industrial agricultural activities) can lock carbon in the soils for some years whereas other treatment options such as incineration release the carbon to the atmosphere inmediately. Moreover the use of compost replaces chemical fertilizers (implying avoidance of GHG related to their production) reduces the use of pesticies (avoiding emissions associated with their production) and improves tilth and workability (less consumption of fuels). Literature: Favoino. E,. Hogg D,. 2008, The potential role of compost in reducing greenhouse gases.	see comment 35412

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26978	10	16	19		20	The use of organic waste as a compost for the agricultural sector can be a great contributor to climate change mitigation. First, this organic waste will be diverted from landfill or incinerators avoiding the corresponding emissions. Instead, it will be producing compost (from separately collected organic waste in MSW or from industrial agricultural activities), which can lock carbon in the soils for some years. Moreover the use of compost replaces chemical fertilizers (implying avoidance of GHG related to their production) reduces the use of pesticies (avoiding emissions associated with their production) and improves tilth and workability (less consumption of fuels). Literature: Favoino. E,. Hogg D,. 2008. There is further relevant literature showing the important benefits of reducing GHG emissions from landfills through home composting and centralised composting, as in: Andersen, J.K. et al., 2010. Greenhouse gas emissions from home composting of organic household waste. Waste management (New York, N.Y.), 30(12), pp.2475–82. Available at: http://www.ncbi.nlm.nih.gov/pubmed/20674324 [Accessed March 18, 2013]. In countries outside Europe, there are notable examples showing the potential of separating biodegradable waste at source. Organics can be used to make biogas in small-scale energy solutions for communities, as grassroots recyclers do in Mumbai (India). They also can be composted domestically or in large-scale facilities for application in agriculture as soil improver as practiced in Bali (Indonesia).	Duplicate of 35412
30193	10	16	22	24		The sentence should be relpaced with "chemical industry (ammonia production without downstream use of CO2) might be early opportunities as the CO2 in vented gas is already highly concentrated (up to 85%)". High concentration of CO2 which is derived from steam reforming of methane should be called "vented gas" rather than "flue gas" .	Accepted - thanks.
20333	10	16	22			That industry studies just look at pure CO2 streams is not correct. The studies by e.g. Kuramochi also look at combustion sources. Hence, the statement is wrong, and can be deleted.	Accepted.
33845	10	16	29			Add: An example is the use of CO2 in greenhouses (e.g in the Netherlands)	Noted: the reviewer does not provide a reference for this, and although I could find newspaper reports, I couldn't find anything in the academic literature.
19782	10	16	3	16	4	"… as a means to save energy,.." would be more accurate if it was cost related otherwise this ignores the raw material costs which can be very important.	Accepted: the phrase "as a means to save energy, generally" has been rewritten as "and leads to an energy saving when..."

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30269	10	16	3			it seems a stretch to say that recycling is widely applied to any plastics. You might also modify the statement about metals. Recycling is widely applied for some metals, not all.	Accepted. This section rewritten as "Recycling is already widely applied for bulk metals (steel, aluminium and copper in particular), paper and glass and leads to an energy saving when producing new material from old avoids the need for further energy intensive chemical reactions. (Plastics recycling rates in Europe are currently around 25% (Plastics Europe, 2012) due to the wide variety of compositions in common use in small products, and glass recycling saves little energy as the reaction energy is small compared to that needed for melting (Sardeshpande et al., 2007).) "
32284	10	16	3	16	9	Recycling can be cost effective and energy/resource saving approach in some cases but not necessarily so in many cases. Collection of quality recyclates is always a challenge and may require significant energy input. Degradation of quality is widely observed in many cases. The discription here is too simplistic and optimistic.	Accepted. Changed to "Recycling is applied when it is cost effective, but in many cases leads to lower quality materials, is constrained by lack of supply because collection rates while high for some materials (particularly steel) are not 100%, and because with growing global demand for material, available supply of scrap lags total demand. "
24314	10	16	31	16	33	"In non-Annex I countries, destruction of HFC-23 is the major cource of credits in the CDM" is not correct. According to the data from UNEP Riso up to March 1, 2013, credits from HFC23 destruction only accounts for 7% of total annual global emission recution.	Rejected (but the statement could be deleted as it is not needed). The statement included in SOD is correct, destruction of HFC23 is the major source of credits in CDM. According with UNEP Riso CDM pipeline June 1st, destruction of HFC-23 is the major source of credits. It represents 38% of CERS issued up to this date. However, the statement is not needed as the issue is mentioned in page 54 (line 11 to 13).
31553	10	16	31	16	33	"In non-Annex I countries, destruction of HFC-23 is the major cource of credits in the CDM" is not correct. According to the data from UNEP Riso up to March 1, 2013, credits from HFC23 destruction only accounts for 7% of total annual global emission recution.	Duplicate

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27844	10	16	35	16	35	Hydrofluorocarbons are not ozone depleting.	Accepted. It should be Ozone depleting substances substitutes. However, see new text according Comment 27845, mention to ODS is not needed.
27845	10	16	35	16	37	The text concerning HFCs refers to measures regarding refrigerants only although HFCs are not solely used as refrigerants. We miss a reference to other uses as well as reduction measures. Secondly, replacement by alternative refrigerants is the most efficient measure to reduce HFC emissions while measures like leak repair wil reduce emissions only slightly. Thirdly, proper disposal is no containment measure. We propose to change the text to: Hydrofluorocarbons used as refrigerants can be replaced by alternatives (e.g. ammonia, HC, CO2). Replacement is also an appropriate measure to reduce HFC emissions from foams (use of alternative blowing agents) or solvent uses. Emission reduction (refrigerants) is possible by leak repair, refrigerant recovery and recycling, and proper disposal.	Accepted. The new text reads: Hydrofluorocarbons used as refrigerants can be replaced by alternatives (e.g. ammonia, hydrofluoro-olefins, HC, CO2). Replacement is also an appropriate measure to reduce HFC emissions from foams (use of alternative blowing agents) or solvent uses. Emission reduction (in the case of refrigerants) is possible by leak repair, refrigerant recovery and recycling, and proper disposal.
35413	10	16	40			The sentence "Many decisions are taken to use extra material to save labour costs" is unclear; the tendency around the world is for material costs to increase (real prices for resources increased by more than 300% between 1998 and 2011) whereas labour costs remain stable or decrease (today labour costs make up around 20% of total costs in manufacturing industries, compared to around 40% for materials). Suggestion for new formulation: "As the cost of materials increases in comparison to labour costs, many decisions are taken to use materials more efficiently".	Accepted partially - less emphasis given to this aspect in revised text
35471	10	16	40			The sentence "Many decisions are taken to use extra material to save labour costs" is unclear; the tendency around the world is for material costs to increase (real prices for resources increased by more than 300% between 1998 and 2011) whereas labout costs remain stable or decrease (today labour costs make up around 20% of total costs in manufacturing industries, compared to around 40% for materials). Suggestion for new formulation: "As the cost of materials increases in comparison to labour costs, many decisions are taken to use materials more efficiently".	Duplicate of 35413
26881	10	16	40			The sentence "Many decisions are taken to use extra material to save labour costs" is unclear; the tendency around the world is for material costs to increase (real prices for resources increased by more than 300% between 1998 and 2011) whereas labout costs remain stable or decrease (today labour costs make up around 20% of total costs in manufacturing industries, compared to around 40% for materials). Suggestion for new formulation: "As the cost of materials increases in comparison to labour costs, many decisions are taken to use materials more efficiently".	Duplicate of 35413
26979	10	16	40			The sentence "Many decisions are taken to use extra material to save labour costs" is unclear; the tendency around the world is for material costs to increase (real prices for resources increased by more than 300% between 1998 and 2011) whereas labout costs remain stable or decrease (today labour costs make up around 20% of total costs in manufacturing industries, compared to around 40% for materials). Suggestion for new formulation: "As the cost of materials increases in comparison to labour costs, many decisions are taken to use materials more efficiently".	Duplicate of 35413

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30271	10	16	45			a new German report shows Steel yields at 90%. http://www.stahl-online.de/Deutsch/Linke_Navigation/MedienLounge/_Dokumente/121101_Fakten_zur_Stahlindustrie_2012.pdf	Taken into account: The given link doesn't work, but as the report cited is from the steel industry, I anticipate that what they are saying is that the yield of the industry itself is 90%. However, the steel industry produces intermediate products - stock materials - and it is downstream that the major yield losses occur. Added "(mainly in downstream manufacturing)" to try to make this clearer.
37534	10	16	5	16	5	Recycling doesn't just avoid further chemical reactions, it avoids the mining, refining, and melting associated with producing virgin materials; these avoided steps really aren't best described as "chemical reactions." Furthermore, recycling is not just limited by collection rates. Commingling of different materials such as plastics and metal alloys can make it difficult and costly to recycle them, even if there is sufficient scrap collected. So it is an issue of collection, sorting, and recyclability of the source materials. Also the recovery efficiency for recycling processes of certain materials is low, which is another factor.	Noted: Partly the response to 30269 addresses this, but the reviewer is also in error. Melting (or more generally, reducing to liquid or powder) is the stage which is common to both virgin and recycling routes, which is why the emphasis was placed on chemical reactions. Refining generally requires at least one chemical reaction, so already covered. Finally, global energy figures show that the energy used in mining is not significant, compared to the major energy intensive industries.
24142	10	16	8	16	9	Readers/authors may confuse cement with concrete. So, we would suggest to replace this paragraph by "Although cement is hardly recycled from concrete, used concrete can be demolished and down-cycled into aggregates or engineering with some energy benefit." Please note that cement has a high potential to utilize several wastes from "other sector" as alternative fuels and materials shown in Chapter 5.	Taken into account: these sentences have been clarified, and an extra reference added, to try to clarify how cement cannot be recycled, and using crushed concrete as a substitute for aggregate may lead to increased emissions: "Cement cannot be recycled although concrete can be crushed and down-cycled into aggregates or engineering fill. However, although this saves on aggregate production, it may lead to increased emissions, due to energy used in concrete crushing and refinement and because more cement is required to achieve target properties (Dosho, 2008).".

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20332	10	16	8			There is still a lot of debate on the effects of recycling concrete. If recycled as aggregate in new concrete (so not as foundation for roads), there may be more benefits (due to cement in the concrete that is still reactive), and the term down-cycling here is not appropriate	See response to 24142
21375	10	16	3	16	9	I highly welcome that the incorrect recognition regarding recycling of metals is deleted. It was misunderstood in first order draft that for example promoting electric arc furnace instead of blast furnace is more environmental friendly but it is totally incorrect. Cooperation between steel production of electric ark 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 deand 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. From a longer-term perspective, steel production is expected to exceeding 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	Noted: changes have already been made.
19196	10	16	37	16	37	Recommend adding hydrofluoro-olefins (HFOs) to the list of alternative refrigerants listed, to read "ammonia, hydrofluoro-olefins, HC, CO2".	Hydrofluoro-olefins (HFOs) will be added as an alternative refrigerant as suggested. See new text as per comment 27845
21374	10	16	5	16	8	Do not delete the phrase "while high for some materials (particulary steel)." It is important to express that not all sectors have problems with collecting and recycling materials and some sectors including steel sector have relatively high recycling rate (83% for steel sector). Please refer to the followings for steel sector's case: http://www.worldsteel.org/dms/internetDocumentList/fact-sheets/Fact-sheet_3Rs/document/Fact%20sheet_3Rs.pdf	Accepted
24742	10	17	1	17	3	It may be preferable to state that there are no insurmountable or uncontrollable barriers to re-use, but to say that there are no barriers based on a single study seems a very large claim. For example, the possibility of inter-granular corrosion would appear to pose risks for recycling of steel components.	Accepted: "insurmountable" inserted.
37536	10	17	13	17	14	"epoxy based composite materials and magnesium alloys have significantly higher embodied energy than steel o aluminium" Yes, but these materials can also make lighter vehicles than steel or aluminum, thus the additional energy needed to manufacture composites and magnesium alloys might be more than offset by the fuel savings they deliver in the transport sector. These lines need to be better reflect the points raised in section 10.5.3.	Accepted: added "(although for vehicles this may be worthwhile if it allows significant savings in energy during use); "
30945	10	17	14	17	15	It says that wood products are energy intensive and implied that they are therefore not likely to be useful for substitution as a way to reduce emissions. Yet Chapter 11, Table 11.4 and page 34, state otherwise. Suggest clarifying.	Noted: I think table 11.4 uses the conditional tense correctly and there is no contradiction.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24744	10	17	14	17	15	Kiln drying wood is likely to be much less energy intensive than aluminium or steel. The description could make the relative energy intensity clear. On line 15, suggest change to: 'so in effect is energy intensive' to 'so is moderately energy intensive'	Taken into account: if like for like service is considered, the statement as written is correct, so an additional reference is added to underline the relatively high energy intensity of kiln dried wood: Puettmann M.E. and Wilson J.B. (2005) Life-cycle analysis of wood products: cradle-to-gate LCI of residential wood building materials, Wood and Fiber Science, 37 Corrim Special Issue, 2005, pp. 18 – 29
37537	10	17	14	17	14	It is stated that epoxy composites and Mg alloys have significantly higher embodied energy than steel or aluminum; embodied energy values and associated references should be shown. Also, it is stated that "wood is kiln dried, so ... is energy intensive." It should instead state "...wood that is kiln dried ... can be considered energy intensive..." - but again some type of value (of energy intensity of kiln dried lumber (as well as other products like pulp & paper products which are more energy intensive) should be shown to back this up.	Accepted: references have been added
19783	10	17	24	17	32	This paragraph is beyond the scope of a Chapter on Industry.	Noted: it would be if there was so much scope for abatement within industry, that regardless of overall product demand, sufficient abatement measures could be found. As that isn't the case, we think this is vital - and hope that future IPCC reports will have a whole chapter on sustainable consumption.
31257	10	17	24	17	32	Least you get a comment asking for this section to be deleted, I would like to say that it should be kept.	Accepted - and see 19783!
24745	10	17	24	17	32	This paragraph should not refer to energy savings as reducing consumer utility, but rather as curbing unnecessary energy consumption. Examples include turning off unused lights and equipment, or use of public transport rather than inefficient private motor vehicles. Policies such as emissions trading, public transport provision and demand-reflective electricity pricing can help to curtail unnecessary or easily avoidable energy consumption. Suggested amendment: 'Industrial emissions would be 24 reduced if overall demand for product services were reduced (Kainuma et al., 2013)– if the population chose to travel less (for example through more domestic tourism or telecommuting), heat or cool buildings only to the degree required and buy less by reducing unnecessary consumption. Clear evidence that, beyond some threshold of development, populations do not become 'happier' (as reflected in a wide range of socieœconomic measures) with increasing wealth, suggests that reduced overall consumption might not be harmful in developed economies (Layard, 2006; Roy and Pal, 2009; GEA, 2012), and a literature questioning the ultimate policy target of GDP growth is growing, albeit without clear prescriptions about implementation (Jackson, 2011).	Accepted - thanks.
22100	10	17	24	17	32	While reducing demand for product services could potentially reduce emissions, there is no wide consensus that this is an acceptable practice for any country.	Noted: given space we'd like to discuss this more, but are unable to go further.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21214	10	17	32			Term "CDM" is used for first time in the chapter and should be defined / elaborated in the sentence.	Accepted
20097	10	17	32	17	40	Box 10.2 is higly interesting, not only because it deals with tourism which, as a substantial and fast growing part of global emissions should deserve better attention in AR5, but also because it is illustrative of some emerging potential mitigation policies based on consumption rather than on prouction. In that perspective, AR5 does some substantial effort to present emissions inventories in both consumption and pridcution approach (including in the SPM). But it does not as far as to highlights potential mitigation options starting from consumption and lifestyles. This box is notable effort, and should be maintained.... should the chapter be shortened !	Noted - and thanks!
29669	10	17	34	18	4	This "Box" section could just be part of a 'demand reduction' section. Clothing demand may be an interesting case study, but tourism's climate impacts fall disproportionately in the TRANSPORTATION sector, so it should not be included in the Industry chapter - let alone given a full page of text. The "travel demand" section should be eliminated or moved to Chapter 9. The textiles/clothing paragraph should be integrated with section 10.4.7 (p. 26 line 18)	Noted - but see comments 20097 and 19783, and the high level decisions which have forced tourism into this chapter (decision of the IPCC plenary)
24067	10	17	34	19	8	Reduce significantly or remove. The example is not needed. Explain the structure shortly instead.	Noted see 29669.
19784	10	17	34	19	8	Box 10.2 is not very relevant and could be considered for removal.	Rejected - this is considered important and the example of tourism must be included in the chapter, as per decision of the IPCC Plenary
30272	10	17	4		16	light weighting is usually accomplished by substituting more energy intensive materials for less energy intensive materials, in fact current trends in substitution are generally in this same direction.	Noted - see37537
24743	10	17	4	17	9	Given that cars are safety critical, it might be desirable to find an alternative example of light weighting. Large passenger aircraft could be a better example because in that case the cost of design for lightness and incorporation of new materials has been justifiable- hence the use of composites in the Airbus A380 and the Boeing 787. Suggest change lines 8-9 to: 'At present, the high costs of labour relative to materials, and other barriers inhibit this opportunity, except in industries such as aerospace where the cost of design for lightness and incorporation of new materials has been justifiable for larger passenger aircraft.'	Accepted.
33521	10	17	44			Tourism has a strong link with mobility growth, see e.g. UNWTO-UNEP-WMO (2008) 2008. Climate Change and Tourism: Responding to Global Challenges. United Nations World Tourism Organization (UNWTO), United Nations Environment Programme (UNEP) and World Meteorological Organization (WMO), UNWTO: Madrid, Spain. I would call this a strong link.	Rejected - the "link"which is pointed to is with industrial products not with mobility (the link with mobility is obviously strong)
31211	10	17	5	17	6	The sentence of "…, in practice cars continue to become heavier as they are larger and have more features." should take a reference. If not, "…, in practice cars continue to become heavier as they are safer and larger." is better.	Noted - but this is a marketing statement: safety in this sense depends on whether the vehicle I am in is heavier or lighter than the one I crash into. Claiming that heavier is safer is unhelpful, as this creates a vicious spiral to be always in a car heavier than the average.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35414	10	17	9			Suggestion to add one extra bullet-point very linked to material efficiency: "Environmental taxation and taxation on resources". In Europe 8 euros are collected from taxing labour for every euro that is collected from taxing environmentally harmful activities. By making disposal more expensive it would be possible to increase state revenues to compensate the reduction in taxes to labour and it would also trigger more recycling and better design, leading to greater material efficiency. Literature: Hogg D,. Seherrington & Vergunst, 2011, A comparative study on economic instruments promoting waste prevention. Proposal for wording for the new bullet-point: Shifting taxation from labour to resources. Through environmental fiscal reform it is possible to reduce burden on labour by increasing taxation on resources and hence triggering not only more recycling of the materials but also incentivise better product design, with less material and higher durability and recyclability. (page 9-10 of Resource Efficiency Roadmap, European Commission 2011).	Accepted partially - we have included a mention of this reference in the material efficiency section 10.11.3, but not the wording suggested by the reviewer as it is not supported by the study.
35472	10	17	9			Suggestion to add one extra bullet-point very linked to material efficiency: "Environmental taxation and taxation on resources". In Europe 8 euros are collected from taxing labour for every euro that is collected from taxing environmentally harmful activities. By making disposal more expensive it would be possible to increase state revenues to compensate the reduction in taxes to labour and it would also trigger mor erecycling and better design, leading to greater material efficiency. Literature: Hogg D,. Seherrington & Vergunst, 2011, A comparative study on economic instruments promoting waste prevention. Proposal for wording for the new bullet-point: Shifting taxation from labour to resources. Through environmental fiscal reform it is possible to reduce burden on labour by increasing taxation on resources and hence triggering not only more recycling of the materials but also incentivise better product design, with less material and higher durability and recyclability. (page 9-10 of Resource Efficiency Roadmap, European Commission 2011).	See 35414
26882	10	17	9			Suggestion to add one extra bullet-point very linked to material efficiency: "Environmental taxation and taxation on resources". In Europe 8 euros are collected from taxing labour for every euro that is collected from taxing environmentally harmful activities. By making disposal more expensive it would be possible to increase state revenues to compensate the reduction in taxes to labour and it would also trigger mor erecycling and better design, leading to greater material efficiency. Literature: Hogg D,. Seherrington & Vergunst, 2011, A comparative study on economic instruments promoting waste prevention. Proposal for wording for the new bullet-point: Shifting taxation from labour to resources. Through environmental fiscal reform it is possible to reduce burden on labour by increasing taxation on resources and hence triggering not only more recycling of the materials but also incentivise better product design, with less material and higher durability and recyclability. (page 9-10 of Resource Efficiency Roadmap, European Commission 2011).	See 35414
26980	10	17	9			Suggestion to add one extra bullet-point very linked to material efficiency: "Environmental taxation and taxation on resources". In Europe 8 euros are collected from taxing labour for every euro that is collected from taxing environmentally harmful activities. By making disposal more expensive it would be possible to increase state revenues to compensate the reduction in taxes to labour and it would also trigger mor erecycling and better design, leading to greater material efficiency. Literature: Hogg D,. Seherrington & Vergunst, 2011, A comparative study on economic instruments promoting waste prevention. Proposal for wording for the new bullet-point: Shifting taxation from labour to resources. Through environmental fiscal reform it is possible to reduce burden on labour by increasing taxation on resources and hence triggering not only more recycling of the materials but also incentivise better product design, with less material and higher durability and recyclability. (page 9-10 of Resource Efficiency Roadmap, European Commission 2011).	See 35414
24315	10	17	15	17	16	Blast furnace slag can't replace limeston, it is therefore recommended to change limestone to clinker.	Accepted.
31554	10	17	15	17	16	Blast furnace slag can't replace limeston, it is therefore recommended to change limestone to clinker.	Duplicate of 24315

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
33284	10	18	1	18	1	The characterization of clothing demand as 'apparently unlimited' is probably misleading. Maybe: higher than supply? Please consider re-phrasing.	Rejected: supply expands to meet demand, and then keeps driving it onwards.
24746	10	18	1	18	2	There are no goods or services for which demand is unlimited - except perhaps money, which is almost perfectly substitutable for other goods and services. Suggest change to: 'Clothing demand: Demand for clothing is not easily satiated, and during the period 20002005, the advent of ‘fast fashion’ in the UK led to a drop in prices, but an increase in sales equivalent to one third more garments per year per person (Allwood et al., 2008).'	Taken into account: Rewritten as "Even in developed economies, consumers appear to have no absolute limit to their demand for clothing, and if prices fall, will continue to purchase more garments: during…".
37538	10	18	1	18	7	This section seems rather obscure. Considering that the Chapter 10 is already over the page limit, the authors could consider cutting this section as it gets into too low a level of detail.	Noted - see 29669.
37539	10	18	1	18	8	While the claim that a 1/3rd increase in clothing sales in UK is attributable to "conspicuous consumption" (as opposed to say, a decrease in quality and clothes not lasting as long), the issue that should be addressed is the associated link to industrial emissions. If, for example,the commodity clothes had half the energy/emissions footprint, then the 1/3rd increase in sales would still represent a net improvement. With data this is anecdotal.	Taken into account: while my observations of the behaviour of the young crowd on the streets late at night in Cambridge suggests that the increase of one third in the number of garments purchased may well be associated with a reduction of one third or more in the size of each garment, the reviewer is correct that clarification is requried. Added "with consequent increases in material production and hence industrial emissions ".
37540	10	18	1	18	8	Given this is the Industry section, it is suggested that the section on clothing / textiles focus less on the behavior and more on how develop low emissions materials, products and processes that will meet the projected demand, from clothing (e.g. refer to approach by the Patagonia company) to hotels (how to build highly efficient hotels/lodging/etc.).	Noted: these are excellent examples, but we are using this space to raise the issue of consumption which sorely needs its own chapter, and cannot afford more space on these nice cases.
27846	10	18	1	18	3	Please change the phrase "Demand for clothing is apparently unlimited" to "Demand for clothing is increasing". The conclusion that clothing demand is unlimited is not correct in general. In developing countries the demand will probably increase at least to levels of developed countries whereas in certain developed countries the demand will decrease due to the demographic change.	Noted - see 24764.
24747	10	18	27	18	37	Major mitigation options for tourism might include very fast trains instead of aircraft in countries such as the US and Australia, more efficient aircraft loading and traffic control systems (e.g. Smooth rather than 'stepped' descent), and bicycle sharing schemes in major tourist destinations. Suggest append to line 37: 'Mitigation options for transport energy consumption for tourism might include use of very fast trains instead of aircraft for moderate distance travel, more efficient aircraft loading and traffic control systems (e.g. Smooth rather than 'stepped' descent), and bicycle sharing schemes in major tourist destinations.' [Examples sourced from Chapter 8]	Agree on the idea, but owing to the limited space we have, this is supposed to be taken up in CH8 which we cross-reference
33522	10	18	31			Original reference, I believe "quoted by" should be avoided in an IPCC report	Accepted - deleted
27847	10	18	5	18	6	What is meant by "new materials"? Fibres produced according to organic standards, recycled fibres? Please specify.	Taken into account: "new fabrics linked to environmental claims"

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27848	10	18	6	18	8	It would be important to specify the results of the examination by Fletcher mentioned in this sentence. Will "shared activity" play a growing role and thus the clothing will be used longer?	Accepted: something went wrong in production with this sentence. Changed to "would be used for longer and valued more, if given personal meaning by some shared activity or association"
25984	10	18	9	19	8	section on turism could be drastically reduced or eliminated, because tourism is not exactly an ´industry´ and should be discussed under ´services´.	see 29669.
37541	10	18	9	19	5	This section of tourism demand could be cut. Chapter 10 is already over the page limit. While tourism may created demand for manufactured products, this discussion could be a section focused on the service sector, not manufacturing. It seems like it might be better postioned in the building and transport sections, esp. given statements at the beginning of Ch. 10 about the importance of not double counting emissions. Perhaps tourism should be in its own section, but if it stays here it is recommended to add a sentence such as "While these impacts are accounted for in the buildings and transport sectors, there are infrastructural demands that require industrial and manufacturing inputs." This sentence would help to transition to the next paragraph, but still more data (of associated industrial activity) should be shown. Or, perhaps a text box in each chapter on tourism could be included (cross-referencing the other relevant chapters).	see 29669.
20334	10	18	9	19	5	Remove! As stated in the section itself it is really about energy use for transport and buildings....	Noted - see 29669.
20167	10	19				A LBNL report on emerging EE technologies for the iron and steel industry can be cited here. It is already cited in some other place in the report by not here which seems to be suitable. Hasanbeigi A., M. Arens, and L. Price (2013). Emerging Energy-Efficiency and Greenhouse Gas Mitigation Technologies for the Iron and Steel Industry. Lawrence Berkeley National Laboratory, Berkeley, CA. Available at http://china.lbl.gov/publications/emerging--technologies-steel	A LBNL report on emerging EE technologies for the iron and steel industry can be cited here. It is already cited in some other place in the report by not here which seems to be suitable. Hasanbeigi A., M. Arens, and L. Price (2013). Emerging Energy?Efficiency and Greenhouse Gas Mitigation Technologies for the Iron and Steel Industry. Lawrence Berkeley National Laboratory, Berkeley, CA. Available at http://china.lbl.gov/publications/emerging--technologies-steel

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21376	10	19	19	19	31	Refer to "ISO14404" as a calculation method of CO2 and energy intensity of a steel plant. ISO14404 is originally based on worldsteel's methodology and developed under steel experts. It is the very first ISO to define the calculation method of CO2 and energy in a specific sector. Edwin Basson, Director General of worldsteel, said: “We are very pleased with the published standard as it confirms the validity and relevance of our methodology. This globally developed and supported standard will drive the continued uptake of this methodology by the industry. Steel is essential to the modern world and the use of steel is critical in enabling man to move towards a sustainable future. As steel plants actively monitor CO2 emissions, focus is sharpened onto those activities that ensure the role of steel in a sustainable modern society. For the better understanding, please refer to worldsteel's website and ISO14404 itself. http://www.worldsteel.org/media-centre/press-releases/2013/New-ISO-Standard.html http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=57298	Noted: but this sounds like a marketing statement for the ISO standard, rather than a new piece of information on the potential options for energy efficiency
29788	10	19	19		31	Discussion on Energy Efficiency and CCS should be separated. CCS will surely benefit from energy efficiency measures but it is NOT an energy efficiency technology. (Please refer to IEAGHG Report No. 2013-TR3 which presented the current state of CCS development in this sector	Accepted - this section has been moved to the next.
19785	10	19	26	19	31	Perhaps it is important to mention that the contribution of ULCOS is limited to external improvements (CCS and renewable energy) rather than any innovation in the industrial processes.	Noted: but I think that's not true - they're also looking at some alternative processes
22101	10	19	26	19	31	There is technology that can reduce emissions from the steel industry by 50%.	Noted
25753	10	19	30	19	31	This part should explain that there are many concerns about CCS such as safety confirmation, storage potential, high cost or public acceptance, as described in (Finkenrath, 2011, page7), (Rubin, 2007, page4447, Table3), (Lohwasser, 2012, Abstract), and (Zoback, 2012, Abstract). CCS cost depends on a number of conditions such as concentration of CO2 in the exhaust gases, capture technology, access to storage site, storage potential, and CO2 monitoring. These literatures are listed in the No12 line of this table.	Accepted: this is covered in chatper 7 so a cross-reference has been given "(discussion of the costs, risks, deployment barriers and policy aspects of CCS can be found sections 7.8.2, 7.9, 7.10, and 7.12)"
33283	10	19	5			Figure 10.3 needs further explanation, e.g. on 'technical efficiency' and 'modal shift'. I would suggest to discuss tourism in an own sub-section and outside of the box 10.2.	Figure deleted
37542	10	19	5			This figure could be better integrated into the previous text discussion.	Figure deleted
24072	10	19	8	19	16	Add mitigation potential and the sectors current total emissions.	Noted: total emissions are already given in section 10.2, and mitigation potentials are covered in sectino 10.7
37543	10	19	9	19	18	It would be very helpful to show (e.g. in a table) the energy intensities of the respective steel production methods shown.	Rejected - unfortunately not enough space available

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30515	10	19	13	19	14	The report should mention that charcoal is also used on blast furnaces to produce pig iron and steel. For example, more than 30% of Brazilian iron and steel production is based on charcoal. In fact, it is an important mitigation alternative, since the use of renewable charcoal for the production of iron and steel avoids GHG emissions from coal coke (Useful Reference: CGEE - Centro de Gestão e Estudos Estratégicos. Incremento do uso do Carvão Vegetal Renovável na Siderurgia Brasileira. April, 2010.)	Noted. The reference is in Spanish, which I can't read, but in general (a) the total fraction of steel made with charcoal is very small and (b) if it were widely adopted, it would place yet another impossible burden on our biomass production There is sufficient discussion on charcoal in 10.4.1 given space constraints.
21377	10	19	19	19	31	Spending 7 lines only for ULCOS is too much, it should be within 2 lines. Rather than referring only to ULCOS, put more emphasis on other typical, affordable and effective energy saving technologies such as "Coke Dry Quenching" Top Pressure Recovery Turbine". Add "Coke Dry Quenching" and "Top Pressure Recovery Turbine" as examples of "various energy saving technologies" in line 23, p19. Reference: SOACT Handbook (p.31, p.40) http://asiapacificpartnership.org/pdf/Projects/Steel/SOACT-Handbook-2nd-Edition.pdf	Accepted: we referenced APP(2010) where we should have referenced this report, which is an excellent catalogue, and have mentioned the two options cited by the reviewer.
29789	10	20	1		12	These are very generalising statements and should require total revision - see next line below for all the comments related to this paragraph	Duplicate in effect of 29790
29790	10	20	1		3	Statement - "The coal and coke used in conventional iron-making is emissions intensive; switching to gas-based DRI and oil a nd natural gas injection has been used, where economic and practicable. " - is misleading. Firstly Gas Based DRI has a lot of limitation - for example - in terms of scale and production - the largest DRI only produced 2.5 MTPY whilst BF could produce upto 5.3 MTPY of iron. Emissions from DRI-EAF could be very similar to the Emissions from BF-BOF. (Note - Electricity in the EAF increases if DRI is melted in the EAF and this is dependent on the quality of DRI). The introduction of NG as injecant has its limitation especially for large BF - as this depress Raceway Adiabatic Flame Temperature. The use of oil as injectant has been limited by cost.	Accepted - atlhough again the reviewer fails to provide a reference. A second sentence has been added: "However, DRI production currently occurs at smaller scale than large blast furnaces (Cullen et al, 2012), and any emissions benefit depends on the emissions associated with increased electricity use for the required EAF process."
20336	10	20	1		12	I found this section very confusing. The use of charcoal results in very large methane emissions due to the bad technology used.	Noted - see 30515
33846	10	20	17			Data for the Netherlands are much higher (>90%)	Noted - but no reference is provided, and I think this is a misunderstanding about the distinction between "recycling" and "re-use"
37544	10	20	26	22	6	Suggest to add reference: Xu, T., T. Galama, J. Sathaye. 2013. Reducing Carbon Footprint in Cement Material Making: Characterizing Costs of Conserved Energy and Reduced Carbon Emissions. In press. Sustainable Cities and Society.	Noted - I read this paper, but it discusses costs rather than throwing any new light on technical potentials which is the aim of this section.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30273	10	20	27		29	this section should be rewritten to make the contributions clear. Right now it is a little awkward.	Accepted - thanks. It now reads "Emissions in cement production arise from fuel combustion (to heat limestone, clay and stand to 1450°C) and from the calcination reaction. Fuel emissions (0.8 Gt CO2 (IEA, 2009c) around 40% of the total) can be reduced through improvements in energy efficiency and fuel switching while process emissions (the calcination reaction, ~50% of the total) are unavoidable, so can be reduced through reduced demand, including through improved material efficiency. The remaining 10% of CO2 emissions arise from grinding and transport (Bosoaga et al., 2009)."
29796	10	20	27		28	This statement should also add about th process CO2 emissions that could be achieved using clinker substitution (for example - Blast Furnace Slag, coal fired power plant fly ash, natural pozzolans, etc…)	Noted - but this is indeed mentioned on page 21, line 23 - so no further discussion is proposed.
29795	10	20	29	21	12	Same comments as the steel industry - CCS should not be classed as Efficiency and Fuel Switching measures.	Noted - but in this case I can't see any reference to CCS in our energy efficiency section.
27849	10	20	30	20	40	Please clarify that the energy consumption for cement production does not only depend on the energy efficiency of the cement kiln, but also on the properties of the raw material (in particular on its water content), on the chemical composition of the clinker (alternatives to conventional clinker are subject to R&D), as well as on the clinker content of the final product (this varies from 0% in granulated blast furnace slag cement to nearly 100% in portland cement).	Noted - I think this is now covered in the responses to 30273 and 29796
24748	10	20	32	20	40	Suggest figures would be more understandable in a bar chart breaking down energy consumption into fuel consumption and clinker production.	Noted - I agree, but don't think we have the space to add such a figure, as we would still need some text.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29797	10	20	32	21	12	Same comments as the steel industry - CCS should not be classed as Efficiency nor as Fuel Switching measures. CCS is NOT efficiency or fuel switching measures. This could create confusion between fuel efficiency and CCS.	Noted - but I think we are clear that CCS is not an energy efficiency measure. We have used the three terms "energy efficiency", "emissions efficiency" and "material efficiency" as convenient labels to differentiate three types of strategy. There might be some confusion about whether CCS is an "emissions efficiency" measure - the same emissions occur, but they are captured - but they are not emitted into the atmosphere, so it seems to fit within the normal definition of the word.
37545	10	20	32	20	40	Energy Efficiency " A citation to Boyd & Zang (2011) should be made. Boyd and Zang observed a 13% improvement in energy intensity between 1997 to 2008 for US cement production through the ENERGY STAR Cement energy performance benchmarking process. Gale A. Boyd and Gang Zhang.(2011) Measuring Improvement in the Energy Performance of the U.S. Cement Industry, Nicholas Institute for Environmental Policy Solutions Report NI R 11-10, Duke University Durham, NC	Noted. Several other publications also consider evolutions of efficiency over time. I spent some time trying to find this report and couldn't locate it - and it isn't clear whether it is peer reviewed.
27850	10	20	32	20	40	Please clarify which of the given figures for energy consumption/demand refers to the production amount of cement clinker (which is most relevant for the energy consumption) or to the production amount of cement (the final product after mixing with a varying amount of other, less energy intensive components). Please - if possible - unify the reference point of the given figures, in order to make them comparable.	The Locher 2006 reference does not define whether the denominator is a tonne of clinker or a tonne of cement. Other references use different denominators (clinker, cement, and cementitious products) which have all been included in the text. Agreed that it would be best to have a common denominator, but since this is a literature review, it is not possible to make them all comparable since we do not have access to the underlying data from each publication.
31451	10	20	33	20	35	"Energy efficiency levels are generally lower than in Non-OECD countries but, where there has been a recent, rapid expansion using the latest plant design, efficiencies can be high" It is unclear whether the "than" should to be deleted.	Noted - this sentence no longer appears in the Final Draft
21215	10	20	4			Add full stop i.e. "emissions."	Editorial

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29791	10	20	4		6	Statement - "Charcoal, another coke substitute, is currently used for ironmaking, notably in Brazil (Taibi et al.; Henriques Jr. et al., 2010), and processing to improve charcoal's mechanical properties is another substitute under development, although extensive land area is required to produce wood for charcoal. " This is a misleading statement. Charcoal is only used for small blast furnace as what has been noted in the experience of Brazil. it will never be able to replace coke for very large BF that you can see in Germany, China, Brazil, South Korea, CIS, etc... where volume of these furnace is greater than 5500m3. Even the improvement of charcoal mechanical strenght during melting is not enough to replace coke for this large BF. So this is an overstatement.	Noted - see 30515
35435	10	20	41	21	2	Suggestion to delete "fossil or biomass wastes could be used instead as they have lower CO2 intensity than coal", as this assertion is not coherent with literature showing than using wastes as a fuel to produce energy produces more CO2 emissions per Kw·h than coal. In page 21 line 1, it should delete 'further potential elsewhere' as it should be acknowledged that incineration of wastes in cement kilns, both municipal solid waste and industrial waste, have been reportedly negative for the social, economical and environmental aspects of the local waste management in several towns and countries. The most remarkable examples are in Spain, where incineration of waste in cement kilns has mostly obeyed economical interests from the cement companies which are currently under much pressure due to the crisis faced in the construciton sector. The public administration does save money in the short-term sending waste to be incinerated in the cement kilns instead of paying for it to be incinerated in the conventional plants or buried in the landfills. However, incineration of waste in cement kilns is still at the bottom of the Waste Hierarchy for Waste Management options according to the European Commision Directives on Waste. The disposal of waste, whether this is in incinerators or in cement kilns, is the least preferable option in comparison to the prevention, reuse or recycling of waste, which offer much advantage in terms of mitigation of GHG emissions, benefits for the local economy through jobs creation, and sustainable development through resource efficiency. For information about Spain please see the report: Puig, I., Jofra, M. & Calaf, M., 2012. La puerta de atrás de la incineración de residuos. Other remarkable examples have been found in Mexico, where the incineration of waste from the Mexico City in cement kilns in the neighbouring state of Hidalgo has stopped after breaching the local and national law. Since the incineration of waste started in March 2012, the local community has organised and filed formal complaints to the local authorities and the Clean Development Mechanism for their eventual support to the project. See report by GAIA: Vargas, J.T. & Vilella, M., 2013. From Bordo Poniente to CEMEX : the CDM ' s support for waste incineration in cement factories. , (January) in http://www.no-burn.org/downloads/From%20Bordo%20Poniente%20to%20CEMEX%20_final.pdf. See other reports about the pollution related to incineration of waste in cement kilns: Carrasco, F., Bredin, N. & Heitz, M., 1994. Atmospheric Pollutants and Trace Gases. , pp.1484–1490.; García-Pérez, J. et al., 2013. Cancer mortality in towns in the vicinity of incinerators and installations for the recovery or disposal of hazardous waste. Environment international, 51, pp.31–44. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23160082 [Accessed April 16, 2013].s pose enourmous problems -	Taken into account: Most of the references provided by this reviewer are not peer reviewed. Of the last two (which are), the first is too old (1998) and the second is not specific to cement. We understand that the issues are similar wastes in incinerators and in cement plants, but I believe that if we had used this reference in earlier versions, other reviewers would object because it is not specific to the cement industry. However, we have modified the text to read “The majority of cement kilns burn coal (IEA/WBCSD, 2009), but fossil or biomass wastes can also be burned. While these alternatives have a lower CO2 intensity depending on their exact composition (Sathaye et al., 2011) and can result in reduced overall CO2 emissions from the cement industry (CEMBUREAU 2009), their use can also increase overall energy use per tonne of clinker produced if the fuels require pre-treatment such as drying (Hand 2007). Waste fuels have been used in cement production for the past 20 years in Europe, Japan, the U.S., and Canada (GTZ/Holcim 2006; Genon and Brizio 2008); The Netherlands and Switzerland use 83% and 48% waste, respectively, as a cement fuel (WBCSD 2005). It is important that wastes are burned in accordance with strict environmental guidelines as emissions resulting from such wastes can cause adverse environmental impacts such as extremely high concentrations of particulates in ambient air, ground-level ozone, acid rain, and water quality

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26943	10	20	41	21	2	Suggestion to delete "fossil or biomass wastes could be used instead as they have lower CO2 intensity than coal", as this assertion is not coherent with literature showing than using wastes as a fuel to produce energy produces more CO2 emissions per Kw·h than coal. In page 21 line 1, it should delete 'further potential elsewhere' as it should be acknowledged that incineration of wastes in cement kilns, both municipal solid waste and industrial waste, have been reportedly negative for the social, economical and environmental aspects of the local waste management in several towns and countries. The most remarkable examples are in Spain, where incineration of waste in cement kilns has mostly obeyed economical interests from the cement companies which are currently under much pressure due to the crisis faced in the construciton sector. The public administration does save money in the short-term sending waste to be incinerated in the cement kilns instead of paying for it to be incinerated in the conventional plants or buried in the landfills. However, incineration of waste in cement kilns is still at the bottom of the Waste Hierarchy for Waste Management options according to the European Commision Directives on Waste. The disposal of waste, whether this is in incinerators or in cement kilns, is the least preferable option in comparison to the prevention, reuse or recycling of waste, which offer much advantage in terms of mitigation of GHG emissions, benefits for the local economy through jobs creation, and sustainable development through resource efficiency. For information about Spain please see the report: Puig, I., Jofra, M. & Calaf, M., 2012. La puerta de atrás de la incineración de residuos. Other remarkable examples have been found in Mexico, where the incineration of waste from the Mexico City in cement kilns in the neighbouring state of Hidalgo has stopped after breaching the local and national law. Since the incineration of waste started in March 2012, the local community has organised and filed formal complaints to the local authorities and the Clean Development Mechanism for their eventual support to the project. See report by GAIA: Vargas, J.T. & Vilella, M., 2013. From Bordo Poniente to CEMEX : the CDM ' s support for waste incineration in cement factories. , (January) in http://www.no-burn.org/downloads/From%20Bordo%20Poniente%20to%20CEMEX%20_final.pdf. See other reports about the pollution related to incineration of waste in cement kilns: Carrasco, F., Bredin, N. & Heitz, M., 1994. Atmospheric Pollutants and Trace Gases. , pp.1484–1490.; García-Pérez, J. et al., 2013. Cancer mortality in towns in the vicinity of incinerators and installations for the recovery or disposal of hazardous waste. Environment international, 51, pp.31–44. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23160082 [Accessed April 16, 2013].s pose enourmous problems -	Duplicate of 35435
41076	10	20	42	20	42	"but fossil" should read "but fossil fuel"? But coal is also a fossil fuel - needs clarification?	Accepted -changed "fossil" to "Municipal"
19786	10	20	5	20	5	"… charcoal's mechanical properties…", replace with "chemical properties".	Noted - but the reviewer is wrong here. It is the mechanical properties that limit the size of BF stacking, as far as I understand.
25985	10	20	6			Please, consider adding info on how charcoal forestry could capture co2 from the atmosphere, while replacing coal as an energy source for iron and steel making. If forests for charcoal are planted on degraded land, the co2 capture could be large. It is as if iron and steel making could be carbon neutral, a true revolution in climate change mitigation. Please refer to the Associacao Mineira de Silvicultura AMS (Minas Gerais Forest Association) www.silviminas.com.br.	Noted - several comments earlier on charcoal, but I think that this one is wishful thinking - the competition for biomass is likely to exclude any substantial use of charcoal in steel making.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29792	10	20	6		7	Statement - "Other alternative fuels include ferrecoke (Takeda et al., 2011), biomass and waste plastics (IEA, 2009a)." need to be clear. Ferro-coke are not alternative fuel. This is a type of coke replacement (as reductant - but not as fuel). Biomass and waste plastic are PCI coal supplements that are introduced together with PCI coal at the bottom (via tuyeres) of the BF (this should be clear and not to be confused with coke replacement as reductant)	Taken into account: the sentence has been changed to read "Other substitutions include use of ferro-coke as a reductant (Takeda et al., 2011), and the use of biomass and waste plastics to displace coal (IEA, 2009a). "
29793	10	20	7		8	Statement - "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." - This is not true - given the fact that coke oven gas consists of 60% H2 is very available within the steel works. But this type of fuel will be replaced by another alternative fuel as this takes away the fuel of other furnaces and users of the steel works.	Noted - but I think this is unhelpful nit-picking. Clearly, the statement implies "additional" hydrogen.
29794	10	20	9		10	The Japanese Course50 programme consists of several other projects not only limited to hydrogen injection. This statement should be rephrased and be specific of which sub-project being referred to.	Taken into account - see response to 21382
24318	10	20	18	20	20	This is different in different countries, e.g. in China, this is not the case. It is recommended to delete this sentence or adding "in the developed countries" in the end.	Accepted: changed to "However, in developed economies steel is 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, A.C.H. and Allwood, 2013a)." Oddly, China is still very inefficient in its use of materials (putting up tower blocks that last only 20 years) - so I think the comment could be applied there.
31557	10	20	18	20	20	This is different in different countries, e.g. in China, this is not the case. It is recommended to delete this sentence or adding "in the developed countries" in the end.	Duplicate of 24318
21378	10	20	13	20	14	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.	Rejected: this comment is a marketing statement for the steel industry, and fails to recognise the point - that I think is clearly made throughout this chapter - that the major inefficiencies in material use occur downstream of the material producers.
21379	10	20	17	20	18	It is questionable.	Noted: the verb "estimate" was used correctly.
30508	10	20	17	20	20	It is questionable. The effectivness of "re-use" is to be carefully investigated on overall energy efficiency including the energy efficiency of the final products which often be sacrificed by re-use.	See 21379

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21380	10	20	18	20	20	When discussing material efficiency of steel, it should be noted that steel is the world's most recyled material. The global rate of recycling of steel is 83% and some specific steel use sector shows much higher recycle rate. Please refer to the followings for steel sector's case: http://www.worldsteel.org/dms/internetDocumentList/fact-sheets/Fact-sheet_3Rs/document/Fact%20sheet_3Rs.pdf As the feature of steel is its recyclability by metling, it is questionable that reuse of the steel is expected to reach 30%. In addition, reuse rate of steel is not decided by its relatively cheap price nor tax policy. These sentences could be misunderstood that tax policy can be work as a method to enhance material efficiency in steel industry.	Noted: recycling is clearly described earlier in the chapter as an energy-efficiency strategy, with steel celebrated as a good case. Recycling does not lead to any change in demand for material production - so is not a 'material efficiency' strategy - rather it is about 'energy efficiency.'
21381	10	20	23	20	25	Delete this sentence. Without explaining how Cooper et al. (2012) explored product life proposing an "onion-skin model", it does not make sence to refer their study.	Accepted - this sentence has been removed and the sub-section rewritten as: "Commercial buildings in developed economies are currently built with up to twice the steel required by safety codes, and are typically replaced after around 30-60 years (Michaelis & Jackson, 2000, Pauliuk et al. 2012, Hatayama et al., 2010), so the same service (for example office space provision) could be achieved with one quarter of the steel, if safety codes were met accurately and buildings replaced after 80 years. Similarly, there is a strong correlation between vehicle fuel consumption and vehicle mass and for example in the UK, 4 or 5-seater cars are used for around 4 hours per week by 1.6 people (DfT, 2010) so a move towards smaller, lighter fuel efficient vehicles, used for more hours per week by more people could lead to a four-fold or more reduction in steel requirements, while providing a similar transport service. There is a well-known trade off between the emissions embodied in producing goods, and those generated during use, so product life extension strategies should account for different anticipated rates of improvement in embodied and use-phase emissions (Skelton and Allwood, 2013b.) "

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21383	10	20	23	20	25	As for steel industry, it is not prefarable to mention "reduced product and service demand" considering business impact and should be deleted based on the following reasons. 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	Noted - but actually, the World Steel Association now is discussing this theme, which is embedded thorughout their 2012 publication "SUSTAINABLE STEEL At the core of a green economy" - and, as everyone agrees, if a significant cut in emissions is requried of the steel industry, using this excellent material more wisely is an essential strategy.
30516	10	20	3	20	6	The report should explicitly consider the differentiation between "renewable charcoal" (from renewable sources of biomass) and "non renewable charcoal (from non-renewable sources of biomass), given the substantive implications in terms of GHG emissions, i.e. non-renewable charcoal implies positive CO2 emissions.	Noted - see 30515
21382	10	20	9	20	10	COURSE50 is a goold expample for emission reduction and fuel switching in the future. Course 50 is investigeted only by Japan but this sentence might be misunderstood that US and Japan are investigating together. Modify as follows; Hydrogen reduction is being investigated in the US (Pinegar et al., 2011) and in Japan as Course 50 (Matsumiya, 2011). Course 50 is an initiative of Japanese steel industry and aims at developing technologies to reduce CO2 emissions by approximately 30% through suppression of CO2 emissions from blast furnaces as well as capture - separation and recovery - of CO2 from blast furnace gas (BFG), and establishing the technologies by ca. 2030 with the final goal of industrializing and transferring the developed technologies by 2050. Reference: http://www.jisf.or.jp/course50/index_en.html	Accepted - with some editing due to space limitations,
31685	10	20		20		Some studies have been undertaken on alternative cement compositions based on other minerals such as Bentonite which result in lower embodied carbon than for OPC but issues of regulation and market acceptance are likely barriers to adoption.	Noted - but the reviewer does not provide a reference. The Hasanbegi, Price et al 2012 reference provdies an extensive list of possible new formulations, which I think covers the point sufficiently.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24316	10	20	27	20	31	It is recommended to change to 2010 data, in order to maintain the comparability in different places. (in Table 10.2, 2010 data is used; in page 12 line 12, 2008 data is used)	Accepted, we have changed this sentence to read: Fuel emissions (0.8 Gt CO2 (IEA, 2009c) around 40% of the total) can be reduced through improvements in energy efficiency and fuel switching while process emissions (the calcination reaction, ~50% of the total) are unavoidable, so can be reduced through reduced demand, including through improved material efficiency. The remaining 10% of CO2 emissions arise from grinding and transport (Bosoaga et al., 2009).
31555	10	20	27	20	31	It is recommended to change to 2010 data, in order to maintain the comparability in different places. (in Table 10.2, 2010 data is used; in page 12 line 12, 2008 data is used)	Duplicate of 24316
24317	10	20	34	20	34	"80 Kwh/t" for clinker production is too high, should be 50Kwh/t.	The sentence says "with electricity consumption of 80 kWh/t clinker or lower (Muller and Harnish, 2008)" which is based on the reference given. The next sentence provides best practice values which combine the fuel and electricity consumption values to give overall best practice energy use. The electricity best practice values for final energy that comprise those overall energy values range from 52-62 kWh/t cement depending upon the type of cement used. This detail is provided in the reference. As such, I do not think that any modification is needed.
31556	10	20	34	20	34	"80 Kwh/t" for clinker production is too high, should be 50Kwh/t.	Duplicate of 31556
24319	10	21		21		Data in table 10.4 is for 2005, it is suggeste to use updated data if possible.	Noted - but the reviewer provides no suggestion for finding the updated data.
31558	10	21		21		Data in table 10.4 is for 2005, it is suggeste to use updated data if possible.	Duplcate of 24319
24143	10	21		21		Good figure to show accurate regional estimation on energy efficiency (GJ per ton of clinker) as well as utilization of alternative fuels.	Noted - thank you.
37546	10	21	13	21	31	The authors should consider mentioning precast concrete as a more materials efficient use of cement and concrete, as scrap is internally recycled in precast plants and some concrete waste is typically associated with traditional cast-in-place methods. Precast components might also be reused. Medgar Marceau has published on this topic.	Noted - this is a good suggestion, but Marceau has not written about this in the peer reviewed literature.
37547	10	21	17	21	29	Concrete can employ greater levelso f cementitious material (of non-cement origin) and thus offset the need for cement. The challenge may be building or road construction codes.	Noted - I think this is already covered on page 21 line 23

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22102	10	21	30	22	6	Infrastructure and buildings must be designed with a long lifespan if their embedded emissions are to be reduced.	Noted - I think this is exactly what is said on page 22 line 1
27851	10	21	9	21	12	Please include information and references on the current development of novel hydraulic binders with low energy demand and related carbon dioxide emissions such as the 'Celitement' pilot project, carried out by the German cement producer Schwenk Group and the Karlsruhe Institute of Technology (see: P. Stemmermann, U. Schweike, K. Garbev, G. Beuchle : 'Celitement - a sustainable prospect for the cement industry', in: Cement International 8 (2010), no.5, p. 52-66; also available under http://www.celitement.de/en/downloads.html).	Noted - I read this paper, which refers to a material for which a pilot plant making 100kg per day was planned in 2011. This, and other possible novel formulations are covered in Hasanbegig, Price et al. 2012, mentioned on page 21 line 10.
20337	10	21	9			I do not think this source is peer-reviewed. It is a consultants report. How valid is this claim?	Noted - but three sources are mentioned on this line.
21387	10	21				(Oda et. al.) provides a figure of primary energy consumption of BOF steel for major steel maiking countries and it should be reflected in chapter 10 between line 18 and 19, p.19. This figure is especially essential for policy makers to understand where the energy saving potential lies in the world. This figure is supported by detailed evidences and thus very reliable. Reference: Fig. 6. Final estimates of SEC for BOF steel in 2000 and 2005. of following article. Oda J., K. Akimoto, T. Tomoda, M. Nagashima, K. Wada, and F. Sano (2012b). International comparisons of energy efficiency in power, steel, and cement industries. Energy Policy 44, 118–129. (DOI: 10.1016/j.enpol.2012.01.024).	Noted - but this reference is already included in that location?
24070	10	22	1	22	6	Reduce example to one paragraph.	Noted - but it already is one paragraph?
30194	10	22	10	22	13	The sentence should be replaced with "However, emissions in this sector are dominated by a relatively small number of key outputs: ethylene, ammonia, nitric acid, adipic acid and caprolactam, used in producing plastics, fertilizer, and synthetic fibers."	Accepted - thanks.
28982	10	22	16			Add: "A study for the European chemical industry has shown that abatement options can be grouped into three categories, which are under the control of the chemical industry itself: energy efficiency improvement, fuel mix change and N2O abatement. By implementing these the European chemical industry could achieve an absolute greenhouse gas emissions reduction of 15 to 25% by 2030 compared to 2010 levels, adding to the 50% reduction achieved between 1990 and 2010. Deeper greenhouse gas emissions reduction is technically possible by decarbonisation of the power sector and, in addition, for the 2030–2050 timeframe, by carbon capture and storage applied to emissions from the chemical industry. These options, however, are costly and require technological breakthroughs. They face several barriers that are largely outside the control of the chemical industry." (Source: CEFIC ECOFYS: Study "European chemistry for growth - unlocking a competitive, low carbon and energy-efficient future", p. iv, April 2013)	Noted - but this is a commercial report commissioned by a chemical industry lobby, and describes an aspiration rather than a set of technology options.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24749	10	22	17	22	36	Suggest the addition of analysis of the benefits of "flow chemistry" and the impact on plastic, and chemical manufacturing plants. Business intelligence indicates that the majority of plant and equipment upgrades undertaken in Australia, leverage off the heat and energy capture technologies identified in the paragraph to reduce energy burden and increase production efficiency. However, potentially greater efficiencies are identified by changes from “batch chemistry” to “flow chemistry”, which allows for greater product movement efficiencies as well as energy savings. Examples of flow chemistry undertaken in Australia that may provide direction for authors include TiRO™, a production method created by the Australian Government’s peak scientific body, The Commonwealth Scientific and Industrial Research Organisation (CSIRO). Using established Kroll process chemistry, CSIRO is developing a new two-step process that enables direct production of titanium metal powder suitable for use in near net shape manufacturing. The TiRO™ process is continuous; this provides a number of benefits in comparison with a batch process: • low inventory and low working capital • safety - risk of metal powder incidents minimised • enables working to demand and just-in-time production • fully automatable • rapid, simple plant start-up and shutdown. Citations: CSIRO (2013) Making titanium metal powder, http://www.csiro.au/en/Organisation-Structure/Flagships/Future-Manufacturing-Flagship/Ti-Technologies/TiRO.aspx Doblin, C., Chryss, A., & Monch, A. (2012), Titanium Powder from the TiRO™ Process. Key Engineering Materials, 520, 95. doi: 10.4028/www.scientific.net/KEM.520.95	Noted, but this would need more explanation and discussion than the detailed point merits.
29798	10	22	17		36	This statement only gives examples but is not a concrete discussion about efficiency measures in chemical industry. The discussion or review of this topics is superficial	Noted - but the reviewer doesn't make any suggestions about how to improve it.
30195	10	22	21			"12% saving possible" should be "12% saving potential".	Rejected - the current statement is sufficient.
24750	10	22	22	22	24	It is unclear how conversion to biomass reduces C02 emissions if it requires greater energy consumption and greater landmass? The sentence seems to pull the reader in two directions. Ideally this should be expanded or changed to identify the properties of biomass as a chemical feedstock, not only as a full replacement (as alluded to in the sentence), but as is more likely, the impact of partial use in chemical processing and its impact on emissions. Comparative studies looking at the virtues of biofuel alternatives for airplane fuel and maritime shipping fuels may provide insight. For example, Virgin Australia is looking to institute a 5% blending of biofuel into its airplane fleet and is currently investigating supply chain issues. Further the benefits of biodiesel used in maritime vessels, and the resulting reduction in sulphur emissions into water provides a strong case study for the chemical industry that may provide more tactile examples of the benefits of alternate feedstocks. Suggested citations: Pond, S (2012) “The Advanced Biofuels Industry: A Global Perspective”, TRX12 Bioenergy & Bioproducts Symposium, Brisbane, Queensland (see Attachment 2 - The Advanced Biofuels Industry: A Global Perspective) CSIRO (2011) Flight Path to Sustainable Aviation, http://www.csiro.au/files/files/p10rv.pdf Nayyar, P (2012) The Use of Biodiesel Fuels in the U.S. Marine Industry, http://www.marad.dot.gov/documents/The_Use_of_Biodiesel_Fuels_in_the_US_Marine_Industry.pdf	Noted - but the intention here was to focus on biomass as a feedstock. The issue of biomass as an energy supply is considered in chapter 7

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30946	10	22	29	22	30	"Very high levels of emissions reduction could be achieved, depending on plant operating conditions (Reimer et al., 2000)." This comment is from 2000; 13 years old. Suggest updating with a more up-to-date source. For instance, the Chemistry Industry Association of Canada Reducing Emissions Report 1992-2012 indicates yearly reductions in emissions since 2000. CIAC (2013). Reducing Emissions Report 1992-2012. Chemistry Industry Association of Canada, Ottawa, Canada. Available at http://www.canadianchemistry.ca/LinkClick.aspx?fileticket=X8Btv72hTXQ%3d&tabid=88.	Noted. The CIAC report is a good read, but is not peer-reviewed and is obviously an industry association marketing document. Instead, a reference to Neelis et al. (2008) has been added - see response to 37548
30198	10	22	29			Delete "low meat diet".	Accepted
20339	10	22	30		31	This is a very old source. Commercially applied processes can guarantee now N2O emissions reductions over 95% in nitric acid plants.	Noted - but the reviewer provides no reference.
25754	10	22	34	22	36	This part should include the potential of heat pump technology in chemical industry because it has huge potential to reduce GHG emission from industrial sectors including chemical industry, as described in (IEA/OECD, 2010, page65-83) and (UNIDO, page38, Fig14). These literatures are listed in the No17 line of this table.	Noted - but the sentence identifie already makes an appropriate statement about this.
33847	10	22	36			The use of CHP however strongly depends on the relation between gas- and electricity prices	Noted - but this is a comment on barriers and implementation, not about technical potential.
27852	10	22	38	22	42	Please include also information and references on the combined NOx and N2O abatement technique of tailgases in nitric acid plants. Beside other techniques, both the catalytic N2O decomposition and the combined NOx and N2O abatement in the tailgas are stated by the European Commission as being Best Available Technique (BAT) in the BAT Reference document "Large Volume Inorganic Chemicals: Ammonia, Acids and Fertilisers Industries" (BREF LVIC-AAF). See: http://eippcb.jrc.es/reference/BREF/lvic_aaf.pdf (Chapter 3.5) and http://procurement.uhde-web.de/cgi-bin/byteserver.pl/archive/upload/uhde_publications_pdf_en_15000012.00.pdf	Noted, but due to space limitations this was not included
30196	10	22	42	22	44	The sentence should be replaced with "N2O emissions from nitric acid production has the potential to reduce GHG emissions by 73 Mt CO2e /year through Best Practice technologies, which is equivalent to 15.7% of emissions in the sector (IFA, 2009)."	Taken into account - the reviewers comment means something different from what was written in the text and on reflection this sentence adds little to the one before it, so has been deleted.
30197	10	22	48	22	50	The sentence should be replaced with "Fuel switching can also lead to significant emission reductions and energy savings. For example, natural gas based ammonia production results in 36% emission reductions compared to Naphtha, 47% compared to Fuel Oil and 58% compared to Coal (IFA, 2009)." Percentages are recalculated by using the data in the reference, page 18 Tab.3. The reference does not show the "27Mt CO2" for fuel switching.	Accepted - the figures as used were for energy, but the reviewer is right that it is better to use the emissions numbers.The 27Mt figure is a maximum potential abatement shown in table 2 of the IFA report.
25986	10	22	6			Cement is largely wasted in buildings design, especially when architects and engineers specify concrete for mere esthetical purposes rather for structural needs. Please contact CONFEA, the Brazilian Engineers Confederation. www.confea.org.br	Noted - this is a nice anecdotal comment in support of the emphasis we are trying to place on material efficiency
25987	10	22				Chemical industry. The whole section could be drastically reduced	Noted - but this is true of every page of the report.
30518	10	22	45	22	46	China "and other developing countries" through CDM	Accepted - thanks.
29670	10	22	7			For consistency, should include paragraph on 'reduced product and service demand'	Noted - we'd like to, but couldn't find any new references to support this - and the reviewer doesn't provide any.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37548	10	22	7			This report has a lot of good energy efficiency information for Section 10.4.3: Neelis, M., Worrell, E., and E. Masanet (2008). Energy Efficiency Improvement and Cost Saving Opportunities for the Petrochemical Industry: An ENERGY STARÂ® Guide for Energy and Plant Managers. Lawrence Berkeley National Laboratory, Berkeley, California. LBNL-964E.	Taken into account - thanks. The relevant sentence has been changed to read "Many options exist to reduce emissions, depending on plant operating conditions (Reimer et al., 2000) and a broad survey of options in the petrochemicals industry is given by Neelis et al. (2008). "
32285	10	22				There are potentials for GHG emissions reduction in this sector. A major barrier to investment is the uncertainties of the market and regulatory environment in the future. Usually plants are operated for decades in chemical industry and many years are needed to recover investment. Even when BAT are available, investment may not follow due to these reasons. The barreir of uncertain future market and regulatory environment has comonality in other idustrial sectors and thus should be discussed in the report.	Noted - these are obviously good comments, that are reflected in our section 10.9 on barriers and opportunities
20168	10	23				A LBNL report on emerging EE technologies for the iron and steel industry can be cited here. It is already cited in some other place in the report by not here which seems to be suitable. Kong L., A. Hasanbeigi, and L. Price (under review). Emerging Energy-Efficiency and Greenhouse Gas Mitigation Technologies for the Pulp and Paper Industry. Renewable and Sustainable Energy Reviews. Available at: http://eaei.lbl.gov/emerging-energy-efficiency-and-greenhouse-gas-mitigation-technologies-pulp-and-paper-industry .	I believe that the reviewer meant pulp/paper when he said steel, because this section is on pulp/paper and the reference he provided is for that sector also. I will add the reference in the text.
20172	10	23				For potential of EE in case-studied pulp and paper plants in China, please see: Kong, Lingbo; Price, Lynn; Hasanbeigi, Ali; Liu, Huanbin; Li, Jigeng. Potential for Reducing Paper Mill Energy Use and Carbon Dioxide Emissions through Plant-wide Energy Audits: A Case Study in China. Applied Energy, Volume 102, February 2013, Pages 1334–1342	See 20168
20340	10	23	1		4	However, there may be large potentials for increasing the efficiency of using fertilizer, as in mnay areas there is a surplus of nitrogen (e.g. Europe, US, China). See: E. Worrell, B. Meuleman and K. Blok, "Energy Savings by Efficient Application of Fertilizer", Resources, Conservation & Recycling 3/4 13 pp.233-250 (1995).	Noted - I agree, but this reference is nearly 20 years old, and has been cited in previous IPCC reports - but led to no further studies on efficient fertiliser application.
20341	10	23	1		4	Similarly, potentials have been found in e.g. Packaging (40% of plastics are used for packaging). See e.g. 25. M.P. Hekkert, L.A.J. Joosten, E. Worrell, W.C. Turkenburg, “Reduction of CO2 Emissions by Improved Management of Material and Product Use: the Case of Primary Packaging” Resources, Conservation & Recycling 1-2 29 pp.33-64 (2000). and: 7. M. A.E. van Sluisveld, E. Worrell. The paradox of packaging optimization – a characterization of packaging source reduction in the Netherlands. Resources, Conservation and Recycling 73: 133–142 (2013).	Accepted. Added "although Hekkert et al. (2000) anticipate a potential 51% saving in emissions associated with the use of plastic packaging in the Netherlands from application of a broad basket of material efficiency strategies" to 324. The reference is the first of the two listed here. (The more recent reference is a broader study on implementation rather than technical potential.)

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37551	10	23	10	23	24	To help the US Pulp and Paper sector improve its energy efficiency and reduce it greenhouse gas emissions, energy performance benchmarking tools were released by EPA for pulp mills and integrated pulp and paper mills (Boyd and Guo 2012) See: Boyd, Gale and Yi Fang Guo (2012) Development of Energy Star's Energy Performance Indicators for Pulp, Paper, and Paperboard mills; DUKE UNIVERSITY, DEPARTMENT OF ECONOMICS	Noted, thank you. The policy section 10.11.1 makes a general reference to the important issue of benchmarking, unfortunately there is no space to go into sector-specific examples such as this one (we might include the example of corn milling below).
20342	10	23	10		24	The list of technologies mentioned seems very random, and not related to the importance of the technologies for energy savings. Some recent papers that do give a good feel for the potentials are: 5. J. Laurijssen, A.P.C. Faaij and E. Worrell. Benchmarking Energy Use in the Paper Industry- A benchmarking study on process-unit level. Energy Efficiency 6: 49-63 (2013). Jobien Laurijssen, Frans J. De Gram, Ernst Worrell and Andre Faaij. “Short-term energy efficiency optimization measures in conventional multi-cylinder dryers in the paper industry” Energy, the International Journal 9 35: 3738-3750 (2010).	Accepted: these references were excellent, and the opening of the section on energy efficiency has been changed to read "A broad range of energy efficiency technologies are available for this sector, reviewed by (Kramer et al., 2009), and Laurijssen et al. (2013). Over half the energy used in paper making is to create heat for drying paper after it has been laid, and Laurijssen et al. (2010) estimate that this could be reduced by ~32% by the use of additives, an increased dew point and improved heat recovery. Energy savings may also be obtained"
19166	10	23	17	23	24	This is the only time that syn-gas and bio-methanol are mentioned. And that is prome black liquor. These products can be made from the dry disstilation of biomass and it is cheaper than trying to prepare ethanol from such feedstocks.	Noted - but this review comment does not lead to any obvious change, or new reference.
24751	10	23	27	23	29	CHP may have little additional potential in Europe, but may have significant potential globally. This statement should be revised based on global potential. Suggest change to: 'Combined heat and power (CHP) accounted for 95% of total on-site electricity produced by EU paper makers in 2009, compared to 88% in 1990 (CEPI, 2011), so has little further potential in Europe, but may offer opportunities globally'.	Accepted.
37552	10	23	33	23	36	What about recycling rates and improvement potential for China, India, and the rest of the world? Clearly, the US and Europe have limited room to improve but from a global perspective there might be huge room to improve. do we have statistics on the rest of the world that can be cited?	Noted - but the reviewer did not provide the required statistics

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20343	10	23	37		42	There is still considerable potential for increased recycling in the paper industry. The GHG benefits may vary depending on the system boundatries of the analysis, but can be imporant in a world where biomass supply is constrained (which it is...): 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).	Accepted: two sentences added: ""Paper recycling generally saves energy, and may reduce emissions (although electricity in some primary paper making is derived from biomass powered CHP plants) and rates can be increased (Laurijssen et al., 2010b). Paper recycling is also important as competition for biomass will increase with population growth and increased use of biomass for fuel."
35415	10	23	4			It should be mentioned that emissions savings from fertilisers can be achieved with the use of compost or application of treated sewage sludge (Favoino E,. Hogg D,.2008 The potential role of compost in reducing greenhouse gases.	Noted - but this reference provides only a qualitative survey and no quantitative assessments of potentials.
35473	10	23	4			It should be mentioned that emissions savings from fertilisers can be achieved with the use of compost or application of treated sewage sludge (Favoino E,. Hogg D,.2008 The potential role of compost in reducing greenhouse gases.	Duplicate of 35415
26883	10	23	4			It should be mentioned that emissions savings from fertilisers can be achieved with the use of compost or application of treated sewage sludge (Favoino E,. Hogg D,.2008 The potential role of compost in reducing greenhouse gases.	Duplicate of 35415
26981	10	23	4			It should be mentioned that emissions savings from fertilisers can be achieved with the use of compost or application of treated sewage sludge (Favoino E,. Hogg D,.2008 The potential role of compost in reducing greenhouse gases.	Duplicate of 35415
20344	10	23	42		45	Paper is also an important packaging material and used for printing. Large reductions are feasible (see also above) and also: Marko P. Hekkert, Jon van den Reek, Ernst Worrell and Wim C. Turkenburg, “The Impact of Material Efficient End-Use Technologies on Paper Use and Carbon Emissions” Resources, Conservation & Recycling 3 36 pp.241-266 (2002).	Taken into account: in fact we'd already cited this paper, but have reinforced the message by rewriting the material efficiency section to read "Higher material efficiency could be achieved through more use of duplex printing, print on demand, the improvement of recycling yields and the manufacturing of lighter paper. Recycling yields could be improved by design of easy to remove inks and adhesives and less harmful de-inking chemicals, and paper weights for newspapers and office paper could be reduced from 45 and 80 g/m2 to 42 and 70 g/m2 respectively and might lead to a 37% saving in papers used for current service levels (Van den Reek, J, 1999; Hekkert et al., 2002). "

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28987	10	23	44	23	46	An appropriate supporting reference for this claim is: Rejeski, D. 2002. E-commerce, the internet, and the environment. Journal of Industrial Ecology 6(2): 1-3. 10.1162/108819802763471717	Noted: This paper is a two page editorial introduction to a special issue, so I think is probably not the right reference.
37549	10	23	5	23	46	Emissions and cost data in this section could be updated with Xu TF, Sathaye J, and Kramer KJ. 2012. "Bottom-up Representation of Industrial Energy Efficiency Technologies in Integrated Assessment Models for the U.S. Pulp and Paper Sector," Lawrence Berkley National Laboratory (LBNL) Report 5801E.	Noted - I've read this paper, and it focuses on costs of implementation not on technical potentials, so does not contribute to the aims of 10.4.
37550	10	23	5	23	46	Suggest to add reference: Xu, T., J. Sathaye, K. Kramer. 2013. Sustainability Options in Pulp and Paper Making: Costs of Conserved Energy and Carbon Reduction in the U.S. In press, Sustainable Cities and Society. DOI: 10.1016/j.scs.2013.01.006	Noted - in all honesty this is very nearly a duplicate publication of the one cited above - so the same comment applies..
24074	10	23	6	23	9	Add mitigation potential and the sectors current total emissions.	See section 10.7 for estimates of mitigation potentials and section 10.3 for sector emissions
25988	10	23				Pulp and paper. The whole section could be drastically reduced	Noted - thank you.
27123	10	23	25	23	36	Changes due to newer statistic data (see below for reference). New text should read as follows (changes indicated with >>> new figure <<<): Emissions efficiency and fuel switching: Direct CO2 emissions from European pulp and paper production reduced from 0.57 to >>> 0.34 <<< ktCO2 per kt of paper between 1990 and >>> 2011 <<<, while indirect emissions reduced from >>> 0.21 <<< to >>> 0.09 <<< ktCO2 per kt of paper (CEPI, >>> 2012 <<<). Combined heat and power (CHP) accounted for 95% of total onsite electricity produced by EU paper makers in >>> 2011 <<<, compared to 88% in 1990 (CEPI, >>> 2012 <<<), so has little further potential. The global pulp and paper industry usually has ready access to biomass resources and it generates from biomass approximately a third of its own energy needs (IEA, 2009a) (>>> 55% <<< in the EU, (CEPI, >>> 2012 <<<). Paper recycling can have a positive impact on energy intensity and CO2 emissions over the total lifecycle of paper production (Miner, 2010; Laurijssen et al., 2010). Recycling rates in Europe and North America reached >>> 70.4% <<< and >>> 66.8% <<< in >>> 2011 <<<, respectively (AF & PA; CEPI, AF & PA; >>> 2012 <<<), leaving a small range for improvement when considering the limit of 81% estimated by (CEPI, 2006). In Europe, the share of recovered paper used in paper manufacturing has increased from roughly 3335% in 1991 to around 44.5% in 2009 (CEPI, >>> 2012 <<<).	Accepted - having checked the source.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27126	10	23	25	23	36	Changes due to newer statistic data (see below for reference). New text should read as follows (changes indicated with >>> new figure <<<): Emissions efficiency and fuel switching: Direct CO2 emissions from European pulp and paper production reduced from 0.57 to >>> 0.34 <<< ktCO2 per kt of paper between 1990 and >>> 2011 <<<, while indirect emissions reduced from >>> 0.21 <<< to >>> 0.09 <<< ktCO2 per kt of paper (CEPI, >>> 2012 <<<). Combined heat and power (CHP) accounted for 95% of total onsite electricity produced by EU paper makers in >>> 2011 <<<, compared to 88% in 1990 (CEPI, >>> 2012 <<<), so has little further potential. The global pulp and paper industry usually has ready access to biomass resources and it generates from biomass approximately a third of its own energy needs (IEA, 2009a) (>>> 55% <<< in the EU, (CEPI, >>> 2012 <<<). Paper recycling can have a positive impact on energy intensity and CO2 emissions over the total lifecycle of paper production (Miner, 2010; Laurijssen et al., 2010). Recycling rates in Europe and North America reached >>> 70.4% <<< and >>> 66.8% <<< in >>> 2011 <<<, respectively (AF & PA; CEPI, AF & PA; >>> 2012 <<<), leaving a small range for improvement when considering the limit of 81% estimated by (CEPI, 2006). In Europe, the share of recovered paper used in paper manufacturing has increased from roughly 3335% in 1991 to around 44.5% in 2009 (CEPI, >>> 2012 <<<).	Duplicate of 27123
28986	10	23	43	23	43	No entry in reference list for Lea-Ayala et al., 2012	Corrected, thank you.
27124	10	23	45	23	46	The following sentence is misleading: "[…] the substitution of electronic media for paper has mixed environmental outcomes, with no clear statistics yet on whether electronics reduce paper demand" The sentence seems to imply that, if electronic media for paper reduce paper demand, then it will reduce GHG emissions. This is not necessarily the case. It depends on the production process and lifetime of the electronic device, the carbon content of the electricity used to recharge the device, how frequently the device is recharged, the energy required to dispose the device, and so forth. For these reasons, we suggest replacing the text: "whether electronics reduce paper demand" with the following: "whether electronics reduce overall GHG emissions"	Accepted - "whether such media reduces paper demand, or whether it leads to a net reduction in emissions"
30519	10	23	6	23	46	It is important to include one item addressing the potential net GHG removals and carbon stocks biomass associated witht the production of pulp and paper. In most developing countries, forestry investments are also controlled by the producers of pulp and paper and most of the barriers related to the development of the industry are associated to such a land-use component. In addition to the carbon stocks provided by commercial plantations, native preservation areas associated with the production may also generate substantive net GHG removals in several developing countries, including Brazil.	Accpeted - a forward reference has been added at page 23 line 36: "The emissions consequences of forestry associated with paper production is discussed in chapter 11"
20345	10	24				See also the MSc Thesis by A. Kermeli: Global CO2 and PFCs abatement potential in the primary aluminium industry up to 2030, Utrecht University, The Netherlands	Noted - but I don't believe this is easily accessibl

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22103	10	24	1	25	2	Aluminium is becoming more popular in car manufacturing because it is lighter than steel and can potentially help in producing cars that emit less. However, the impact of increased aluminium productino is not assessed either in terms of capacity, environmental impacts or financial consequences. The impact of this shift has to be assessed	Noted - the reviewer's comment is correct, but points to no new references or insights.
19787	10	24	10	24	17	Even though the units here are not mistaken it would be easier for a non-expert reader to have in brackets these figures in the same units.	Accepted - better to stick to GJ/T and keep emphasising "primary" and "final" energy.
21216	10	24	12			Change to "electro-hydraulic"	Rejected - unclear what this refers to
24075	10	24	2	24	5	Add mitigation potential and the sectors current total emissions.	See 24074
20346	10	24	33		39	There is a lot of data on PFC emission reductions (from the industry initiative, and the US EPA initiative in the US). Why is this not used?	Noted - lack of space.
37553	10	24	39	24	39	Substitute chemicals with low and zero-GWP are commercially available and technically proven for SF6 use in magnesium.	Noted - no reference is provided.
25989	10	24				Non ferrous metals. Paragraphs on Aluminum should be reduced. Other metals, copper, zinc are missing, despite being intense energy users.	Noted - but the reviewer provides no additional references.
29671	10	24	1			For consistency, should include paragraph on 'reduced product and service demand'	Noted - but we found no new references on this, and the reviewer provides none.
37556	10	25	10	25	11	Actually, it is the processing of whey as a byproduct of cheese production that is the most energy intensive aspect of dairy processing. So dried whey production might be better stated as the most energy intensive part of the dairy sector: Brush, A., E. Masanet, and E. Worrell (2011). Energy Efficiency Improvement and Cost Saving Opportunities for the Dairy Industry: An ENERGY STARÂ® Guide for Energy and Plant Managers. Lawrence Berkeley National Laboratory, Berkeley, California.	Taken into account - see response to 20347, and the rewrite of the Energy Efficiency section for Food.
25755	10	25	15	25	15	This part should be kept in the final version report because heat pump technology has huge potential to reduce GHG emission from industrial sectors including food processing sector, as described in (IEA/OECD, 2010, page65-83) and (UNIDO, page38, Fig14). These literatures are listed in the No17 line of this table. In addition, this part should mention 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 100℃, 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 - but this report, which is indeed extremely enthusiastic, makes its claims assuming that all heat pumps have a COP of 4. In fact, a UK government study going on at present suggests that COPs achieved in practice may be very much lower than that - so the incautious enthusiasm of this report reads to me more as a marketing report and I don't think the existing text needs further work.
37557	10	25	17	25	18	"direct use of turbine gas for drying compared to steam"based heating methods (Masanet et al., 2008)" There is no mention of direct use of turbine gas for drying in Masanet et al. 2008, nor is this reviewer aware of any instances of direct use of natural gas turbine exhaust for drying. The authors may very well be referring to direct-firing of natural gas instead of steam-based, indirect drying, which refers to direct burner combustion in the dryer unit, *not* the use of turbine gas.	Accepted - this phrase has been deleted.
37558	10	25	18	25	19	"thermal and mechanical vapour recompression in drying further enhanced by use of reverse osmosis can deliver energy use efficiency." This seems to be an error. Thermal and mechanical vapor recompression apply to evaporation systems, not drying systems. The latter use direct-firing of fuels or indirect steam without vapor recovery. It seems as though the authors mean evaporation, not drying. Please make the correction.	Accepted - "drying" has been changed to "evaporation"

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22104	10	25	30	25	33	Best before dates could be reviewed to reduce food waste. However, the suggestion that "in developing countries small farmers… transportation" would not have a clear impact on emissions.	Accepted - deleted.
19788	10	25	31	25	33	"…be encouraged to organise, diversify and upscale their production and marketing…". It is not clear why this is a good suggestion for climate change abatement. Essentially we would end up having to increase transport of goods from developing to developed countries.	Accepted
19789	10	25	36	25	38	The standards for overweight and obese people are debatable. Also, even if they exist this does not lead logically to promoting low emissions food. Even if these people exist nothing links their condition to high emissions food (which is high protein food).	Noted - but I think the statement remains as a powerful statement about the potential for demand reduction.
28988	10	25	39	25	43	A global estimate for the impact of meat and diary can be found in: Wirsenius, S. 2003. The biomass metabolism of the food system: A model-based survey of the global and regional turnover of food biomass. Journal of Industrial Ecology 7(1): 47-80. DOI: 10.1162/108819803766729195 "The global appropriation of terrestrial phytomass production by the food system was estimated to be some 13 Pg (1.43 × 1010 short tons) dry matter, or 230 EJ (2.18 × 1017 Btu) gross energy (higher heating value), per year in 1992-1994. Of this phytomass, about 8% ended up in food commodities eaten. Animal food systems accounted for roughly two-thirds of the total appropriation of phytomass, whereas their contribution to the human diet was about 13% (both on a gross energy basis). The ruminant meat systems were found to have a far greater influence than any other subsystem on the food system's biomass metabolism, primarily because of the lower feed-conversion efficiency (calculated as carcass produced by total feed intake, including pasture and other human-inedible feedstuffs) of those systems."	Taken into account: the statement "and Wirsenius (2008) estimates that two thirds of food-related phytomass is consumed by animals, which provide just 13% of the gross energy of human diets. " has been added.
27853	10	25	42	25	43	The sentence seems to be incomplete, so it lacks information. Please complete this, as how to fulfil the demand of meat and diary would be an interesting statement.	Accepted: thanks for pointing this out. The sentence now reads "In order to maintain a constant total demand for meat and dairy, Garnet (2009) suggests that by 2050 average per capita consumption should be around 25kg meat and 50 litres of milk per week, which is around four times less than current averages in developed economies.", and the following sentence was deleted to make space.
37555	10	25	8	25	21	10.4.6 Food Processing " Energy Efficiency Insert after Line 21- : Wet CornMilling is the most energy intensive process within the food processing sector. Boyd and Delgado (2012) through the process of re-benchmaking the Industry for EPA's ENERGY STAR Industrial Focus initiative observed a reduction of 6.7 trillion Btu in annual energy use, a 4.3% reduction in overall energy use by this industry, and an annual reduction of 470 million kg of energy-related CO2 equivalent emissions from improved energy efficiency. Boyd, Gale and Christian Delgado (2012) Measuring Improvement in the Energy Performance of the U.S. Corn Refining Industry, Working Paper EE 12-7, July 2012 Duke University	Accepted -we considered this in the policy section 10.11 but unfortunately due to lack of space it ended up being deleted (other examples have been kept)

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37554	10	25	3			A good reference for food waste is: http://www.nrdc.org/food/files/wasted-food-IP.pdf	Accepted - thanks. The sentence has been modified to "Up to one third of food produced for human consumption is wasted in either in production/retailing stage, or by consumers (NRDC (2012) estimates 40% waste in the US). "
37559	10	26	1	26	17	Section 10.4.7: what about materials efficiency for textiles and clothing? Surely there is a lot of material loss in cut and sew operations and ways to reduce this loss?	Noted - actually the cutting operations are rather efficiency, as we understand it (due to laser cutting and excelletn layout software) - but the reviewer doesn't propose any new references
27854	10	26	11	26	17	Please include also information on the use of fibres with reduced relevance to the climate, such as recycled synthetic fibers or fibers produced according to organic standards (reduced use of pesticides and fertilizer).	Noted - please supply references when making this sort of statement.
20349	10	26	11		17	This seems all very random information. Pleaae shorten this.	Noted - this seems a random review comment
27855	10	26	12	26	17	Potential for shortening of the section: Delete the sentences from "Hong et al…" on (Line 12) to the end of the section (Line 17). Replace it by some examples of techniques/measures, such as maintenance improvements, fuel switching, heat recovery from process water and from waste heat of the stenters and give only one figure for possible savings.	Noted - the reviewer provides no references for such examples
35285	10	26	13	26	13	Taiwan shall be changed to “Taiwan Province of China”.	Accepted
24752	10	26	20	26	21	While this statement is broadly the case, some preliminary work has been published by Australian researchers regarding energy and GHG impacts of mining and mineral processing. Suggest that the following citations are considered in order to put further nuance in the meaning of this statement. Suggested citations: T Norgate, N Haque. (2010). Energy and greenhouse gas impacts of mining and mineral processing operations. Journal of Cleaner Production, 18 (3), 266-274; N Haque, T Norgate. (2012). Estimation of greenhouse gas emissions from ferroalloy production using life cycle assessment with particular reference to Australia. Journal of Cleaner Production, 29, 220-230.	Accepted - many thanks for these two excellent references. The opening sentences have been modified to read "The energy requirements of mining are dominated by grinding (comminution) and the use of diesel-powered material handling equipment (Norgate and Haque, 2010, US DofE, 2007). Whilst every mine is different, the major area of energy usage – up to 40% of the total – is in electricity for commination (Smith, 2012)." The second reference is in the comment below this one.
24753	10	26	22	26	24	The proportion of energy consumed in commination will vary, but 90% appears to be an extreme case. For brown coal, it is a small component. The US DOE's Mining Energy Bandwidth Study provides a suitable average figure for US mining but the details could not be confirmed in the timeframe. Suggest change to: 'Whilst every mine is different, the major area of energy usage, mainly electricity, is in commination which can make up to 40% of total energy usage (Smith, 2012).' Suggested Citation: US Department of Energy (2007). Mining Industry Energy Bandwidth Study, BCS Incorporated, June 2007, http://www1.eere.energy.gov/manufacturing/resources/mining/pdfs/mining_bandwidth.pdf	Accepted - and incorporated in response above

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29673	10	26	26	26	28	Should clarify that this is a difference in attention given (not reduction potential). For example: "Material efficiency using less new material to provide the same final service - is an important and promising option for GHG reductions that, unlike energy efficiency, has to date received very little attention."	I think this refers elsewhere, and doesn't need action.
24320	10	26	13	26	13	Taiwan shall be changed to “Taiwan Province of China”.	Accepted
31559	10	26	13	26	13	Taiwan shall be changed to “Taiwan Province of China”.	Accepted
19791	10	27	12			Consider this FAQ for removal.	Rejected as FAQs are a dedicated structural element
20351	10	27	12		19	I miss the following opportunities: renewables, re-use of industrial products, and recycling of materials.	Rejected: those options are included in the main categories (e.g. renewables under emissions efficiency)
24756	10	27	20	27	25	Most industrial sites are operating well away from theoretical limits for most of their equipment. For example, design of insulation, piping, compressors or refrigeration systems is typically a compromise, inter alia, between performance, reliability, efficiency and cost. Even where equipment approaches theoretical limits in its optimal operating mode, it is unlikely to be operated continuously in that mode. Suggest change to: 'In the last two to three decades there has been an improvement in energy and process efficiency in industry, driven by the relatively high share of energy costs. As a result, energy intensities in best practice are increasingly approaching technical limits for some major processes at the designed load, particularly in the major energy intensive industries. However, many options for efficiency improvement still remain at varying loads and for smaller processes, and there is still significant potential to reduce the gap between actual energy use and the best practice in most industries and in most countries.'	Accepted - text revised
33848	10	27	24			after remain add: such as breakthrough technologies in iron- and steel making	Accepted partially - text revised
37560	10	27	28	27	28	"In addition, long"term step"change options including a shift to low carbon electricity or radical product innovations (e.g. alternatives to cement) may have the potential to contribute to significant GHG mitigation in the future." (p. 27, lines 28-30) This idea is also mentioned in the executive summary, but not fully substantiated. For a published exploration of the role of industry electrification in emissions mitigation, see Williams JH, DeBenedictis A, Ghanadan R, Mahone A, Moore J, Morrow WR III, Price S, Torn MS. 2012. "The Technology Path to Deep Greenhouse Gas Emissions Cuts by 2050: The Pivotal Role of Electricity" Science 335, 53 (2012); DOI: 10.1126/science.1208365.	Noted - but no references included in the FAQs
21217	10	27	47			Change to "valuable"	Comment seems misplaced, there is no line 47 on this page
19790	10	27	8	27	11	This paragraph could be benefitted if more information was included.	Noted - but no references were included by the reviewer
24754	10	27	8	27	11	This section notes the favourable economics of renewable technologies for industry, but fails to discuss barriers to uptake of renewable technologies (e.g. solar hybrid, CSP etc.). These barriers, which include the lack of reliable renewable resource data (e.g. insolation), short investment horizons, perceived technology risk, lack of organisational capacity, and characteristics of remote electricity grids (or grids with limited redundancy) warrant further discussion. It is suggested that the following sentence (at minimum) is appended to the paragraph: "Research also suggests, however, that there are multiple barriers to increased utilisation of renewable energy in the mining sector (Evans and Peck, 2011)." Suggested references: http://www.ret.gov.au/energy/Documents/clean-energy-program/acre/studies/WARREA-Mid-West.doc http://www.ret.gov.au/energy/Documents/clean-energy-program/acre/studies/WARREA-%20Pilbara.doc	Accepted - text revised

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24755	10	27	9	27	11	Solar CSP thermal' needs to be checked. It is likely to be either concentrated solar voltaic or concentrated solar thermal. The combination of the two has been attempted but perhaps not on an industrial scale.	Accepted - text revised
22105	10	27	9	27	11	There are many mitigation strategies for the mining sector which do not have negative abatement costs. It is not obvious which ones this section refers to.	Accepted - text revised
29672	10	27	19			For consistency, should reorganize paragraphs as in previous sections (energy efficiency; emissions efficiency) and include paragraph on 'reduced product and service demand'	Accepted - thanks.
33288	10	27	31			Please consider discussing the role of infrastructure as a key historic driver as it seems relevant for the industry sector.	Rejected - no room to cover this in this section
22106	10	28	1	28	33	While there are obvious gains from the promotion of industrial parks, these are not widespread in Europe.	Industrial parks are popular worldwide, especially now in developing countries. We are focusing on the global assessment, not one single continent.
28989	10	28	11	28	11	Rather than "appearance", use the appropriate term of art "generation" or "arising"	Accepted.
24084	10	28	14	28	20	Reduce text in this part to one example referring to all eco parks	We believe that it's necessary to provide more examples in order to provide convincible proof.
24077	10	28	21	28	33	Remove	Rejected. This paragraph provided the methods on how to encourage industrial symbiosis through case studies and should be reserved.
33849	10	28	22			after pipelines add: and co-siting	Accepted.
32286	10	28	34	29	10	Energy and resources can be efficiently used among factories of different companies in an industrial park. http://www.meti.go.jp/report/downloadfiles/g40202b51j.pdf	We agree
21218	10	28	4			Change to "efficiency"	It's not clear where we should change it.
19792	10	28	1			Consider this section for removal.	Rejected. One of the differences between AR4 and AR5 is that we should reflect the benefits of industrial symbiosis
21384	10	28	37	28	40	In order to support this message, it should be clearly noted that the by-product slags from brast furnace for steelmaking replaces cement klinker, which need to use massive energy to produce, thus replacing klinker by BF slags can reduce CO2 emission in a massive scale.	Thank you but we need a reference to reflect it. Please provide a useful reference before we can consider it.
19793	10	28	34			Consider this section for removal.	Rejected. One of the differences between AR4 and AR5 is that we should reflect the benefits of industrial symbiosis
32287	10	29	11	29	25	It should be explicitly mentioned that demands for low emission technology in some sector (not only in industry but transport, building and others) may increase the energy consumption of chemical industry since it provides materials and technologies for the end use. The ICCA simulation is an interesting analysis and quantitative facts should better be included here.	The current draft states "These materials or products consume energy at the time of manufacturing, but the potential energy?saving effect is observed over a long period of time (ICCA, 2009)", which covers the point of reviewer.
19795	10	29	40			Consider this FAQ for removal.	Rejected as FAQs are a dedicated structural element

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25990	10	29				Cross sectoral-in this text, causes are blended with effects and. Issues are not extricated. Should be rewritten	Taken into account during revision
19794	10	29	11			Consider this section for removal.	Rejected - rationale to remove this part not given
21385	10	29	12	29	25	One example of the necessity for coss 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 desigin/forming technologies, even though tail-pipe emission shows slightly higer emission as compared with other materials such as Aluminium. Social level mitigation can only be achieved such a cross-sectroal lufe-cycle analysis. See following: http://www.worldautosteel.org/life-cycle-thinking/greenhouse-gas-materials-comparison-model/	The reviewer gave an important another example from viewpoints of using steel instead of aluminum, but the paragraph has already stated "For instance, the increase in GHG emissions from increased aluminum production could under specific circumstances be larger than the GHG savings from vehicle weight reduction (Geyer, 2008)." , that covers the reviewer's point somehow. (The example shown by the reviewer was from Dr Geyer who is same person in the cited material.)If one or two lines are additionally allowed, it would be OK to include the points, using Dr Geyer's latest paper.
31453	10	30		30		We propose to extend the table by adding a coloumn presenting golobal production levels of the various non-ferrous metals listed in the table.	Rejected: There is no table on page 30, and table 11 (on page 61) does not refer to any non-ferrous metals
29674	10	30	34	30	34	McKinsey is not peer-reviewed research. Should not be included.	Rejected - it is only one of several sources used
31452	10	30	35	31	20	There are no description of mitigation options for PFCs. PFCs from aluminium production can be reduced substantially by process control. Background information can be found here: http://www.aluminum.org/Content/NavigationMenu/TheIndustry/Environment/ReducingPFCEmissionsintheAluminumIndustry/default.htm	Rejected, there are various msention in 10.4. Reference used in section 10.8
30199	10	30	37			Add "comparing with the BAU" after "50% reduction".	Section redrafted completely
24321	10	30	39	31	1	The estimated mitigation potential of China and India is too huge. According to the Oil and Chemical Industry development Guile in the 12th Five Year Plan Period of China (2011), the energy conservation potential of major energy-consuming products like ammonia, ethylene and causitic soda is not hogher than 20%.	Section redrafted and have more information now
31560	10	30	39	31	1	The estimated mitigation potential of China and India is too huge. According to the Oil and Chemical Industry development Guile in the 12th Five Year Plan Period of China (2011), the energy conservation potential of major energy-consuming products like ammonia, ethylene and causitic soda is not hogher than 20%.	Section redrafted and have more information now
22107	10	30	6	30	17	This section rightly outlines the lack of knowledge on climate change feedbacks to mitigation options and potentials as well as costs for the industry.	Noted, thakns
29678	10	30	6			This section/discussion would be better suited to Chapter 12, as it is more directly relevant to cities and human settlements than it is to Industry, specifically.	Rejected - it is not irrelevant to industry even if literature is very scarce

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19796	10	30	6			Consider moving this section towards the end of Chapter 10.	Rejected - we are not allowed to do this
33264	10	30	6			Section 10.6 on climate change feedback and interaction with adaptation should consider input from the WGII report.	Agree - we have screened WG2 Ch10 to identify possible connections but none were apparent
33295	10	30	6			With input from the WGII report, this section should answer three guiding questions: What climate change feedbacks are of particular relevance for the sector and how do they play out? Are there synergies and/or trade-offs between sector-specific mitigation and adaptation measures? What knowledge gaps need to be addressed by further research?	See comment 33264. the three issues are mentionned in the current text. WG2 ch10 (0,5page on industry and mining) yields little additionnal information and confirms the diagnosis of a knowledge gap
25991	10	30				Please add McKinsey graph showing several mitigation technologies and their costs versus potentials.	Section redrafted and assessment based on several sources, accompanied by detailed annex on method for estimatino.
33289	10	30	18			The section is descriptive, remains anecdotal and no key messages emerge. The costs and potentials of specific mitigation options and their associated uncertainties need to be discussed and visualized.	Section redrafted with clearer messages
24757	10	30				Suggest that this section can be shortened by providing clear and relevant comparisons or tabulating examples as appropriate where studies provide useful results but do not fit in with the explanation. For example, comparisons with Brazil and Latin America just create confusion.	Section redrafted
25756	10	30				This part should explain that the potential of "net negative cost" is uncertain and may be overestimated because there are hidden costs such as opportunity cost for amenity and transaction cost for information collection, as described in (Yamaguchi, 2012, page161-177). This literature is listed in the No22 line of this table.	Section redrafted
21219	10	31				Bottom notes - change word to "limitation"	Section redrafted
20257	10	31		31		Add caveat of page 5 line 15-20 to the figure regarding the negative cost potential	Taken into account while redrafting
19797	10	31	20			Which year's USD are these?	Accepted
37561	10	31	21			Given that the text in this section refers to global emissions mitigation, a figure on India mitigation costs seems arbitrary.	Rejected - these are based on actual data and demonstrates at cost levels in various industries mitigation actions are happening. Also it is important to provide regional information vis a vis global information.
24323	10	31	30	32	15	It is suggested that the authors revise this paragraph and show the range of each result based on various studies. All the current national-level mitigation potential and cost estimates are all from LBNL. Therefore the literature basis should be substantially extended. The authors could consider further literatures such as (Wang K et al, 2007), (Hoogwijk M et al,2010), (Hanaoka T, et al, 2008), (Hanaoka T et al, 2009), (Akimoto K, et al, 2010) .... Figure 5 in (Akashi O et al, 2011) is a good way to represent the synthesized results. Table 7.8 on page 474 of AR4 is also a good way.	Section redrafted, relevant literature now included
31562	10	31	30	32	15	It is suggested that the authors revise this paragraph and show the range of each result based on various studies. All the current national-level mitigation potential and cost estimates are all from LBNL. Therefore the literature basis should be substantially extended. The authors could consider further literatures such as (Wang K et al, 2007), (Hoogwijk M et al,2010), (Hanaoka T, et al, 2008), (Hanaoka T et al, 2009), (Akimoto K, et al, 2010) .... Figure 5 in (Akashi O et al, 2011) is a good way to represent the synthesized results. Table 7.8 on page 474 of AR4 is also a good way.	Section redrafted, relevant literature now included

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24322	10	31	4	31	7	Need to add the important preconditions and assumptions for the McKinsey study, otherwise the information could be misleading.On page 7 of McKinsey&Company (2009), it is clearly noted under the Exhibit 1 that "the curve presents an estimate of maximum potential of all technical GHG abatement measures below 60 euro per tCO2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play".	Section redrafted
31561	10	31	4	31	7	Need to add the important preconditions and assumptions for the McKinsey study, otherwise the information could be misleading.On page 7 of McKinsey&Company (2009), it is clearly noted under the Exhibit 1 that "the curve presents an estimate of maximum potential of all technical GHG abatement measures below 60 euro per tCO2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play".	Section redrafted
35288	10	32	16	32	18	It is meaningless to compare a predicated scenario of steel industry in China with regional energy supply in 2007 Therefore, it is suggested to delete this sentence.	Section redrafted
24325	10	32	16	32	25	The results of scenario study shall be quoted properly with the sceraio's built-in assumptions, without the assumptions readers cannot judge the probability of this event. Otherwise, more researches need to be included to represent the varieties of studies.	Section redrafted
31564	10	32	16	32	25	The results of scenario study shall be quoted properly with the sceraio's built-in assumptions, without the assumptions readers cannot judge the probability of this event. Otherwise, more researches need to be included to represent the varieties of studies.	Section redrafted
20355	10	32	31		33	This is a very brief discussion. Note that the European paper industry (CEPI) has developed a roadmap to come to significant reductions in GHG emissions. Most of the potentials have been allocated, with an ongoing project on identifying the break-through technologies (the missng "wedge" in the roadmap potentials). See also Zafeiris (2010); already included in the references).	Section redrafted
24326	10	32	36			Reference is needed after "efficiencies".	Section redrafted and appropriately considered
31565	10	32	36			Reference is needed after "efficiencies".	Section redrafted and appropriately considered
25757	10	32	36	32	38	This part should be kept in the final version report because heat pump technology has huge potential to reduce GHG emission from industrial sectors including food processing sector, as described in (IEA/OECD, 2010, page65-83) and (UNIDO, page38, Fig14). These literatures are listed in the No17 line of this table. In addition, this part should mention 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 100℃, as described in (Sakamoto, 2011, page840). This literature is listed in the No128 line of this table.	Section redrafted, reference included
37562	10	32	41	32	46	"Mechanical dewatering potentially reduces the energy intensity of drying by 99% compared to rotary drying (Masanet et al., 2008). Direct use of turbine gas for drying, gives about 35-45% estimated reductions in primary fuel consumption as compared to steam"based heating methods (Masanet et al., 2008)." These two sentences are incorrect. First, there is no mention of mechanical dewatering saving 99% energy compared to rotary drying in Masanet et al. 2008! The Masanet et al. report states that mechanical dewatering before rotary drying led to 40 times lower energy use than rotary drying alone for beet pulp at a UK plant. Please make the correction to accurately reflect the source. Moreover, the Masanet et al. 2008 report mentions direct-firing of natural gas into dryers saving energy compared to indirect steam drying. It does *not* mention the use of turbine gas. Please make this correction, too. Lastly, mechanical vapor recompression and thermal vapor recompression apply to evaporation, not drying.	Accepted, statement deleted
20354	10	32	46		47	What do refrigerators have to do with estimating potentials for industrial GHG emission mitigation? Please remove here; and move to chapter on buildings.	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35287	10	32	5	32	9	It is meaningless to compare a predicated scenario of cement industry in China with regional energy supply in 2007. Therefore, it is suggested to delete this sentence.	Accepted
21220	10	32	7			Provide space i.e. "McKinsey & Company"	Accepted
24324	10	32	5	32	9	(Hasanbeigi, Morrow, et. Al., 2012) is not available. The results of scenario study shall be quoted properly with the sceraio's built-in assumptions,without the assumptions readers can not judge the probability of this event. Otherwise, more researches need to be included to represent the varieties of studies.	Section redrafted and reference now available
31563	10	32	5	32	9	(Hasanbeigi, Morrow, et. Al., 2012) is not available. The results of scenario study shall be quoted properly with the sceraio's built-in assumptions,without the assumptions readers can not judge the probability of this event. Otherwise, more researches need to be included to represent the varieties of studies.	Section redrafted and reference now available
24758	10	33	11	33	33	Discussion of industry-wide technologies and abatement costs is extremely important and should be a separate sub-section. This is where many of the low cost, short payback measures are found. In the marginal abatement discussion, the time period should be specified. Suggest that before line 11, start a new subsection 10.7.2 Industry-wide abatement potential. Also note: In the marginal abatement discussion in Table 10.6 the time period should be specified - e.g. negative cost after 2 years is very different to negative cost after 10 years.	Section redrafted with additional information as compared to previous draft
25758	10	33	20	33	21	This part should include heat pump technology because it has huge potential to reduce GHG emission from industrial sectors, as described in (IEA/OECD, 2010, page65-83) and (UNIDO, page38, Fig14). These literatures are listed in the No17 line of this table.	Taken into account in final draft
20462	10	33	26	33	33	Recommend referencing the shortfalls of the McKinsey estimates of MAC's that is outlined in Chapter 3 of this volume, on pages 80-82.	Accepted, section redrafted
24327	10	33	26	33	33	Need to add the important preconditions and assumptions for the McKinsey study, otherwise the information could be misleading.On page 7 of McKinsey&Company (2009), it is clearly noted under the Exhibit 1 that "the curve presents an estimate of maximum potential of all technical GHG abatement measures below 60 euro per tCO2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play".	Section redrafted, now based on several studies (including McKinsey) with mitigation options and their costs and potentials
31566	10	33	26	33	33	Need to add the important preconditions and assumptions for the McKinsey study, otherwise the information could be misleading.On page 7 of McKinsey&Company (2009), it is clearly noted under the Exhibit 1 that "the curve presents an estimate of maximum potential of all technical GHG abatement measures below 60 euro per tCO2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play".	Section redrafted, now based on several studies (including McKinsey) with mitigation options and their costs and potentials
25759	10	34				This part should include heat pump technology because it has huge potential to reduce GHG emission from industrial sectors, as described in (IEA/OECD, 2010, page65-83) and (UNIDO, page38, Fig14). These literatures are listed in the No17 line of this table. In addition, this part should also explain that the actual cost for CCS depends on a number of conditions such as concentration of CO2 in the exhaust gases, capture technology, access to storage site, storage potential, and CO2 monitoring, as described in (Finkenrath, 2011, page7), (Rubin, 2007, page4447, Table3), and (Lohwasser, 2012, Abstract). These literatures are listed in the No12 line of this table.	Section redrafted
37563	10	34	1			CHP and cogeneration are characterized separately. EPA's CHP Partnership program looks at CHP as the broader term that includes cogeneration, waste heat to power and trigeneration. See www.epa.gov/chp	Section redrafted
28990	10	34	20	34	20	"concentrate" should be "constitute"	Section redrafted
37564	10	34	28	34	31	EPA "Global Mitigation of Non-CO2 GHG" Report cites China, Nigeria, Mexico, India and US as five largest emitters in WW sector.	Section redrafted
21221	10	34	29	34	33	Provide space i.e. "McKinsey & Company"	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37565	10	35	1			"ODS Substitutes" Should emissions from foam sector be included? Improved computer controls to optimize cell performance, rapid kill of anode effects and regulate alumina feed plus improved alumina feeding techniques applicable to all technology types. "Other sources/Total" What does this include? SF6 from electric power transmission and distribution?	Section redrafted
37566	10	35	1			It may be helpful to move this figure up to p.34 line 16 (between sections 10.7.2 and 10.7.3) to be closer to the related text.	Editorial
37567	10	35	1			Why don't the cumulative totals across each cost category (data in column 7) equal the total potential listed in the second column for all sources? The only source for which the cumulative equals the total is HFC-23 and HFC-22, which makes it seem like the rest of the rows contain errors. The same issue occurs in Table 10.8.	Section redrafted
21222	10	35	19			Provide space i.e. "McKinsey & Company"	Editorial
27856	10	35	3	35	4	Please explain which assumptions were made until 2030. Link does not work.	Section redrafted
28991	10	36		36		The year on which the figures in the table are based should be indicated. E.g., are 2010 dollars used?	Section redrafted
28992	10	36		36		The year on which the figures in the table are based should be indicated. E.g., are 2010 dollars used?	Accepted
29675	10	36	1			This table could be significantly compressed, particularly by removing the "Technologies" column, which could be included in the body of text, for example.	Accepted
34358	10	36	19			Please consider inserting "addition policy objectives, e.g. " at the end of the line.	Accepted
34359	10	36	21			Please consider replacing 'benefits and costs' with 'welfare effects' to make a clear distinction to co-benefits/adverse side-effects that are defined as the 'physical' side-effects without evaluating the welfare effects. Please refer to section 3.5.3 for further discussion on the conceptual framework.	Accepted, change inserted
37568	10	36	3	36	17	Waste and wastewater are noticeably absent in the discussion of co-benefits within this section. There is no discussion of this in the document. Co-benefits of mitigation within the waste/ww sector are numerous and include improved air and water quality and the associated reduction in health impacts.	Accepted, change in text inserted
24759	10	36	4	36	17	Discussion of co-benefits should primarily discuss the financial benefits to companies from energy efficiency projects that are additional to energy savings, such as maintenance savings, avoided investment costs (e.g. New compressors to compensate for leaks), productivity improvements etc. Co-benefits can only result in project implementation if they bring direct financial benefits to companies or are subsidised by governments. Major disasters aside, social benefits are worth noting from a policy viewpoint, but it should not be assumed that all readers would value environmental outcomes. Social acceptance is most relevant to those few, mostly European or Scandinavian countries for whom environmental concerns can affect market value. Suggest change to: 'Cost effectiveness and the perceived direct financial costs and paybacks are the major drivers of final deployment of mitigation technologies. However, other co-benefits should also be considered.'	Accepted, change in text inserted
37569	10	36	4	41	28	While very interesting, the material in this section could be shortened to reduce the length of the chapter. I found the other sections with data more interesting and useful than the qualitative discussions of co-benefits and risks, for which the table and some brief explanation in text would suffice.	Section redrafted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34356	10	36	4	36	17	Please consider replacing the first paragraph with an introductory paragraph with the following wording which will be suggested to each sector chapter to increase consistency and help the reader understand the underlying idea of this section and the links to other parts of the report: "Besides economic cost aspects, the final deployment of mitigation measures will depend on a variety of additional factors, including synergies and trade-offs across mitigation and other policy objectives. Co-benefits, risks and uncertainties associated with alternative mitigation measures and their reliability (10.8.1 and 10.8.2) as well as public perception thereof (10.8.3) can affect investment decisions, individual behavior as well as priority setting of policymakers. (footnote: Please refer to the respective sections in the framing chapters as well as to the glossary in Annex I for concepts and definitions – particularly 2.2, 3.5.3, and 4.8.) The extent to which co-benefits and risks actually materialize and their net effect on welfare will differ greatly across regions, and depend on local circumstances, implementation practices as well as the scale and pace of the deployment of the different measures. Table 10.9 provides an overview of the potential co-benefits and risks of the main mitigation measures that are assessed in this section, classified into economic, social (incl equity), and environmental (incl health) effects according to the three sustainable development pillars described in chapter 4."	Accepted
24760	10	36	7	36	7	Suggest add sentence: "The IEA's estimates that payback periods for the majority energy efficiency measures are short, ranging from as low as two years to eight years." Citation: IEA, (2012), World Energy Outlook, Paris.	Noted, section 10.9 now includes this but not this section
34357	10	36	7	36	9	These characteristics rather belong to the barriers and opportunities sections and are not actually discussed further in this section (apart from social acceptance in the public perception section).	Section redrafted
33290	10	36	3			The section does not provide a multiobjective perspective, but, in describing mitigation benefits, comes across as advocacy at times. It is often unclear, if any of the objectives really lie outside mitigation.	Section redrafted
34380	10	36	3			Please change 'spillover effects' to 'spillovers' according to outline changes agreed to at the last Plenary.	Section redrafted
24761	10	37	7	37	7	Suggest add sentence: "Energy productivity has the added co-benefits of improving national productivity, increasing energy security and lowering the overall cost of GHG mitigation to industry."	Considered while redrafting the chapter
24328	10	38				"New employment opportunity" of emission efficiency, fuel switching and CCS should be classified as social co-benefits and risks. Besides, it is now uncertain whether this option can definitely bring new employment opportunity, as argued on page 51, line 7-13 of chapter 10. The following literature needs to be added as they provide a more neutral way of understanding. (Cai W, et al., 2011) says it will depend on how fuel switch policies in power sector are designed. (Böhringer C, et al, 2012) says the employment gains in Germany from renewable energy promotion will be quite limited and hinge crucially on the level of the subsidy rate and the financing mechanism.	Accepted
31567	10	38				"New employment opportunity" of emission efficiency, fuel switching and CCS should be classified as social co-benefits and risks. Besides, it is now uncertain whether this option can definitely bring new employment opportunity, as argued on page 51, line 7-13 of chapter 10. The following literature needs to be added as they provide a more neutral way of understanding. (Cai W, et al., 2011) says it will depend on how fuel switch policies in power sector are designed. (Böhringer C, et al, 2012) says the employment gains in Germany from renewable energy promotion will be quite limited and hinge crucially on the level of the subsidy rate and the financing mechanism.	Duplicate
25992	10	38				Table 10.9. CCS should be dealt with in a separate row, because of it is so different from the other two. Some contents of table 10.9 are objectionable. Examples: "Innovation risk because feasibility not yet established (Worrell et al., 2003)". "- New skill development/training". "-" Negotiation with labour unions".	New table does not include CCS
19798	10	38	1			First row, last column. The reference for the "not yet established" feasibility is very old and probably not valid anymore.	Table redrafted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
33291	10	38	1			The table is well structured, but the entries often remain too unspecific and should focus more on the risks and benefits that besides mitigation.	Table redrafted
37570	10	38	1			This table is very useful. Examples may help to make these ideas more tangible.	Table redrafted
37571	10	38	1			One reference on water savings associated with energy efficiency (for industrial steam systems) is: Masanet, E., and M.E. Walker (2013). Energy-Water Efficiency and U.S. Industrial Steam. AiChE Journal. Volume 59, Issue 5.	Considered, thank you
34360	10	38	1			Please shorten the table by using the color coding as done in other chapters (green for co-benefits and red for risks). Please make an attempt to adapt the discussed policy objectives to the wording used in other chapters (such as 'productivity', 'employment creation', 'technology transfer' etc. in place of similar objectives but different wording) to support the effort to facilitate greater synthesis across sectoral assessments in section 6.6.	Accepted
37469	10	4	10	4	20	It would be useful to identify the specific "industries" included. For F-ghg direct emitters report appears to be incomplete. For example, where are direct emissions from F-ghg production and users of F-ghgs such as refrigeration & air conditioning, foams, etc.	Rejected for ES, scope of the chapter is described in the introduction section 10.1.
24725	10	4	2	4	5	It would be useful if the actual % of global emissions including relevant electricity emissions could be actually stated, rather than just being referred to. It could take industrial emissions to around 30% of global emissions.	Accepted. Global emissions including indirect electricity emissions are now included.
25981	10	4	2	4	4	Is is true that the emissions from industry (10%) are larger than those of the transport sector? Please confirm.	Yes, this has now been confirmed.
24726	10	4	22	4	28	This summary seems to apply a very narrow framework to industrial energy use and emissions. As the buildings chapter did, there is a case to break up CO2 emissions from this sector by factors: demand for outputs is fundamental, as is the selection of materials, design (which may utilise materials efficiently), process efficiency, utilisation of recovered materials, etc. The blanket suggestion that most processes are approaching technical limits is not well founded. Suggested citation: Australian Government Department of Resources, Energy and Tourism (2013). Energy Efficiency Exchange website. URL: www.eex.gov.au	Considered and appropriately responded /worded in final order draft.
24727	10	4	22	4	28	It appears contradictory to say that 'improvements in energy and process efficiency in energy-intensive manufacturing have been strong' without specifying growth rates. Similarly, it is contradictory to say that potential of 25-30% improvement remains and that energy intensity in best practice approaches theoretical limits. Rephrase as: 'Energy intensities in best practice for some major items of equipment - such as steam turbines for thermal generation at the design load - tend to approach theoretical limits. However, many of the auxiliary (supporting) systems are not optimised to the same degree and may affect performance of the major components when working at different loads. For example, cooling water pumps and boiler fans are unlikely to be optimised at fluctuating loads and both affect efficiency. In practice, few plants approach best practice because operating modes and technology change over time. Citation: Department of Resources, Energy and Tourism, (2012), Supplementary Guidance for Electricity Generators: Measurement, data analysis and opportunity evaluation, Canberra	Considered and appropriately responded /worded in final order draft.
29662	10	4	23	4	25	RE: "As a result… across all industries" - 'at most 25-30%' is too strong. Propose changing to "As a result, energy intensities in best practices are approaching technical limits. Absent radical innovation, some have estimated only 25-30% remaining achievable energy intensity improvement across all industries"	Considered and appropriately responded /worded in final order draft.
31255	10	4	24	4	25	You are saying that energy intensities are approaching technical limits, but that you are excluding radical innovations, in which case we are not near the technical limits. I would rephrase to avoid saying that we ar enear technical limits (if you believe that radical innovations with big further energy savings are possible).	Considered and appropriately responded /worded in final order draft.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20320	10	4	24			The statement that we are approaching "technical limits" is without much meaning, without a clear definition of technical limit. This is not given, and this sentecne can be understood in many ways, some of which are not true.	Considered and appropriately responded /worded in final order draft.
30435	10	4	29	4	33	Should also mention importance of retrofitting or upgrading old capital equipment to newer, more efficient and reliable ones. Might also mention that these typically improve utilization/run-time and result in maintenance savings as well	Rejected, in general we agree with the statement and the role of retrofitting, however this paragraph is about cross cutting technologies and retrofitting is not specific to these technologies but process-specific as well. Comment would have been useful for co-benefits section if some references had been suggested by reviewer
37470	10	4	29	4	33	Why does paragraph 4 conclude with the statement "especially for SMEs"? Controls will help cost effectively improve EE (of energy consuming systems) for all sizes of companies, and given that generally the largest percentage of industrial energy is consumed by a relatively small number of large (energy intensive) companies, narrowing the paragraph towards SMEs seems unnecessarily limiting. If, however, the implication is that (for example) fewer SMEs have adequately deployed cost effective control technologies (than have large companies) - then the statement should specify the reason for highlighting SMEs ...	Noted - language changed.
30433	10	4	30			"electronic control systems" - might use "energy management systems" since these are broader than just control and can involve process optimization and best practices as well. Other key technologies include better real-time monitoring and automation	Noted - but EnMS are considered a policy measure, which are covered in 10.11, whereas this paragraph referred to technologies
24728	10	4	30	4	33	The text indicates that electronic control systems are of particular value to SMEs. However, no explanation or evidence is provided. Suggest the statement is either 1) further explained, or 2) the words 'especially for Small and Medium Enterprises (SMEs)' deleted.	Noted - language changed
37471	10	4	30	4	33	It's not clear why the authors chose to highlight the example of control system being particulatlry improtant for SMEs', but there is a reference to support this statemen if this statement is absolutely necessary: Masanet, E. (2010). "Energy Benefits of Electronic Controls at Small and Medium Sized U.S. Manufacturers." Journal of Industrial Ecology. Volume 14, Issue 5.	Noted - language changed
30192	10	4	31			"Steam combustion" should be "steam generation".	Accepted
29787	10	4	31			There is no such thing as "steam combustion"	Accepted
20321	10	4	34		36	I am not sure what the value is of this statement...propose to delete it.	Accepted
29663	10	4	35	4	35	Should add another sentence contextualizing the driver behind this fact ("Particularly many emerging economies typically produce more than they consume"), e.g. "This imbalance is driven largely by demand for goods in developed and rapidly developing economies."	Noted, however statement deleted from FD Ex. Summ. Emissions embodied in trade are mentioned in sectino 10.3 and covered thoroughly in chapter 14
30266	10	4	37			the proposed growth in primary materials from 45% to 60% by 2050 seems very modest. Certainly earlier IEA forecasts were higher. This slow growth suggests an underlying assumption of a worldwide economic downturn. Perhaps this should be stated explicitly.	This statement was removed from the Ex Summ. A mention to this scenario is made in FAQ 10.2 in the context of the scenarios discussed in section 10.10

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35467	10	4	37	4	44	It is important to differenciate sources of emissions reductions from current scenario. Waste prevention being the best performing, waste reuse and preparation for reuse the second and only then recycling as ways to reduce emissions. According to Wrap, 2010 "Environmental benefits of recycling - 2010 update" the recycling of paper/cardboard, plastics and biopolymers for most indicators provides more environmental benefits than incineration or landfill. plus there is a big potential in emissions reductions through recycling. According to a study from 2008 if the EU would recycle 65% of its MSW it would reduce 303 M tonnes of CO2eq(recycling rates in the EU in 2005 were already providing 158M tonnes of CO2eq savings in comparison with scenario of 100% disposal in landfills and incinerators): Sander, K., Ökopol 2008, Climate protection potentials of EU recycling targets.	Noted - new waste hierarchy figure and text has been produced for section 10.14/Appendix
26877	10	4	37	4	44	It is important to differenciate sources of emissions reductions from current scenario. Waste prevention being the best performing, waste reuse and preparation for reuse the second and only then recycling as ways to reduce emissions. According to Wrap, 2010 "Environmental benefits of recycling - 2010 update" the recycling of paper/cardboard, plastics and biopolymers for most indicators provides more environmental benefits than incineration or landfill. plus there is a big potential in emissions reductions through recycling. According to a study from 2008 if the EU would recycle 65% of its MSW it would reduce 303 M tonnes of CO2eq(recycling rates in the EU in 2005 were already providing 158M tonnes of CO2eq savings in comparison with scenario of 100% disposal in landfills and incinerators): Sander, K., Ökopol 2008, Climate protection potentials of EU recycling targets.	see 35467
26975	10	4	37	4	44	It is important to differenciate sources of emissions reductions from current scenario. Waste prevention being the best performing, waste reuse and preparation for reuse the second and only then recycling as ways to reduce emissions. According to Wrap, 2010 "Environmental benefits of recycling - 2010 update" the recycling of paper/cardboard, plastics and biopolymers for most indicators provides more environmental benefits than incineration or landfill. plus there is a big potential in emissions reductions through recycling. According to a study from 2008 if the EU would recycle 65% of its MSW it would reduce 303 M tonnes of CO2eq(recycling rates in the EU in 2005 were already providing 158M tonnes of CO2eq savings in comparison with scenario of 100% disposal in landfills and incinerators): Sander, K., Ökopol 2008, Climate protection potentials of EU recycling targets.	see 35467
31681	10	4	45	5	2	The example of routes to indirect emissions reduction hrough changes to tourism is not a very clear example. Reduction in demand for health services through lifestyle change may be more helpful. So a direct change of less food and transport use reduces indirect demand on health services and thus health care supplies produced by industry.	Reject. Examples are many. We selected tourism due to request from the Plenary and many other reviewers favour this as well. So maintaining it with modifications. Health services is potentially a relevant example,so are various other activities of every day life but the peer reviewed literature dealing with their link to CC is very scarce.
37472	10	4	46	4	46	Instead of the phrase: "...changes in lifestyle..." it is suggested to use an alternative such as: "...changes in products and infrastructure that provide the same level of service..."	Taken into account - the language has been adapted, "lifestyle" has been kept but with appropropriate qualifiers.
33839	10	4	5			delete "indirect"	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
33263	10	4	1			The Executive Summary lists more than 20 key findings. You may want to focus this section more strongly on fewer and the most relevant findings.	Noted, ES has been redrafted
24306	10	4	31	4	31	There is no such an expression of "steam combustion". It is suggested to change that to "steam boiler".	Accepted
31545	10	4	31	4	31	There is no such an expression of "steam combustion". It is suggested to change that to "steam boiler".	Accepted
24724	10	4	1			The summary does not mention many important factors that affect industrial energy use, including material substitution. The body of the chapter does describe some of the broader changes such as low emission cement, but this bigger picture, which drives much of the mitigation potential, does not appear in the summary. This means the headline statement in the SPM (10 to 26% savings) is very conservative.	Rejected, SOD ES did cover these options and FD continues to do so, and so does SPM
19799	10	40	1	40	39	Consider these paragraphs for removal.	Section redrafted
24085	10	40	10	40	39	Reduce text significantly	Section redrafted
35416	10	40	12			Proposal to either replace the word "landfills" by "disposal" or add "or incinerators and other disposal options". Reason: from the perspective of material efficiency and preservation all disposal options require a new process of extraction, manufacture and consumption of the material, in fact, landfills allow for material recovery later in time - i.e. via landfill mining- whereas incinerators might recover some energy but requires the whole production cycle to start again. Therefore from the point of view of circular economy and material efficiency one should include all disposal options as those which impede closing the material loop.	Considered in Figure 10.2
35474	10	40	12			Proposal to either replace the word "landfills" by "disposal" or add "or incinerators and other disposal options". Reason: from the perspective of material efficiency and preservation all disposal options require a new process of extraction, manufacture and consumption of the material, in fact, landfills allow for material recovery later in time - i.e. via landfill mining- whereas incinerators might recover some energy but requires the whole production cycle to start again. Therefore from the poit of view of circular economy and material efficiency one should include all disposal options as those which impede closing the material loop.	Considered in Figure 10.2
26884	10	40	12			Proposal to either replace the word "landfills" by "disposal" or add "or incinerators and other disposal options". Reason: from the perspective of material efficiency and preservation all disposal options require a new process of extraction, manufacture and consumption of the material, in fact, landfills allow for material recovery later in time - i.e. via landfill mining- whereas incinerators might recover some energy but requires the whole production cycle to start again. Therefore from the poit of view of circular economy and material efficiency one should include all disposal options as those who impede closing the material loop.	Considered in Figure 10.2
26982	10	40	12			Proposal to either replace the word "landfills" by "disposal" or add "or incinerators and other disposal options". Reason: from the perspective of material efficiency and preservation all disposal options require a new process of extraction, manufacture and consumption of the material, in fact, landfills allow for material recovery later in time - i.e. via landfill mining- whereas incinerators might recover some energy but requires the whole production cycle to start again. Therefore from the poit of view of circular economy and material efficiency one should include all disposal options as those which impede closing the material loop.	Considered in Figure 10.2

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24763	10	40	14	40	15	This sentence needs clarification, and the paragraph should really be separated into positive and negative spill over effects. In particular decreased energy security should be highlighted as a negative spill over effect for inaction, but increased energy security a positive effect of action. This is of particular relevance to energy intensive industries that are impacted by energy price fluctuations. Suggest change to: 'In industry, possible positive and negative spillover effects may be related to trade, carbon leakage, technology and knowledge transfer and energy security, among other things.' Suggested reference regarding complementarity between energy efficiency and energy security: IEA (2012), Energy Technology Perspectives 2012: Pathways to a Clean Energy System, IEA, Paris, chapter 1	Reject: some of the arguments are relevant for co-benefits section and been duly taken care of. Spill-overs section rewritten now
32288	10	40	14	40	25	It looks that spillover is narrowly defined. It is not so usual that a company shifts production site, which is in operation, to other country for the sake of lower energy or other costs. More frequent situations are that when new investment is needed company may find other locations thun the place of current operation. It is probably not possible to factor out CC policy impacts but the future prospect of increasing fuel costs and other in the oeprating location will lead an investment decision to find other locations.	Paragraph added
34361	10	40	14	40	25	Please delete this paragraph as it is based on a different definition of 'spill-over effects' (see Annex I).	Accepted
28981	10	40	18	40	25	Delete from "…. would get relocated…." until the end of that paragraph "…counter developmental". Write instead: "… would locate future investments in countries with less stringent carbon abatement policies. While empirical evidence suggests that only a small share of the high GHG emitting industries have internationally mobile plants and processes and varied distribution options for their products enabling them effectively to go for trade diversion and relocation, a study concerning the European chemical industry shows that differences in regional carbon abatement policies influence the size of future production of GHG intensive industries in the respective regions considerably. Under global level-playing field conditions and just building on carbon abatement options under control of the chemical industry (increased energy efficiency, fuel mix change and N2O emissions abatement) the European chemical industry could reduce the emissions intensity by 40% in 2030 and 55% by 2050 as compared to a situation without further improvements in the greenhouse gas intensity beyond 2010. These options would reduce greenhouse gas emissions by 15% in 2030 compared to absolute 2010 levels with stabilisation around these levels towards 2050. Less reduction in greenhouse gas emissions intensity of the European chemical industry would be realised with a continued, fragmented policy framework. Under such policy conditions, reductions in greenhouse gas emissions intensity would be approximately 30% in 2030 and less than 50% in 2050 compared to 2010. Higher absolute greenhouse gas emissions reduction would be achieved by these options in Europe under such and other scenarios of fragmented action, up to 25% absolute greenhouse gas emission reduction in 2030 compared to 2010. However, this would happen at the expense of a shift of investment in new production to outside of Europe, with no overall reduction in global greenhouse gas emissions or even a potential increase. The current net trade ratio for the European chemical industry of about 10% (expressed as net export as % of demand), would turn into 0% in 2030 and even -20% in 2050 in a scenario in which only Europe implements stringent emission reduction policies, resulting in import dependence for chemical products in Europe." (Source: CEFIC ECOFYS: Study "European chemistry for growth - unlocking a competitive, low carbon and energy-efficient future", p. vii-viii, p. 137, April 2013)	Carbon leakage is mentioned in section 10.11 and discussed in depth in chapter 15

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25760	10	40	19	40	23	This part should be deleted completely and there should be an explanation 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, do not work well. This information is described in (Rosendahl, 2011, abstract), (Aichele, 2012, page336), and (Peters, 2011, page1). These literatures are listed in the No9 line of this table.	see 28981
24762	10	40	2	40	2	Suggest change end of sentence from 'other policy objectives such as local pollution and therefore health' to 'other policy objectives such as energy productivity and local pollution and therefore energy security and public health respectively.'	Section redrafted
30142	10	40	27		28	The line "A typical example is the tradeoff between investing in mitigation vs. adaptation (Gunawansa and Kua, 2011; Chakraborty and Roy, 2012a)." is not relevant here and could be deleted.	Section redrafted
34362	10	40	27	40	28	Please give a cross-reference instead of introducing new references here. If these are gone, there are no references to substantiate the other findings in this paragraph.	Section redrafted
30143	10	40	31		32	Give an example to support and explain the statement "A clear conflict between economic development and mitigation policies is usually also found in the tourism sector." or delete it.	Deleted
30144	10	40	32		35	I think the following could all be deleted: "At the company level, companies may need to trade off between the investments in e.g. health and safety vs. those aimed at reducing their climate impact. Potential conflicts must be studied and opportunities where the cobenefits are more significant than the conflicts must be identified."	Deleted
32289	10	40	36	40	39	Cost of energy supply with CCS can increase very significantly as estimated in the energy sector. Industry sector exposed to competition with international competitors would find it forbidding to install CCS to continue operation in many areas.	Appropriate message included in redrafted section
30145	10	40	36		39	However, other emissions could increase and there are also impacts from the manufacture and disposal of the solvent and from upstream fuel production to satisfy the increased energy requirements of the CCS process.	Rejected, no reference suggested so not clear if opinion piece or substantiated in literature
24764	10	40	41	40	43	Knowledge of environmental risks is only lacking for some industrial mitigation strategies, not all. In most cases, the environmental effects are unambiguously positive. These include energy conservation, improved controls, leak reduction, heat recovery, cogeneration and use of more efficient designs in new plants. Suggest change to: 'While there is a wealth of literature on the environmental impacts of energy-related mitigation technologies (e.g. biofuels, battery-electric vehicles), knowledge on environmental risks for industrial mitigation options is so far lacking. However, in many cases the environmental effects are unambiguously positive. These include energy conservation, improved controls, leak reduction, heat recovery, cogeneration and use of more efficient designs in new plants.'	See response above
25761	10	40	43	40	45	This part should be kept in the final version report because there are many concerns about CCS such as safety confirmation, storage potential, high cost or public acceptance, as described in (Finkenrath, 2011, page7), (Rubin, 2007, page4447, Table3), (Lohwasser, 2012, Abstract), and (Zoback, 2012, Abstract). CCS cost depends on a number of conditions such as concentration of CO2 in the exhaust gases, capture technology, access to storage site, storage potential, and CO2 monitoring. These literatures are listed in the No12 line of this table.	Section redrafted and appropriately considered
30146	10	40	45		48	On the other hand the mining impacts from any additional need for rare earths etc (which I think will be small in this sector - far more relevant in the power sector for PV panels and wind turbines) will probably be far outweighed by the reduced need for virgin materials thanks to increased material efficiency.	Non-energy mining sector falls within the scope of this chapter
24765	10	40	49	41	1	Mine closures are not generally a mitigation issue. Suggest deleting this discussion.	Reject: social issue relevant for metal industries

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24766	10	40				Suggest this subsection should discuss technological risks and uncertainties affecting company decisions around mitigation projects. These include technical uncertainties about efficiency performance of new solutions, implementation risks when replacing existing systems, or perceived reliability issues when new processes are introduced. These risks at the company level can be greater barriers to implementation of mitigation projects than wider, indirect environmental concerns that are not the legal responsibility of the producer. Suggested discussion of factors affecting decisions on energy audits is in: Mike Bailey, Rich Lauman, Geoff Wickes & Brian Crumrine (2009) "Get 'er Done! How to Implement Energy Efficiency Projects by Understanding Organizational Behavior and Decision Making". 2009 ACEEE Summer Study on Energy Efficiency in Industry.	The comment and paper suggested is more related to barriers rather than incertanties and risks. It is taken care of in barriers section
34363	10	40	40			Please consider assessing literature on accidents and technology failure related to mitigation options in the industry sector.	Accepted - included
20171	10	41				On barriers to industrial EE, please see the paper: Hasanbeigi, Ali; Menke, Christoph; du Pont, Peter (2010). Barriers to Energy Efficiency Improvement and Decision-Making Behavior in Thai Industry. Energy Efficiency, Volume 3, Issue 1 (2010), Page 33. DOI 10.1007/s12053-009-9056-8.	Accepted, reference included
34364	10	41	11	41	19	Please provide references to substantiate the findings here.	Section redrafted
24767	10	41	23	41	27	Mining is associated with significant conflict as described, particularly at the local community level but it is also associated with large economic benefits. Suggest further balance is required in this section: "Few industries have as profound an influence on community development as mining. Mining activities have generated social conflicts in different parts of the world (Martinez-Alier, 2001; WB, 2007; Germond-Duret, 2012; Guha, 2013). The Latin American Observatory of Mining Conflicts reported more than 150 active mining conflicts in the region, most of which started in the 2000s (OCMAL, 2010). Besides this general experience, the potential for interactions of social tensions and greenhouse gas reduction mitigation initiatives in this sector are poorly documented and analysed as tensions surrounding the use of renewable energy, agricultural land alienation, water quality impacts, fugitive emissions and exploration of new fossil fuel sources to date have largely been found in the general media only." Suggest citations: International Council for Mining and Metals (ICMM) (2012). The role of mining in national economies. ICMM, October 2012, http://www.icmm.com/the-role-of-mining-in-national-economies ICMM (2012). Human rights, social development and the mining and metals industry. ICMM, June 2012, https://www.icmm.com/human-rights-social-development-and-the-mining-and-metals-industry	Rejected - social comflicts around mining activities is a major issue of conecern in developing countries. Keeping it here helps in highlighting risk
37572	10	41	29	41	44	Another good reference on industrial efficiency barriers is: Russell, C. (2005). Barriers to Industrial Energy Cost Control: The Competitor Within. Chemical Processing. June 8th.	Rejected, topics already covered by referenced peer-reviewed literature.
35417	10	41	44			One more relevant bullet-point would be "harmful subsidies and incentives: includes subsidies and premiums mainly to fossil fuels and false renewable energies but also the lack of progressive taxation on resources". As it has been reported in Spain, premiums to electricity generated by waste incineration have a great economical importance to make incinerators viable, which in its turn become an incentive to burn recyclable materials instead of investing public funds into material efficiency strategies. Reference: Puig, I., Calaf, M. & Mestre, M., 2010. La incineración de residuos en cifras. Análisis soci-económico de la incineración de residuos municipales en España,	Rejected, this type of barrier falls into the category of institutional and legal, but reference and particular incentive is too specific to cite here

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35475	10	41	44			One more relevant bullet-point would be "harmful subsidies and incentives: includes subsidies and premiums mainly to fossil fuels and false renewable energies but als the lack of progressive taxation on resources". As it has been reported in Spain, premiums to electricity enerated by waste incineration have a great economical importance to make incinerators viable, which in its turn become an incentive to burn recyclable materials instead of investing public funds into material efficiency strategies. Reference: Puig, I., Calaf, M. & Mestre, M., 2010. La incineración de residuos en cifras. Análisis soci-económico de la incineración de residuos municipales en España,	See 35417
26885	10	41	44			One more relevant bullet-point would be "harmful subsidies and incentives: includes subsidies and premiums mainly to fossil fuels and false renewable energies but als the lack of progressive taxation on resources"	See 35417
26983	10	41	44			One more relevant bullet-point would be "harmful subsidies and incentives: includes subsidies and premiums mainly to fossil fuels and false renewable energies but als the lack of progressive taxation on resources". As it has been reported in Spain, premiums to electricity enerated by waste incineration have a great economical importance to make incinerators viable, which in its turn become an incentive to burn recyclable materials instead of investing public funds into material efficiency strategies. Reference: Puig, I., Calaf, M. & Mestre, M., 2010. La incineración de residuos en cifras. Análisis soci-económico de la incineración de residuos municipales en España,	See 35417
33292	10	41	29			The introduction and table 10.10 are organized according to a suite of topics: Technological; financial, and institutional, cultural and legal aspects. For greater accessibility, the text could also follow this structure.	Rejected, table gives aspects and text arranged by option for greater consistency with options earlier in the chapter
24329	10	42	10			Before "Schleich and Gruber", it is suggested to add some findings from Liu Xianbing. (Liu X, et al., 2012)(Liu X, et al., 2013a) (Liu X, et al., 2013b) made surveys in China's iron and steel, cement and chemical industries and found that the affordability for increased energy cost goes down when market competition degree and energy price become higher, energy management strategies becomes weaker and when company's size becomes smaller. It is suggested that economic incentives and technical support are important for assisting small and medium-sized enterprises in better practice of energy saving activities.	Rejected, references cited are incomplete and could not be identified
31568	10	42	10			Before "Schleich and Gruber", it is suggested to add some findings from Liu Xianbing. (Liu X, et al., 2012)(Liu X, et al., 2013a) (Liu X, et al., 2013b) made surveys in China's iron and steel, cement and chemical industries and found that the affordability for increased energy cost goes down when market competition degree and energy price become higher, energy management strategies becomes weaker and when company's size becomes smaller. It is suggested that economic incentives and technical support are important for assisting small and medium-sized enterprises in better practice of energy saving activities.	Rejected, references cited are incomplete and could not be identified
25762	10	42	23	42	25	This part should be deleted or revised to explain that the total energy efficiency of cogeneration depends on heat demand and that its efficiency would be low if heat is not utilized effectively, as described in (Pedro, 2012, page82). This literature is listed in the No115 line of this table. In addition, this part should also explain the huge potential of heat pump technology to reduce GHG emission from industrial sectors, as described in (IEA/OECD, 2010, page65-83) and (UNIDO, page38, Fig14). These literatures are listed in the No17 line of this table.	Rejected, this section is on barriers and not on technology assessment (that is in 10.4)
33850	10	42	37			Add: High prices of natural gas in comparison with other fuels may lead to a reduction of the CHP potential.	Rejected, fuel cost already mentioned on this paragraph

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32290	10	42	4	42	37	Energy efficency improvement in many cases can be achieved net negative cost. However, without clear perspective of the future market and market environment, investment is still risky. It is a major reason why energy efficiency improvement potential has not been explored in the past. Some policy measures to address the barrier is necessary and thus should be explicity discussed.	Rejected: investment risk is mentioned at start of section and is common to capital projects; this section does not cover policy
23370	10	42	10	42	17	Specific: The findings of the study by Schleich and Gruber (2008) are not correctly reported. a) Their study is on barriers to energy efficiency in the services sector (and small commercial businesses) in Germany; they do not study energy-intensive industries; instead they argue that - in contrast to organizations in the services and commercial business sector - companies from energy-intensive industries like the power, the iron and steel or the mineral processing industries tend to be quite aware of the potential cost savings from investing in energy efficiency. The high energy cost share in these companies provides a strong economic incentive to find and realise efficiency potentials. Likewise, since investing in energy efficiency directly affects the core production processes in energy-intensive companies, energy use is automatically considered in investment decisions. b) the findings are not correctly reported either; Schleich and Gruber (2008) find that in the German commercial and sercices sectors the most prevalent barriers are lack of information about energy consumption patterns and the investor/user dilemma. Could add that Fleiter and Schleich (2012) find that high investment costs and lack of capital impede the adoption of profitable energy efficiency measures in small and medium sized companies in Germany. Literature: Fleiter, T., Schleich, J. and Ravivangpong, P. (2013): Adoption of Energy-Efficiency Measures in SMEs - An Empirical Analysis Based on Energy Audit Data from Germany. Energy Policy 51, 863-875 DOI: 10.1016/j.enpol.2012.09.041. ISSN: 0301-4215	Accepted, more references included.
19800	10	42	4			Consider for removal. It is covered better in FAQ 10.4 and Table 10.10.	Rejected, references and detail given in text essential for assessment
19801	10	42	38			Consider for removal. It is covered better in FAQ 10.4 and Table 10.10.	Rejected, references and detail given in text essential for assessment
21373	10	42	38	43	10	It should be stressed that high costs of CCS limit viable CCS business models. In addition, it should be explained that CCS requires huge energy for capture and strage 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.	Rejected, cost of CCS covered in 10.7 and high capital costs already mentioned.
37573	10	43	40	43	42	The authosrs should include the fact that there are currently available, technically feasible options to reduce emissions from all F-ghg sources.	Accepted, however technology options already mentioned in text and table -- no change
27857	10	43	40	43	47	The whole paragraph seems rather confusing. No rating of relevance is given and rather out of data sources are cited.	Accepted, recent reference added and text clarified, however rating of barriers is beyond the scope of this very breif description of barriers for this area.
27858	10	43	47	43	47	Lack of information and communication and education about solvent replacements is an important barrier. However, the same barrier is even more important for applications that lead to higher emissions. A good and current overview on barriers gives UNEP 2010: "Barriers to the use of low-GWP refrigerants in developing countries and opportunities to overcome these". We suggest to add: "Lack of awareness of alternative refrigerants and lack of guidance as to their use in a given or new system (UNEP 2010) as well lack of awareness of alternative blowing agents"	Accepted, reference and lack of awareness statement added.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37574	10	43	48	43	49	This 1999 reference is obsolete - cost is not a major barrier as reflected by significant reductions from this sector since 1999. Technically feasible to reduce PFC emissions from all aluminum technology types (Soderberg, Prebake). See International Aluminium Industry 2011 Anode Effect Survey.	Rejected, reference not peer reviewed.
30507	10	43	8	43	10	Intense research for CO2 cpture for BF has been conducted by steel industry as COURSE50 which includes research for further waste energy utilization even under less finantial incentive situation. "These ---industry" should be revised as " Despite efforts by industry efforts, CO2 capture cost remains main barrier for CCS.	Accepted, lack to technology maturity indicated as opposed to lack of research
40715	10	43	11	43	20	Not only the lack of human and institutional capacities, but also there are some technological problems to re-produce sufficiently high quality products with appropriate cost and energy. (Material efficiency: A white paper, J. M. Allwood, M. F. Ashby, T.G. Gutowski, E. Worrell, Resources, Conservation and Recycling, 55 (2011) pp362-381.) So please add the intrinsic problems.	Accepted, reference added, however, space constraints limit additional descriptions of barriers given in comment.
25763	10	44				In the column of "Energy Efficiency for reducing energy requirements", heat pump technology should be included in the same parts as cogeneration with information of its huge potential to reduce GHG emission from industrial sectors, as described in (IEA/OECD, 2010, page65-83) and (UNIDO, page38, Fig14). These literatures are listed in the No17 line of this table. In addition, this part should also explain that the actual cost for CCS depends on a number of conditions such as concentration of CO2 in the exhaust gases, capture technology, access to storage site, storage potential, and CO2 monitoring, as described in (Finkenrath, 2011, page7), (Rubin, 2007, page4447, Table3), and (Lohwasser, 2012, Abstract). These literatures are listed in the No12 line of this table.	Rejected: technology options are described in 10.4 not 10.9.
27860	10	44		44		Technological Aspects: Technology / Non-CO2-GHGs: it is doubtful whether approaches and technologies are in fact available. It should be "+/-". Example: Experts are not sure whether alternatives to SF6 used in the process of magnesium die casting are completely available having the same technical characteristics. Another example are coolants for cooling units at <-50°C. To our knowledge alternatives are not available yet.	Accepted: change to +/- and text modified
27859	10	44	11	44	12	"Lack of control of HFC leakage" is no typical example for a barrier to implemented GHG mitigation measures in the industry. We propose: Implementation of GHG mitigation measures in industry faces a variety of barriers: Expectation of high return on investment (short payback period), high capital costs and long project development times for several technologies, lack of access to capital for energy efficiency improvements and feedstock/fuel change, fair market value for cogenerated electricity to the grid, and costs/lack of awareness of need for control of HFC leakage are typical examples.	Accepted: recommended change made to FAQ
21223	10	44	14			Change to "fulfillment"	Accepted: shortened
22108	10	44	15	44	20	While the existing GDP-based system will probably remain intact, it is essential to review the investment policies within the national and EU systems.	Noted: no change
37575	10	44	29			"Non CO2 GHGs" column Disagree cost is a significant barrier for reducing PFC emissions from primary aluminum. Significant emission reduction achieved through best management practices.	Accepted: cost removed from financial row however retained in technology row
30947	10	44	4	44	4	By economies in transition, are you referring to all developing countries which are not in the East Asia region?	Rejected: economies in transition not mentioned on this line?
32291	10	44	6	44	28	Uncertainties of the future market, fuel, material prices, government regulations are also major barrier to investment in particular in industry sector where large scale investment is necessary.	Noted: no change -- all of these are factors in investment risk is assessed in chapters 3 and 16
31454	10	45				In row 3 (cultural) , column 3 (emissions efficiency etc.) it is not clear to us what is meant by "incineration" when it says " - (negative) social acceptablility of incineration and CCS ". Please clarify.	Accepted: incineration removed

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
31455	10	45				In row 2 (institutional and Legal), column 3 it is stated "- (negative) CCS regulatory and permitting uncertainty". We think it should considered to either be more precise about what is the exact problem today- or to delete this sentence while we assume that these "uncertainties" cannot be solved in due time for this Report.	Accepted: removed
30948	10	45				The report speaks widely of the potential for CO2 capture and storage (CCS) and this table cites "lack of financial incentive for CCS." However, it may be worth noting that some countries are providing financial incentives to CCS. For instance, significant government investments have been made in Canada: in 2008, the province of Alberta committed $2 billion to CCS projects; the province of Saskatchewan committed $240 million; and the federal government (Natural Resources Canada) committed $617 million.	Accepted: changed to lack of sufficient financial incentive for widespread deployment
27861	10	45		45		We recommend to complement Table 10.10 by adding "+ regulations for energy efficiency of equipment" to subchapter "Institutional and Legal", column " Energy efficiency for reducing energy requirements", because regulations are one possibility to improve energy efficiency of cross sectoral technologies	Accepted: added refering to seciton 10.11 on policy
34365	10	45				Please replace the term 'acceptability' in the cultural row with 'acceptance' according to the agreements made in Wellington.	Accepted: changed
33300	10	46	43	46	44	Can this finding be backed from the bottom-up perspective?	Accepted: detailed studies also exhibit this behaviour as shown in figure 10.9
37576	10	46	1	47	19	This section could use a few sentences stressing that long-term forecasting is inherently very uncertain, especially for the industrial sector given the possibilities of disruptive technologies and demand from major shifts in consumer behavior. There needs to be some caveats that the projections presented are not fact, but rather uncertain modeling estimates. The authors should avoid phrases like "Scenarios indicate generally strong growth" and "Final energy (FE) demand from industry increases in scenarios" and use terms like "the models estimate" or "demand is likely to grow." There is a danger that the lay reader will interpret the results as much more certain than they truly are unless the authors frame the results using language that reflects their uncertainties.	Accepted: statement about uncertainty included at start of section.
33293	10	46	1			This section relies heavily on Chapter 6, the link of sectoral studies (“bottom-up”) to results from integrated models (“top-down”) is not well established.	Accepted: studies with detailed depections of the industry sector (e.g. IEA) are discussed and are within the range of scenarios assessed
33294	10	46	1			The figures illustrate top-down approach, no figures display the overlay of sectoral and scenario data for key sectoral indicator(s), data from sector and scenarios on relation between changes in carbon and energy intensity, comparison(s) of carbon intensity ranges (and/or other indicators) from integrated models with ranges or single studies from scenario studies clustered by e.g. final energy, mapping of data from both perspectives with respect to fuel usage.	Accepted: figure 10.9 shows a comparison of sub-sector studies, and figure 10.6 shows these in relation to a larger set of scenarios.
25764	10	47	1	47	1	This part should explain that it is uncertain whether BECCS can be utilized in the future, as described in the section TS.3.3 (page 21, line 37). Safety confirmation, affordability and public acceptance are indispensable in CCS site selection. There is a much higher barrier to adopt BECCS than CCS because BECCS requires stable biomass supply for generation at reasonable cost. Since feasibility for BECCS has not been established so far, it is not appropriate to expect huge potential for BECCS in the future, as described in (Rhodes, 2008, page323). This literature is listed in the No7 line of this table.	Accepted: text refers to the Biomass annex where BECCS is assessed

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25765	10	47	4	47	7	This part should be deleted completely because it is uncertain whether BECCS can be utilized in the future, as described in the section TS.3.3 (page 21, line 37). Safety confirmation, affordability and public acceptance are indispensable in CCS site selection. There is a much higher barrier to adopt BECCS than CCS because BECCS requires stable biomass supply for generation at reasonable cost. Since feasibility for BECCS has not been established so far, it is not appropriate to expect huge potential for BECCS in the future, as described in (Rhodes, 2008, page323). This literature is listed in the No7 line of this table.	Accepted: BECCS is not assed in this section; the section refers to the Bioenergy Annex of Chapter 11 for that assessment.
25766	10	47	8	47	9	This part should explain that "voluntary agreement" is an effective method to improve energy efficiency and reduce GHG emissions, as described in the section 15.5.7.4. There are successful examples of "voluntary target scheme" in the world. Each industry in Japan has voluntary target and the voluntary target scheme has played a big role, as described in (Yamaguchi, 2012, page35 and 154), (Manuel, 2010, page 6 and 13), and (Yamaguchi, 2010, abstract). In addition, there is also a successful example of "voluntary target scheme" in Netherlands, as shown in (Martijin, 2002, page162). These literatures are listed in the No22 line of this table.	Rejected: policy choices are discussed in a different section.
19194	10	47	13	47	16	Thank you for including the important idea that carbon capture and storage (CCS) is not currently expected to become widespread by 2020; I would urge you to keep the following line in the final version of this chapter "In this scenario, CCS is already present in 2020 which would be challenging since CO2 capture has yet to be applied at commercial scale..."	Accepted: text retained with minor modificaiton
33296	10	48	1			Could be inserted at page 46, line 22	Accepted within editorial constraints
37577	10	48	1			Figures 10.6 and 10.7 could be better integrated into the earlier text and made more readable. For example, it might be more clear if "2010 = 1" was added to the y-axis labels.	Accepted: label added to figure 10.6
25993	10	49				Fig 10.9 Use of colors, lines, shades became very confusing. Should be redesigned for visual clarity	Accepted: figure simplified
25994	10	49				Fig 10.8 is impressive but should be redesigned in much larger scale and with separate lines. Message is lost in some kind of spagetti.	Accepted: additional panels used toclarify results
33297	10	49	1			Could be inserted at page 46, line 33	Accepted within editorial constraints
29676	10	49	7			This figure is very confusing, and these data could potentially be much more clearly represented in a bar graph with averages of different Category scenarios. Bars could show energy share.	Accepted: additional panels used to clarify results
33298	10	49	7			Could be inserted at page 47, line 1	Accepted within editorial constraints
37578	10	49	7			Figure 10.8 is not clear and somewaht messy. Can the authors think of a better, more intuitive way of presenting the data? As the graph currently stands, the takeaway messages are very hard to discern due to the tight packing of lines, overlapping of lines, confusion over what dot belongs to what line, etc. Please redesign or consider dropping this graph.	Accepted: additional panels used to clarify results
33273	10	5	11	5	33	The key findings 10 and 13 are related and could be condensed to one.	Accepted, text revised
33840	10	5	11			Add: The net effect however is a decrease in emissions or the industry as a whole.	Noted - the comment is not clear. The intention was to point that there could be an increase of emissions resulting for the increase in PV manufacturing, This has now been reomved from the Exec. Summ. but is still mentioned in FAQ 10.3, with appropriate qualifiers

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24730	10	5	15	5	24	Assessing bottom-up energy efficiency potential typically requires energy assessments /audits at site level and this creates uncertainty in aggregate estimates. Methods for quantifying energy savings through energy assessments are known, but there is not a single method that applies in every case (DRET 2013). The reference to up to 90% savings also sounds high and suggests very favourable circumstances. It would be preferable to use a typical number or range (e.g. 10-30%- see UNIDO) rather than such an extreme figure. Suggested citations: Department of Resources, Energy and Tourism, Energy Savings Measurement Guide: Version 2, Canberra, 2013, available from: www.energyefficiencyopportunities.gov.au Global Industrial Energy Efficiency Benchmarking: An Energy Policy Tool, Working Paper, November 2010, available from http://www.unido.org/fileadmin/user_media/Services/Energy_and_Climate_Change/Energy_Efficiency/Benchmarking_%20Energy_%20Policy_Tool.pdf	Taken into account - Executive Summary now reflects new findings of costs and potentials (10.7) and Transformation Pathways (10.10) sections
20255	10	5	15	5	20	KEEP the caveat here on the potential estimate. It is important to acknowledge it.	Accepted
37475	10	5	15	5	29	It is somewhat confusing to refer to emission mitigation costs in units of Euros per ton and US Dollars per ton on the same page. The authors should choose one unit of currency and use it consistently throughout so that the reader more logically see how costs across technologies compare.	Accepted
37477	10	5	17	5	17	It is suggested to use the phrase "practical limits" instead of "theoretical limits" since theoretical is generally accepted as meaning theoretical thermodynamic limits, and no industrial processes have sufficiently attained that target (whereas it is easier to demonstrate that practical limits using, e.g., state-of-the-art technologies have been attained).	Accepted, language changed
37476	10	5	17	5	18	As a general comment, this chapter implies that some mature industries are at their technical limits of improvement in energy efficiency. This is incorrect. There is still room for improvement in every sector. DOE has found that 10 to 25% or ore can be saved in manufacturing facilities with the implementation of basic energy management measures.	Accepted, language changed
20322	10	5	17			Virtually no process has reached it's thermodynamic limits yet.	Accepted, language changed
35283	10	5	20	5	24	The conclusion that “Marginal abatement cost estimates show that 33-51% of this reduction can be achieved at net negative cost…” is not reliable, as it comes from only two literatures (McKinsey & Company, 2010; Akashi et al., 2011) and is drawn based on many assumptions. Therefore, it is not appropriate to include this conclusion in the ES since this conclusion is of low evidence and low agreement. It is suggested to delete the last two sentences of the paragraph.	Accepted - section10.7 and its corresponding summary in the Exec Summ have been revised thoroughly
37478	10	5	21	5	24	It is suggested that this section is clarified as a few things aren't clear; for example: >is the 7 GTCO2 mentioned actually CO2 equivalent? And to what percent reduction does that correspond? > are the marginal abatement cost estimates that are achievable with a cost of carbon "an additional" amount beyond the 33 - 51% achievable at net negative cost; if so, stating this would help clarify.	Accepted - section10.7 and its corresponding summary in the Exec Summ have been revised thoroughly
37479	10	5	21	5	24	It is suggested that this section is clarified as a few things aren't clear; for example: >is the 7 GTCO2 mentioned actually CO2 equivalent? And to what percent reduction does that correspond? > are the marginal abatement cost estimates that are achievable with a cost of carbon "an additional" amount beyond the 33 - 51% achievable at net negative cost; if so, stating this would help clarify.	Accepted - section10.7 and its corresponding summary in the Exec Summ have been revised thoroughly
31256	10	5	22	5	24	I would rephrase this as "…. achieved at negative cost, with additional reductions of 13-19% at 0-20 euros/tCO2, 12-23% at 20-50 euros/tCO2, and 16-38% …."	Noted - section 10.7 and its corresponding summary in the Exec Summ have been revised thoroughly

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25750	10	5	22	5	24	This part should explain that the potential of "net negative cost" is uncertain and may be overestimated because there are hidden costs such as opportunity cost for amenity and transaction cost for information collection, as described in (Yamaguchi, 2012, page161-177). This literature is listed in the No22 line of this table.	Noted - section 10.7 and its corresponding summary in the Exec Summ have been revised thoroughly
19776	10	5	24	5	26	unit "Euro/tC02" should clarify the year for currency value	Accepted
24731	10	5	25	5	29	Suggest note that similar benefits can still be found in developed countries. In Australia, energy assessments for the largest energy consumers under the Energy Efficiency Opportunities (EEO) program, focusing on paybacks up to 4 years resulted in companies adopting measures with savings of around 5% of energy consumption assessed, with financial benefits amounting to over $90 per tonne of GHGs abated. Citation: Department of Resources, Energy and Tourism, (2012), Energy Efficiency Opportunities – Continuing Opportunities 2011. Results of EEO, Assessments reported by participating corporations, Canberra.	Accepted - section10.7 and its corresponding summary in the Exec Summ have been revised thoroughly
37480	10	5	25	5	29	It would benefit the reader if the section described an example or two of both the "actions taken" and the "barriers that block implementation."	Accepted - section10.7 and its corresponding summary in the Exec Summ have been revised thoroughly
20323	10	5	25		29	I do not see any evidence for the 20 USD-statement. Generally, many cost-effective measures will be implemented, meaning below 0 USD/t. ON what evidence is this number based?	Accepted - section10.7 and its corresponding summary in the Exec Summ have been revised thoroughly
29664	10	5	3	5	6	Should delete this paragraph from the executive summary. Not of significant importance.	Rejected - we consider it important
24729	10	5	3	5	6	Over their lifecycle, PV cells produce a net reduction in GHG emissions compared to fossil fuel power generation Taking a lifecycle approach to GHGs would therefore suggest not concentrating on emissions from PV cell manufacture specifically and not, for example, the energy required to manufacture fossil fuel-fired power stations. Suggest that the embodied energy of manufactured products should either be 1) discussed for all products; or 2) left out.	The statement is no longer included in ES. A similar statement is included in FAQ 10.3 but only as an example of interactions between sectors
37473	10	5	3	5	6	It's important to point out that while, yes, the emissions of the industrial sector might increase as it produces more efficient technologies, there should be net savings in emissions from a global perspective due to the emissions savings from the application of those technologies in other sectors. Otherwise this paragraph reads like production of these technologies is a bad thing. These lines need to be better reflect the points raised in section 10.5.3.	Accepted - language in ES and FAQ 10.3 revised
37474	10	5	3	5	6	"Future demand for those products may increase, resulting in increasing industrial emissions." (p.5, lines 5-6) Research on net emissions effects could help to substantiate this sentence. Otherwise one might expect that the emissions savings from mitigation technologies more than make up for emissions embodied in production.	Accepted - language in ES and FAQ 10.3 revised
31682	10	5	30	5	33	The information in this paragraph is not coherent and it is unclear how the opening statement is supported or expounded through the following three sentances.	Accepted - text revised
37481	10	5	30	5	30	It would be helpful to the reader to know what percentage reduction of each source corresponds to the stated 0.7 GTCO2e reduction.	Accepted, this statement no longer appears in ES
37482	10	5	32	5	33	Can this statement be made more precise? What is considered high cost and why? EPA analysis does not suggest all electronics abatement costs to be "high".	Accepted, this statement no longer appears in ES
24732	10	5	34	5	42	Suggest emphasising that the reason why sharing waste heat increases efficiency is that there are less losses in transferring the energy as heat than as electricity (work), and that it enables low value waste heat to be efficiently utilised.	Rejected, due to limited space in executive summary, we cannot provide so many details
20324	10	5	35			Public resistance? The key problem is generally resistance within the company...	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37483	10	5	36	5	36	To Paragraph 14, consider adding "and marginal abatement cost estimates for technologies that have these co-benefits show that many are cost-effective." cite Sathaye, J., T. Xu, C. Galitsky 2011	Noted - this reference is used in cement discussino. No references are included in the ES
30434	10	5	39			Add "cooling" to the list, add "streams" to waste	Accepted for cooling
33842	10	5	39			add: co-siting (before information, waste, heat ….etc	Rejected; due to severe space constraints we have to limit the number of examples
30267	10	5	43		45	pointing out increases in demand needed to respond to mitigation measures, or adaption measures, as pointed out here, is an excellent addition to the report.	Noted, thanks
37484	10	5	43	5	44	The rationale of this section would benefit by adding a phrase to the end of the first sentence, such as: "...that may see increased demand for infrastructural materials."	Accepted, se point 9 of new ES
25749	10	5	7	5	9	This part should be kept in the final version report and also explain that there are many concerns about CCS such as safety confirmation, storage potential, high cost or public acceptance, as described in (Finkenrath, 2011, page7), (Rubin, 2007, page4447, Table3), (Lohwasser, 2012, Abstract), and (Zoback, 2012, Abstract). CCS cost depends on a number of conditions such as concentration of CO2 in the exhaust gases, capture technology, access to storage site, storage potential, and CO2 monitoring. These literatures are listed in the No12 line of this table.	Accepted, however general discussion of CCS and connected uncertainties and problems is covered in chapter 7, chapter 10 concentrates only on the additional aspects being characteristic for industrial applications
29665	10	5	8	5	9	With respect to CCS, the problem is not just a lack of public acceptance but a lack of successful implementation of CCS projects, not to mention cost effectiveness. Propose changing to "…or Carbon dioxide capture and storage (CCS), which once demonstrated, tested, cost-effective, and publicly accepted may contribute to significant GHG mitigation in the future.	Accepted
33841	10	5	8			alternatives to cement or to the production of pig iron	Rejected; due to severe space constraints we have to limit the number of examples
24307	10	5	20	5	24	the indication of nearly "50% reduction "at "net negative cost" is not dependable.This is summarized based on only one study, which doesn't justify the "high uncertainty" conclusions made by the previous sentences. Either delete the part from "Corresponding" to "50/tCO2", or make a summary based on broader literatures. The authors should have easy access to those literatures. For sample literatures and summaries, please check the #6 comment.	Accepted - section has been revised thoroughly
31546	10	5	20	5	24	the indication of nearly "50% reduction "at "net negative cost" is not dependable.This is summarized based on only one study, which doesn't justify the "high uncertainty" conclusions made by the previous sentences. Either delete the part from "Corresponding" to "50/tCO2", or make a summary based on broader literatures. The authors should have easy access to those literatures. For sample literatures and summaries, please check the #6 comment.	Accepted - section has been revised thoroughly
24308	10	5	25	5	29	There is no content in the main text which elaborates this viewpoint in details. We even failed to find another "20 USD/tCO2" in the main text. This paragraph in the ES needs to be deleted.	Accepted - section has been revised thoroughly
31547	10	5	25	5	29	There is no content in the main text which elaborates this viewpoint in details. We even failed to find another "20 USD/tCO2" in the main text. This paragraph in the ES needs to be deleted.	Accepted - section has been revised thoroughly
32283	10	5	3	5	6	This is an important point to suggest that collection of sectoral minimization approaches may not bring most efficient or effective GHG reduction as a whole. It should be mentioned that a study with LCA aspect is a must to examine if particular polity alternative is more effective than others.	Accepted, covered in FAQ 10.3
29679	10	50	1			These data could be more clearly represented in table form.	Accepted: figure simplified
33299	10	50	1			Could be inserted at page 47, line 11	Accepted within editorial constraints
37579	10	50	1			The 2050 global emissions bar chart appears to have lower values than Figure 10.7 on p.49; what accounts for the difference?	Accepted: newer IEA scenario now used in this section

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22109	10	50	23	50	26	Public opposition is an issue in all large-scale infrastructure. CCS implementation at a commercial scale is highly questionable even without public opposition.	Accepted: barriers are covered in section 10.9 and other chapters for CCS
24330	10	51	13	51	21	Adds information from (Cai W, et al., 2011) and (Böhringer C, et al, 2012). Cai says it is never a simple Yes or No question to say that green economy will bring green jobs, especially in developing countries, where shutting down inefficient facilities that has not reached the end of their lifetime is a common and necessary measure; therefore the mitigation policies need careful design. Böhringer C says the employment gains in Germany from renewable energy promotion will be quite limited and hinge crucially on the level of the subsidy rate and the financing mechanism.	Rejected: deleted draft discussion; there is not a simple answer
31569	10	51	13	51	21	Adds information from (Cai W, et al., 2011) and (Böhringer C, et al, 2012). Cai says it is never a simple Yes or No question to say that green economy will bring green jobs, especially in developing countries, where shutting down inefficient facilities that has not reached the end of their lifetime is a common and necessary measure; therefore the mitigation policies need careful design. Böhringer C says the employment gains in Germany from renewable energy promotion will be quite limited and hinge crucially on the level of the subsidy rate and the financing mechanism.	see 31569
25767	10	51	13	51	22	This part should be deleted totally and there should be an explanation that mitigation policies can rather lead hollowing out of industry. 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 No9 line of this table.	Accepted: deleted
25768	10	51	26	51	27	This part should explain that "voluntary agreement" is an effective method to improve energy efficiency and reduce GHG emissions, as described in the section 15.5.7.4. There are successful examples of "voluntary target scheme" in the world. Each industry in Japan has voluntary target and the voluntary target scheme has played a big role, as described in (Yamaguchi, 2012, page35 and 154), (Manuel, 2010, page 6 and 13), and (Yamaguchi, 2010, abstract). In addition, there is also a successful example of "voluntary target scheme" in Netherlands, as shown in (Martijin, 2002, page162). These literatures are listed in the No22 line of this table.	Thank you but as the reviewer rightly points out, Voluntary Agreements are covered in detail in chapter 15. Chapter 10 agreed with chapter 15 to limit our coverage of VAs to a small number of examples and to refer the reader to chapter 15. Therefore these suggestions cannot be incorporated
24144	10	51	37	51	44	PAT to enhance energy efficiency is not cap-and-trade scheme but baseline and credit scheme. Since this paragraph is focused on the energy efficiency, please delete other GHG emissions reduction mechanisms such as cap-and-trade scheme, EU-ETS, US state of CA which are discussed in the Chapter 13 and 15.	Accepted partially, paragraph has been modified but kept under 10.11.1 as the main impact of these schemes is on energy efficiency
25769	10	51	37	51	40	This part should be deleted completely because Cap & trade schemes have not been effective to reduce GHG emissions and enhance energy efficiency in energy-intensive industry. Market-based mechanism such as emission trading has several problems. Volatility of emission permit prices affects volatility of product prices as evidenced by fluctuating price developments in the EU-ETS. Therefore, the market-based policy tools of cap-and-trade cannot provide credible incentives for the technological change, as described in (Montgomery, 2005, abstract) and (Baldursson, 2009, page29). 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, do not work well, as shown in (Rosendahl, 2011, abstract), (Aichele, 2012, page336), and (Peters, 2011, page1). These literatures are listed in the No9 line of this table.	Rejected as our text does not go into an assessment of the merits of the instrument, it clearly refers the reader to chapter 15 for details
29677	10	51	4	51	5	This sentence is a tautology. Instead, could be "Industry-related climate change mitigation options are varied, some impacting employment negatively and others growing employment."	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19802	10	51	4	51	22	Employment benefits should also be considered for other non-favourable (for climate change) energy sectors such shale gas.	Shale gas is not in the scope of chapter 10; see chapter 7
22110	10	51	4	51	22	Employment in the energy sector should be examined not just for climate change mitigation options but also for other competitive options especially in the energy sectors, e.g. shale gas.	Shale gas is not in the scope of chapter 10; see chapter 7
37580	10	51	23	55	21	Section 10.11 details several policy options that are available to encourage efficiency and emission reductions in the industrial sector. One important economic instrument that is not included in this section is a carbon tax. With consideration of a carbon tax underway in the China, Mexico and other countries, as well as its implementation in many countries and subnational jurisdictions, it is appropriate to include mention of a carbon tax in the IPCC report. A carbon tax uses the power of market price signals to encourage efficiency and greenhouse gas emission reductions from a variety of sources. An upstream carbon tax, for example, would impose a charge on coal, oil, and natural gas in proportion to the amount of carbon they contain. This tax would be passed forward into the price of electricity, petroleum products, and energy-intensive goods. The economic rationale for creating a price on greenhouse gas emissions is multifold. First, it would correct an underlying market failure that has led to increasing concentrations of greenhouse gases in the atmosphere. The burning of fossil fuels and other activities that release greenhouse gases are associated with warming global temperatures and adverse climate impacts. The costs of these impacts, including an increase in extreme and damaging weather events, rising sea levels, loss of biodiversity and other effects, will be borne by society as a whole, including future generations. However, these costs are not currently included in the market prices of goods that emit greenhouse gases, leading to an inefficient use of resources and excessive emissions from a societal perspective. A carbon tax would attempt to include these costs in market prices. Second, use of a market-based policy instrument can achieve greenhouse gas emission reductions at lower cost to regulated sectors than a command-and-control approach, which emphasizes source- and sector-based mandates for particular technologies or processes. As technologies that reduce CO2 emissions during or post-combustion are not yet widely available, the primary way to reduce CO2 emissions is to switch to fuel sources with lower carbon content or reduce consumption of fossil fuels. Use of an economic instrument to establish a common price on greenhouse gas emissions is necessary to provide incentives for a broad range of emission reduction options across firms and other emitters. Some emission reductions will be achieved by firms as they switch from higher- to lower-carbon fuels and invest in energy-saving technologies. Other reductions will come from consumers, who will respond to higher energy prices by purchasing less energy-intensive goods and changing their behavior in ways that use energy more efficiently. A number of countries have existing carbon taxes or are considering them. Table A below lists the regions that have implemented a carbon tax. TABLE A: Regions with Carbon Taxes COUNTRY / JURISDICTION□START DATE□TAX RATE□ANNUAL REVENUE□REVENUE DISTRIBUTION Finland□1990□$30/metric ton CO2□$750 million□Government budget; accompanied by independent cuts in income taxes Netherlands□1990□~$20/metric ton CO2 in 1996□$4.819 billion*□Reductions in other taxes; Climate mitigation programs Norway□1991□$15.93 to $61.76/metric ton CO2□$900 million (1994 estimate)□Government budget Sweden□1991□Standard rate: $104.83/metric ton CO2 Industry rate: ~23.04/metric ton CO2□$3.665 billion□Initially government budget; Starting in 2000, revenue used	1) carbon tax is an aggregated /overarching policy instrument an discussed in the integrative chapter/chapter 15 accordingly. nevertheless we have reworded the second paragraph in 10.11 to include carbon tax. 2)The policy section refers to reductions in both direct and indirect emissions 3)The issue of market context cannot be covered due to space limitations, moreover the reviewer does not suggest any references. 4) benchmarking is covered in general in 10.11.1, without the details given the space limitations.
37581	10	51	29			Section should reference energy management standards. ISO 50001 is an internationally recognized standard published in June 2011 that has more than 2200 sites certified thus far.	Accepted
37582	10	52	1			Figure 10.10 is inaccurate as it describes energy management as a regulation or as part of an agreement. There are voluntary standards such as ISO 50001. It is neither regulation or an agreement.	Accepted - figure revised

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37583	10	52	21	52	22	The text references "energy management schemes" used in combination with voluntary agreements - these are not energy management standards.	Accepted
37584	10	53	22	53	30	The authors should consdier adding text after line 30: Voluntary programs that engage industrial sectors have been used in the United States by the US EPA to reduce greenhouse gas emissions. The ENERGY STAR for Industry program provides sector specific energy performance benchmarking tools, energy guides, and provides a forum for industrial energy managers to share best practices. The program engages 24 sector and sub sectors. One of the first industries ENERGY STAR engaged in this process, motor vehicle manufacturing, was observed to reduce it sector-wide fossil fuel by 12% for a reduction of 700,000 metric tons of energy-related carbon between 2000 - 2005. (Boyd 2010) Boyd, Gale (2010) Assessing Improvement in the Energy Efficiency of U.S. Auto Assembly Plants; Working Paper EE 10-1, June 2010 Duke University	Rejected - unfortunately not enough space and suggested reference is not peer reviewed
19803	10	53	3	53	9	Japan is world famous for its policies in industrial efficiency. Consider mention here.	Rejected - these are only examples, and reviewer provides no suggested references. Japan examples are mentioned elsewhere in the section (e.g 10.11.2)
30949	10	53	3	53	9	The content in this paragraph could be elaborated on. For instance, do many countries compare energy usage among facilities, or is this specific to Canada and the Netherlands (which were listed here). Furthermore, it is indicated that this practice facilitates comparisons. Is this only for companies or both?	First question: accepted, start of sentence revised. Second question: rejected, we believe the wording implies that that benchmarking facilitates comparisons at different levels (e.g. plant-level, company-level, as well as internationally).
22111	10	53	3	53	9	Benchmarking is used for promoting best sectoral practice in industries around the world.	Accepted, start of sentence revised
30950	10	53	31	53	32	Suggest removing reference to Canada - the adoption of Energy Management Systems in industry is not mandatory in Canada.	Accepted, CAnada deleted
37585	10	53	31	53	32	Line 31 says "The adoption of Energy Management Systems (EMS) in industry is found to be mandatory, as in Japan, Italy, Canada, Turkey or Portugal." There is no description of what the authors mean by EMS. If the meaning is a set of business processes to foster continual improvement in energy performance, then this would be termedn "EnMS". In the ISO system, the abbreviation "EMS" is for "Environmental Management System". Also, the list of countries does not seem accurate. By example, Japan has a legal requirement for an onsite eneryg manager and annual reporting on energy efficiency improvements for many industries. The authors should check whether the adoption of an "Energy Management System" (ISO or otherwise) is mandatory. The emphasis has been on embedding energy managers - which is not the same as an EnMS. The Canadian Industry Program for Energy Conservation (CIPEC) of Natural Resources Canada makes no mention of any mandatory requirement for "Energy Management Systems". Also, Ireland, Sweden, and Denmark have for many years linked fiscal policies (typically tax levies and aoidance of tax levies) to the adoption of an Energy Management System standard, first national and now ISO 50001. Germany has instituted similar fiscal policies more recently, as are other EU countries.	Accepted, thank you as this did need clarifying
30951	10	53	32	53	32	Suggest considering adding examples of countries that have adopted voluntary schemes, since examples of countries using mandatory schemes are listed in a series.	Rejected, we unfortunately do not have the space to go into this level of detail

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19804	10	53	37	53	40	Not sure if the role of synergies is explored in other Chapters but it is a huge one and should be explored especially for its benefits for emerging economies.	Noted. We agree that the issue would merit giving a few more details, but unfortunately space limitations do not allow this. We have added a reference to section 10.8 and the AR5 framing chapters.
30952	10	53	37	53	37	What co-benefits and what other policies?	Noted. We agree that the issue would merit giving a few more details, but unfortunately space limitations do not allow this. We have added a reference to section 10.8 and the AR5 framing chapters.
22112	10	53	37	53	40	The role of synergies is mentioned only very briefly here. Policies to reduce local air pollution can offer benefits in GHG reduction if coordinate properly.	Noted. We agree that the issue would merit giving a few more details, but unfortunately space limitations do not allow this. We have added a reference to section 10.8 and the AR5 framing chapters.
21388	10	53	20	53	21	Keep this phrase with suporting study as a key factor contributing to successful VAs (Yamaguchi M. and Okazaki T.(2012). Climate Change Mitigation) Dialogue between industry and government plays an important role in industrial voluntary actions.	Noted but not enough details given to find this supporting reference, and we have already quoted Yamaguchi 2012
30510	10	53	20	53	21	Keep this phrase with suporting study as a key factor contributing to successful VAs (Yamaguchi M. and Okazaki T.(2012). Climate Change Mitigation) Dialogue between industry and government plays an important role in industrial voluntary actions.	duplicate
20358	10	54	20		22	I would argue with this. While the GHG emission reductions of waste management are more and more recognized and accounted for, policies are still focusing on waste management, and not driven by climate concerns. See e.g. 4. E. Worrell, M. van Sluisveld, Material Efficiency in Dutch Packaging Policy, Phil. Trans. R. Soc. A. 371: 20110570 (2013) (doi:10.1098/rsta.2011.0570)	Accepted, text revised
24768	10	54	33	54	35	This statement is out of date, with the citation referring to draft policy in 2010 not 2012. Suggest removing the sentence referring to Australian policy.	Accepted, sentence deleted
25770	10	54	6	54	6	This part should be kept in the final version report because "voluntary agreement" is an effective method to improve energy efficiency and reduce GHG emissions, as described in the section 15.5.7.4. There are successful examples of "voluntary target scheme" in the world. Each industry in Japan has voluntary target and the voluntary target scheme has played a big role, as described in (Yamaguchi, 2012, page35 and 154), (Manuel, 2010, page 6 and 13), and (Yamaguchi, 2010, abstract). In addition, there is also a successful example of "voluntary target scheme" in Netherlands, as shown in (Martijin, 2002, page162). These literatures are listed in the No22 line of this table.	Accepted
25771	10	54	9	54	10	This part should be kept in the final version report because there is a successful example of voluntary action for capturing SF6 in Japanese power industry, as described in (Nishimura, 2008, abstract). This means that it is not necessary to adopt cap & trade scheme for non-CO2 GHG. <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	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27862	10	54	9	54	11	Please delete: With regards to gases with relatively high global warming potential (GWP) such as HFCs, PFCs, and SF6, successful policy examples exist for capture in the power industry (e.g. Japan). However there is not much evidence for the industry sector. We do not have knowledge about capture measures regarding HFCs or PFCs. No source is given for this statement. Hence, it is not possible to check what was meant.	Rejected. For the first part we can refer to the energy chapter - we have now added a reference, The second part is only a qualitative statement saying that not significant information for the industry sector is available. Such a statement (observation based on checking the literature) does not need or indeed can have a reference as it denotes a gap in te literature
19195	10	54	9	54	18	I commend the authors for including this entire paragraph on abatement options for HFCs, PFCs, and SF6, and would recommend that the entire paragraph be included in the final version of the chapter.	Noted, thank you
27863	10	55	11	55	16	The CDM in the 1st CP was dominated by HFC and N2O projects due to very low abatement costs compared to other project types (e.g. renewable energy). As the CDM is an offset mechanism, all reductions produced by the project will lead to increased emissions in Annex I countries and no net mitigation will be achieved. Financing HFC abatement at CER market prices has led to very inefficient allocation of funds (high overpayment) and "perverse" incentives to increase production or inflate baselines to increase revenues of project operators. These project types were discussed controversially in recent years and finally excluded from EU ETS since 2013.	Noted, a footnote has been added to refer the reader to the wider discussion on CDM (including its shortcomings) in chapter 13. The comment has been forwarded to chapter 13 for consideration.
29680	10	55	23	55	26	This sentence is unclear. Proposed rewording: "Some key challenges for the industrial sector are uncertainty, low quality, and incompleteness of data available in the public domain on energy use and costs. These information deficiencies are present across technologies and at regional and global scales. Improved data could greatly improve our capacity to assess performance and mitigation potential."	Accepted partially
22113	10	55	30	55	37	The role of energy and environmental accounting is hugely important in allowing comparisons among states and industries and promoting best practices. However, reporting is done with the use of various methods or no methods at all which remains confusing.	Agree, text already goes in that direction
30509	10	55	42	55	43	Insert following sentense. The worlsteel has developed KPI for CO2 emmition intesity of steel production site applicable worldwide, and the KPI. Such proposal frpm industry sector could be one solution to fill the Gaps.	Rejected - seems to be a rather specific example and is not referenced
24769	10	55				Australia has comprehensive quantitative data on the industry sector through NGERS and EEO. The data obtained has provided a systematic approach to avoid double counting and in particular assisted with in-depth assessment of mitigation technologies, quantitative data on co-benefits and better understanding demand reduction strategies through improved modelling. Suggest that Australia's progress in this regard is worth referencing, even if only as a footnote. Suggested citation: Department of Climate Change and Energy Efficiency (2012). Inputs to the Energy Savings Initiative modelling. from the Industrial Energy Efficiency Data Analysis Project. ClimateWorks Australia, July 2012, http://www.climateworksaustralia.org/sites/default/files/documents/publications/climateworks_esi_ieedap_report_jul2012.pdf	Noted - but the section has been reduced considerably and unfortunately there is no space to mention an otherwise commendable case of best pratic
21386	10	55	23	55	27	This kind of boundary issues are very important. Should not be deleted.	Accepted
33301	10	56	19	56	19	Please consider referring to this section as an 'appendix'	Accepted. The industry chapter has been restructured to integrate the waste excursus in it.
37586	10	56	21	56	24	Perhaps this is implicit here but waste generation is also linked to population growth.	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28993	10	56	6	56	7	An appropriate supporting reference here would be: Lifset, R. and M. Eckelman. 2013. Material efficiency in a multi-material world. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences 371(1986). DOI: 10.1098/rsta.2012.0002	Thank you, we passed on this reference to the authors of section 10.4
19805	10	56	19			Consider reducing the size of this section and bringing it in the chapter.	Accepted. The industry chapter has been restructured to integrate the waste section.
33265	10	56	19			The excursus section on waste seems disconnected from the main chapter. Please seek to strengthen the linkages, e.g. by cross-referencing, where adequate. For consistency with the report structure, the section should be referred to as an Appendix.	Accepted. The industry chapter has been restructured to integrate the waste excursus as an appendix.
23054	10	57				Both of these figures 10.11 and 10.12) are overly simplistic. Moreover, the limited information conveyed by these figures is duplicated in the accompanying sentences in the text. Deletion of both of these figures is recommended. Indeed, the “waste hierarchy” shown in Figure 10.12 and discussed in the accompanying sentences is also overly simplistic and contains some confusing entries. It is overly simplistic because local municipalities need multiple options for managing their waste using environmentally acceptable and locally affordable strategies. For example, this hierarchy implies that composting is always better than incineration--this is simply not true. This figure also contains entries for “aerobic composting” and “anaerobic composting”, which is confusing. If “anaerobic composting” means what is more commonly referred to as “anaerobic digestion”, e.g. production of biogas in controlled anaerobic processes, then it should be so stated. In general, the idea of a waste hierarchy limits, rather than expands, the scope of waste management options for local communities. Therefore, in the context of the AR5 report, this is policy prescriptive and should be avoided.	Taken into account. Figure 10.11 is a simplified illustration to convey the different components that are addressed in the chapter. Composting is also added to be consistent with the text. Figure 10.12 has been modified from "Anaerobic Composting" to "Anaerobic Digestion as per Reviewer suggestion.
23055	10	57				See previous comment.	See 23054
20810	10	57		57		When referring to the waste hierarchy, I would stick to the one set by the EU Directive 2008/98 (Art. 4), rather than the one suggested by Kaufman and Themelis. The latter is in fact questionable, at least in its top part. For example the better ranking of anaerobic digestion and composting compared to WTE is not always demonstrated, as it depends on several local factors such as the energy efficiency of the WTE plant, the type of displaced energy, etc. The mentioned EU Directive sets a five steps hierarchy, and is much more cautious with respect to its representativeness, as the same Art. 4 states that "When applying the waste hierarchy, Member States shall take measures to encourage the options that deliver the best overall environmental outcome. This may require specific waste streams departing from the hierarchy where this is justified by life-cycle thinking on the overall impacts of the generation and management of such waste"	Accepted. The Figure has been revised.
21224	10	57	10			Term "intransparent" might need to be rephrased or changed	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23069	10	57	10	61		Please review these pages carefully to maintain a “policy neutral” discussion regarding alternative waste management practices. Certainly, incineration with APT is a fine technology; however, the current discussion gives a rather strong pro-incineration message that is not balanced with other technologies.	The section has been reviewed and it is believed that it provides a "policy neutral" discussion by discussing all means of managing solid wastes. The section clearly states that recycling and composting are generally preferable means of managing residues. It also states that post-recycling residues can be treated by only two means: Thermal treatment with energy recovery, or Sanitary landfilling.This is the international reality with about 18% of the post-recycling MSW (200 million tons) processed in waste-to-energy plants in over forty countries.
37587	10	57	10			This hierarchy of waste mangement is commonly used by industry. EPA uses a slightly different hierarchy that addresses aneorbic digestion as a waste diversion strategy and considers waste-to-energy at the same level as modern landfill recovering and using CH4. The EPA hierarchy of waste mangement suggests the following order: of waste management practices: (1) Reduce/Reuse, (2) Recycling, Composting and Anaerobic digestion, (3) Waste to Energy/Landfilling with Energy Recovery, (4) Treatment and Disposal. The EPA hierarchy is available at www.epa.gov/osw/nonhaz/municpal/hierarchy.htm. We strongly suggest the authors review this hierarchy as well.	Accepted. The Figure has been revised.
28994	10	58		58		"SWDS" should be defined in the figure caption because a different acronym for the same concept is used in the accompaning text	Accepted. SWDS will be defined in the Figure.
23056	10	59				The current (2010) emissions from landfill CH4, wastewater CH4, and wastewater N2O represented in this figure (from EDGAR calculations) were previously stated in Table 10.2 of the same chapter. Table 10.2 also included the CO2 contribution from incineration of fossil carbon. Since 2 of the 3 trends in Figure 10.3 are steadily upward, this figure could be deleted and the “delta’s” from 1970 could be simply stated in the text. I’m not sure that I believe the drop in CH4 from SWDS (“solid waste disposal sites”/acronym not explained) after 1990, which fortuitously coincides with the beginning of the EU Landfill Directive in 1991. The authors need to check the basis for the entire series of numbers shown in the SWDS graph to check for consistencies in reporting. Realistically, it has taken a large number of years to implement the EU directive and, indeed, there is still considerable landfilling activity in the expanded EU. Especially, the authors should compare the EDGAR numbers for Europe to the following: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Waste_statistics http://scp.eionet.europa.eu/publications/WP2012_1/wp/WP2012_1	Accepted. Series was checked with the suggested Europe database. The drop in CH4 emissions seems to be related to the drop in the US and EU emissions starting 1990. A clarifying sentence in the text was added.
23058	10	59			43	lines 43ff on “urban mining”. Is this the same as recycling? The cited reference is “under review” so it is difficult to know the meaning. Or does this refer to landfill mining, e.g, digging up old landfills to recover recyclable materials? Based on empirical evidence, the trials of landfill mining in previous decades (esp. during the 1990’s) were not very successful and there was certainly no “high degree of agreement” regarding this practice. If “urban mining” does refer to recycling, then this reference could just be added to the subsequent discussion on recycling Please clarify.	Section redrafted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27864	10	59	16	60	9	The term "waste management" is not up to date anymore. It should be considered to introduce the term "resource management" instead. "Resource management" represents more the intention of effective resource use in every step of its life cycle.	Rejected. It is believed that if the term "resouce management" is introduced, readers may be confused.
33464	10	59	17	59	22	Studies of most cultures show that self-reliance and stewardship are principle rules. Wasting is not a part of most sustainable cultures. For most of history recycling and composting were the proper management of resources. Current trends in marketing and production and lack of rules that safeguard the air, water and land have allowed industries to profit by polluting. Products should not be allowed to be sold if they cannot be repaired, recycled and/or composted. In Italy the Engineers want incinerators; the public wants none of this. There are now over 100 Cities in Italy that have Zero Waste goals. Some are today attaining the 90% level of success. In parts of Europe and Asia e.g. Japan, Taiwan, there are rules for discard management. Lack of land space had Japan declare Zero Waste Global. Thousands of Japanese corporations have declared Zero Waste from landfill, air and mining. Some like Toyota, Honda, Recoh have achieved better than a 90% reduction. Not zero but close. All their factories, all over the world meet the same standard. Europe's increased landfill fee has encouraged many Cities and Businesses in the EU to adopt zero waste goals. In Europe where Commercial discards have to managed by the producers, companies are finding e.g. (breweries, wineries and food producers) that if they compost their organic discards they have hardly any other material left. Culture and managing resources have always been on the same page, waste not, want not. Communities conserve to sustain themselves. It's about jobs and resources and when applied at the highest and best use there are significant greenhouse gas reductions. The community concept must be applied at a global level. Compostable organics back to the ground for food production and recycling back to technology. The land, air and water are not sinks for poisons and compounds.	Section redrafted
27865	10	59	17	59	18	It is true that waste prevention can only to a low extent be initialized by waste management activities. Nevertheless EU-27 countries work on Waste Prevention Programmes where measures at different stages of the life cycle of products are examined. It might be worth to include an example.	Section redrafted
20361	10	59	17		19	I do not understand this sentence....as if lifestyles cannot be affected by policy or by public preferences.	Section redrafted
23057	10	59	18	59	22	Need to provide references for these statements and cite reliable comparative numbers from those references to support the statements in lines 18-22 (e.g., per capita waste generation data trends, Nordic countries approaching zero waste, etc.).	section redrafted
35419	10	59	19			The sentence referring to "zero waste" should be removed because the meaning that it gives to "zero waste" has nothing to do with what it is internationally accepted and contradicts the only peer-reviewed definition of zero waste. That is: "Zero Waste is a goal that is both pragmatic and visionary, to guide people to emulate sustainable natural cycles, where all discarded materials are resources for others to use. Zero Waste means designing and managing products and processes to reduce the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water, or air that may be a threat to planetary, human,animal or plant health." Definition by the Zero Waste International Alliance. Hence "zero waste" doesn't mean zero waste to landfill -as it is implicitly understood in the text- but zero waste to disposal (that includes landfill and incineration). Moreover, it is not true that the goal has not been approached. Many municipalities in the Zero Waste Europe network are already recycling more than 80% of their waste and realising active prevention actions which are getting them closer and closer to zero waste.	section redrafted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35477	10	59	19			The sentence referring to "zero waste" should be removed because the meaning that it gives to "zero waste" has nothing to do with what it is internationally accepted and contradicts the only peer-reviewed definition of zero waste. That is: "Zero Waste is a goal that is both pragmatic and visionary, to guide people to emulate sustainable natural cycles, where all discarded materials are resources for others to use. Zero Waste means designing and managing products and processes to reduce the volume and toxicity of waste and materials, coserve and recover all resources, and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water, or air that may be a threat to planetary, human,animal or plant health." Definition by the Zero Waste International Alliance. Hence "zero waste" doesn't mean zero waste to landfill -as it is implicitely understood in the text- but zero waste to disposal (that includes landfill and incineration). Moreover, it is not true that the goal has not been approached. Many municipalities in the Zero Waste Europe netwrok are already recycling more than 80% of their waste and realising active prevention actions which are getting them closer and closer to zero waste.	section redrafted
26887	10	59	19			The sentence referring to "zero waste" should be removed because the meaning that it gives to "zero waste" has nothing to do with what it is internationally accepted and contradicts the only peer-reviewd defintion of zerowaste. That is: "Zero Waste is a goal that is both pragmatic and visionary, to guide people to emulate sustainable natural cycles, where all discarded materials are resources for others to use. Zero Waste means designing and managing products and processes to reduce the volume and toxicity of waste and materials, coserve and recover all resources, and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water, or air that may be a threat to planetary, human,animal or plant health." Definition by the Zero Waste International ALlianc. Hence "zero waste" doesn't mean zero waste to landfill -as it is implicitely understood in the text- but zero waste to disposal (that includes landfill and incineration). Moreover, it is not true that the goal has not been approached. Many municipalities in the Zero Waste Europe netwrok are already recycling more than 80% of their waste and realising active prevention actions which are getting them closer and clsoer to zero waste.	section redrafted
27866	10	59	19	59	22	What is meant by saying that Nordic countries reached zero waste in relative terms? Decoupling from GDP? Please explain more precisely.	section redrafted
26985	10	59	19			The sentence referring to "zero waste" should be removed because the meaning that it gives to "zero waste" has nothing to do with what it is internationally accepted and contradicts the only peer-reviewed definition of zero waste. That is: "Zero Waste is a goal that is both pragmatic and visionary, to guide people to emulate sustainable natural cycles, where all discarded materials are resources for others to use. Zero Waste means designing and managing products and processes to reduce the volume and toxicity of waste and materials, coserve and recover all resources, and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water, or air that may be a threat to planetary, human,animal or plant health." Definition by the Zero Waste International Alliance. Hence "zero waste" doesn't mean zero waste to landfill -as it is implicitely understood in the text- but zero waste to disposal (that includes landfill and incineration). Moreover, it is not true that the goal has not been approached. Many municipalities in the Zero Waste Europe netwrok are already recycling more than 80% of their waste and realising active prevention actions which are getting them closer and closer to zero waste.	section redrafted
23682	10	59	2			Increased packaging efficiencies are critical and merit mention	section redrafted
27867	10	59	21	59	22	This phrase does not contain any information regarding waste and should be removed.	Section redrafted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35420	10	59	22			Waste reduction can also be achieved with active practices of home-composting. For instance in Flanders, Belgium, 41% of households do home-composting which contributed to the reduction of residual waste generation from 104kg/inh/year in 1995 to 46 in 2006. Ref: Ovam, Flemish waste agency. Waste reduction is also the result of better design and to this end the EU is revising the ecodesign directive (2009/125/EC)	Accepted. Text has been revised to refere to home composting.
35478	10	59	22			Waste reduction can also be achieved with active practices of home-composting. For instance in Flanders, Belgium, 41% of households do home-composting which contributed to the reduction of residual waste generation from 104kg/inh/year in 1995 to 46 in 2006. Ref: Ovam, Flemish waste agency. Waste reduction is also the result of better design and to this end the EU is revising the ecodesign directive (2009/125/EC)	Accepted. Text has been revised to refere to home composting.
26888	10	59	22			Waste reduction can aslo be achieved with active practices of home-composting. For instance in Flanders, Belgium, 41% of households do home-composting which contributed to the reductionof residual waste generation from 104kg/inh/year in 1995 to 46 in 2006. Ref: Ovam, Flemish waste agency. Waste reduction is also the result of better design and to this end the EU is revising the ecodesign directive (2009/125/EC)	Accepted. Text has been revised to refere to home composting.
26986	10	59	22			Waste reduction can also be achieved with active practices of home-composting. For instance in Flanders, Belgium, 41% of households do home-composting which contributed to the reduction of residual waste generation from 104kg/inh/year in 1995 to 46 in 2006. Ref: Ovam, Flemish waste agency. Waste reduction is also the result of better design and to this end the EU is revising the ecodesign directive (2009/125/EC)	Accepted. Text has been revised to refere to home composting.
28995	10	59	23	59	34	This discussion of EPR is confused and more or less wrong. The central focus of EPR is post-consumer waste. Generally speaking pre-consumer waste is readily recycled and EPR systems that allow the recycling of pre-consumer wastes to count toward regulatory targets are viewed as flawed because the pre-consumer wastes that are collected for this purposes are typically those that would have been collected anyway. If the point is that EPR could be targeted at those pre-consumer wastes that are not being recycled, such a practice does not to my knowledge exist. Thus this claim would have the status "low agreement, low evidence." Such a claim also runs somewhat counter to the rationale for EPR which attempts to create a tighter link between producers and end of life management of their products. Producers already face market incentives to manage pre-consumer wastes (in contrast to post-consumer wastes). Also general references on EPR would be appropriate here:Lifset, R. 1993. Take It Back: Extended Producer Responsibility as a Form of Incentive-based Policy. Journal of Resource Management and Technology 21(4): 163-175; OECD, ed. 2001. Extended Producer Responsibility: A Guidance Manual for Governments. Paris: OECD.	Will be taken into account. Text revised.
22114	10	59	28	59	34	EPR is already part of the EU waste legislation but not mandatory and not applicable to all industries.	Noted.
27868	10	59	35	60	3	The section on urban mining rather belongs to "Recycling and reuse" than to "Waste reduction", as the waste already exists. Moreover, the problems of urban mining such as oftentimes high costs of recovery and the danger of inflammation when depositing energetic material should be mentioned.	Accepted. Discussion on urban mining has been moved to recycling and reuse section.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
28996	10	59	43	60	3	This paragraph on urban mining needs revision for several reasons. (1) The boundary between urban mining and conventional recycling is quite muddy, and thus numbers attributed to urban mining are very prone to double-counting. (2) If urban mining is to be used as a concept distinct from conventional recycling, care must be taken. Urban mining can legitimately be used when products or materials are pulled from use-phase stocks (either dormant or actively used). Thus the term appropriately refers to activities such as recovery of copper from underground cabling that is no longer used or waste electronics that are stored (and no longer used) in user premises. Or to illegal recycling of stolen manhole covers or copper piping from buildings. It can also refer to commercial practices where older equipment that is still in use is recovered for refurbishment or recycling by businesses as part of a strategy of closed loop supply chain management. It should not be used to refer to recycling of, e.g., waste electronics that are discarded as that is a flow, not a stock, and already captured in the conventional notion of recycling (and the associated relevant statistics). (3) The limited empirical evidence on urban mining suggests that it is not especial productive. A study of active efforts in urban mining during World War I where residents of Vienna were paid to give up products and furnishings (in use) shows that even in this extreme case, the amount of material recovered was quite modest. 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. http://dx.doi.org/10.1111/j.1530-9290.2010.00257.x. (4) Finally, where a strong literature does not exist and where the productivity of this strategy is not established, it is inappropriate to rely on a reference to a paper under review as the sole source of support.	Noted.
27869	10	59	43	60	3	The definition of urban mining should be explained. Why a waste stream like paper is identified for urban mining is not understandable. Why not recycle it? The GHG saving potential should be clarified.	Accepted. Discussion on urban mining has been moved to recycling and reuse section.
20811	10	59	46	60	3	It is not clear what the reported numbers are referring to. It might be the CO2 savings from material recycling, but then it should be moved to the following paragraph. Moreover, as I don't feel comfortable with most of the numbers, I suggest to check some further literature, such as Rigamonti, M. Grosso, M. Giugliano (2010) Journal of Cleaner Production, 18, 1652-1662	Accepted. Numbers for CO2 savings have been removed as the reference is not yet published.
19646	10	6				Point 21. "Approximately only 20% of municipal solid waste (MSW) is recycled while the rest is deposited in open dumpsites or landfills." To be changed in "Approximately only 20% of municipal solid waste (MSW) is recycled, 13% is combusted with energy recovery and the rest is deposited in open dumpsites or landfills."	Taken into account but no reference given for the 13% figure on composting
30436	10	6	1	6	7	Another obstacle is lack of people resources in many industries which, as a result, may tend to focus their time on higher priority items such as safety, compliance and production, rather than energy efficiency	Noted - comment is right, but due to space constraints we have to limit number of examples
37486	10	6	1	6	6	This section seems to describe mostly (perhaps exclusively) efficiency. Because of this, the word "mitigation" in the first sentence seems superimposed; if the first use of mitigation is replaced with "energy efficiency," and the second use of mitigation with with "associated emissions reduction," then the phrase "several technologies" in line 4 could be described more specifically (and should be, as one or two examples woul benefit the reader). Further the rest of the paragraph would then read coherently as it would be targeted towards a focused topic, i.e. industrial energy efficiency.	Rejected, paragraph also highlights other mitigation optins (e.g. feedstock/fuel change, lack of control of HFC leakage, user preferences)
37485	10	6	1	6	7	This section does not include environmental permitting as one of the barriers to mitigation. If efficiency improvement projects have co-benefits such as increased production, as is many times the case, significant environmental permits may be required at potentially high costs and extended schedules.	Rejected: discussion seems to be to detailed for ES, those kind of feedbacks are discussed in the main section on barriers in 10.9

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24734	10	6	12	6	20	This comment simply reflects the limited extent to which top down models have incorporated energy efficiency potential documented in bottom up studies, due to their flawed assumptions. Suggest a statement should be removed.	Rejected for ES discussion: limitation of top down models is addressed in the main section on TP (10.10)
37488	10	6	12	6	20	This section states carbon intensity (e.g. fuel switching) is the dominant option. However, use intensity (e.g. materials substitution; materials efficiency) is also important. If use intensity is secondary, that should be stated (and referenced), but it should also be stated that over the long term as (if?) current production methods push up towards practical minimum energy use that the only viable way to get additional emissions reductions.	Taken into account - paragraph revised
25751	10	6	14	6	17	The part of "(or negative)" should be deleted completely because it is uncertain whether BECCS can be utilized in the future, as described in the section TS.3.3 (page 21, line 37). Safety confirmation, affordability and public acceptance are indispensable in CCS site selection. There is a much higher barrier to adopt BECCS than CCS because BECCS requires stable biomass supply for generation at reasonable cost. Since feasibility for BECCS has not been established so far, it is not appropriate to expect huge potential for BECCS in the future, as described in (Rhodes, 2008, page323). This literature is listed in the No7 line of this table.	Accepted, we can delete here the reference to BECCS as this is more relvant to the energy chapter and does not belong to CCS specific aspects in industry
33843	10	6	20			Add some lines of text about re-use of material	Accepted - text revised
35381	10	6	20		24	Suggestion to delete "thereby reducing emission intensity"; recycling is the only waste management options that reduces energy intensity; the same cannot be applied to substituting fossil fuels by waste, neither to energy from waste incineration or landfill gas capture. Producing energy from waste in incinerators is more energy intensive than producing energy in coal plants according to Hogg, D,. 2006, "A changing Climate for Energy from waste?". Furthermore, specific comparison analysis about energy conservation potential in various treatments options have been carried out in Morris, J., 1996. Recycling versus incineration : an energy conservation analysis. Waste Management, 3894(95), which concludes that for 24 out of 25 solid waste materials, recycling saves more energy than is generated by incinerating mixed solid waste in an energy-from-waste facility. Recycling conserves energy that would otherwise be expended extracting virgin raw materials from the natural environment and transforming them to produce goods that can also be manufactured from recycled waste materials. Furthermore, energy conserved by recycling exceeds electricity generated by energy-from-waste incineration by much more than the additional energy necessary to collect recycled materials separately from mixed solid waste, process recycled materials into manufacturing feedstocks, and ship them to manufacturers, some of whom are located thousands of miles away.	Accepted - taken into account
35433	10	6	20		24	Suggestion to delete "thereby reducing emission intensity"; recycling is the only waste management options that reduces energy intensity; the same cannot be applied to substituting fossil fuels by waste, neither to energy from waste incineration or landfill gas capture. Producing energy from waste in incinerators is more energy intensive than producing energy in coal plants according to Hogg, D,. 2006, "A changing Climate for Energy from waste?". Furthermore, specific comparison analysis about energy conservation potential in various treatmnts options have been carried out in Morris, J., 1996. Recycling versus incineration : an energy conservation analysis. Waste Management, 3894(95), which concludes that for 24 out of 25 solid waste materials, recycling saves more energy than is generated by incinerating mixed solid waste in an energy-from-waste facility. Recycling conserves energy that would otherwise be expended extracting virgin raw materials from the natural environment and transforming them to produce goods that can also be manufactured from recycled waste materials. Furthermore, energy conserved by recycling exceeds electricity generated by energy-from-waste incineration by much more than the additional energy necessary to collect recycled materials separetly from mixed solid waste, process recycled materials into manufacturing feedstocks, and ship them to manufacturers, some of whom are located thousands of miles away.	Accepted - taken into account

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26941	10	6	20		24	Suggestion to delete "thereby reducing emission intensity"; recycling is the only waste management options that reduces energy intensity; the same cannot be applied to substituting fossil fuels by waste, neither to energy from waste incineration or landfill gas capture. Producing energy from waste in incinerators is more energy intensive than producing energy in coal plants according to Hogg, D,. 2006, "A changing Climate for Energy from waste?". Furthermore, specific comparison analysis about energy conservation potential in various treatmnts options have been carried out in Morris, J., 1996. Recycling versus incineration : an energy conservation analysis. Waste Management, 3894(95), which concludes that for 24 out of 25 solid waste materials, recycling saves more energy than is generated by incinerating mixed solid waste in an energy-from-waste facility. Recycling conserves energy that would otherwise be expended extracting virgin raw materials from the natural environment and transforming them to produce goods that can also be manufactured from recycled waste materials. Furthermore, energy conserved by recycling exceeds electricity generated by energy-from-waste incineration by much more than the additional energy necessary to collect recycled materials separetly from mixed solid waste, process recycled materials into manufacturing feedstocks, and ship them to manufacturers, some of whom are located thousands of miles away.	Accepted - taken into account
30268	10	6	21		24	recycling seems to get very little attention in this report even though it holds some significant potential, perhaps on the same order as the potential from improved energy efficiency.	Accepted - the framing of this option has been improved in the report
20325	10	6	21		24	This is really funny remark. What makes it a NEW industrial activity?	Accepted
20807	10	6	25	6	27	If recycling does not include energy recovery, as it should be the case, the percentage amount of waste going to energy recovery worldwide is missing	Accepted - text revised
20806	10	6	25	6	37	The paragraph is quite confused and some sentences are questionable. See below for more details.	Accepted - text revised
35396	10	6	25		27	The figures of this sentence lack a proper reference and data source. It is probably incorrect to only mention recycling and landfilling as the two only post-consumer existing ends to waste, ie, incineration of waste should also be mentioned. Providing references and making explicit the data source is specially important in the field of waste, as normally data from waste is of highly uneven quality and not comparable, because of vast disparities in how the data is generated, definitions of terms, etc. For latest data on waste, see: Daniel Hoornweg and Perinaz Bhada-Tata, “What a waste: A Global Review of Solid Waste Management,” World Bank, March 2012.	First part of the comment: rejected - ES has necessarily rely on examples and can not refer to specific literatur (this is done in the main text). Second part: literature suggested has been used in the text
35450	10	6	25		27	The figures of this sentence lack a proper reference and data source. It is probably incorrect to only mention recycling and landfilling as the two only post-consumer exisiting ends to waste, ie, incineration of waste should also be mentioned. Providing references and making explicit the data source is specially important in the field of waste, as normally data from waste is of highly uneven quality and not comparable, because of vast disparities in how the data is generated, definitions of terms, etc. For latest data on waste, see: Daniel Hoornweg and Perinaz Bhada-Tata, “What a waste: A Global Review of Solid Waste Management,” World Bank, March 2012.	see 35396
24735	10	6	25	6	37	Suggest that there are at least 2 different aspects to the waste issue that could be noted. First, diverting organics from landfill (or mining them from landfills) avoids emissions attributed to the waste sector at present (mainly CH4) and the CH4 captured can be used as a source of zero emission energy. Inorganics can be extracted from wastes and treated in various ways to produce materials that can replace production of virgin materials, often with a net reduction in GHGs.	Taken into account in main text

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26958	10	6	25		27	The figures of this sentence lack a proper reference and data source. It is probably incorrect to only mention recycling and landfilling as the two only post-consumer exisiting ends to waste, ie, incineration of waste should also be mentioned. Providing references and making explicit the data source is specially important in the field of waste, as normally data from waste is of highly uneven quality and not comparable, because of vast disparities in how the data is generated, definitions of terms, etc. For latest data on waste, see: Daniel Hoornweg and Perinaz Bhada-Tata, “What a waste: A Global Review of Solid Waste Management,” World Bank, March 2012.	see 35396
20326	10	6	25		37	Waste management should really be in a separate chapter, otherwise all kinds of analyses will be difficult. Also, many activities in waste management are really part of the public domain (e.g drinking water, waste water)	Rejected - this was a structural decision made by co-Chairs who did not wish a separate chpater about waste. Ex cursus section in the industry chapter aims to summarize different waste aspects and give references to other places in the report dealing with the specific aspects related to waste
20808	10	6	30	6	31	What is "material substitution" in this context? Is this material recycling? How would you consider it a "non-traditional approach"?	Accepted - text revised
35382	10	6	30		34	Suggestion of deleting the sentence "waste to energy plants over their lifetime of approximately 30 years are more economic than landfilling". In fact, incinerators are the most expensive method to generate energy and to handle waste, while also creating significant economic burdens for host cities. According to the U.S. Energy Information Administration Annual Energy Outlook 2010, the projected capital cost of new waste incinerator facilities is $8,232 per kilowatt hour. That is twice the cost of coal-fired power and 60 percent more than nuclear energy. Waste incinerator operations and maintenance costs are ten times greater than coal and four times greater than nuclear. Reference: U.S. Energy Information Administration (Department of Energy), Updated Capital Cost Estimates for Electricity Generation Plants, November 2010. http://www.eia.gov/oiaf/beck_plantcosts/pdf/updatedplantcosts.pdf Moreover, billions of taxpayer dollars are spent subsidizing the construction and operations of incinerators. In 2011, Harrisburg, PA became the largest U.S. city to declare bankruptcy, and the financial blame rests squarely on the shoulders of its staggering debt payments for upgrades at the city’s incinerator.Reference: Lewis, Al, Don’t trash my city, Harrisburg activist warned, Market Watch, October 19, 2011, http://www.marketwatch.com/story/dont-trash-my-city-harrisburg-activist-warned-2011-10-19?reflink=MW_news_stmp. Also take into account that Detroit taxpayers have spent over $1.2 billion dollars in debt service payments from constructing and upgrading the world’s largest waste incinerator.Reference: Guyette, Curt, Fired Up: Detroit Incinerator’s Long Simmering Opposition, Detroit Metro Times, April 2008. http://www.metrotimes.com/editorial/story.asp?id=12748. As a result, residents have had to pay high trash disposal fees of over $150 per ton. The city could have saved over $55 million in just one year if it had never built the incinerator. For a fraction of these costs, investments in recycling, reuse and remanufacturing would create significantly more business and employment opportunities. Reference: Seldman, Neil, Recycling First -Directing Federal Stimulus Money to Real Green Projects, E Magazine, 2008.	Accepted - deleted from Executive Summary, statement still appears in waste section but has been qualified

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35434	10	6	30		34	Suggestion of deleting the sentence "waste to energy plants over their lifetime of approximately 30 years are more economic than landfilling". In fact, incinerators are the most expensive method to generate energy and to handle waste, while also creating significant economic burdens for host cities. According to the U.S. Energy Information Administration Annual Energy Outlook 2010, the projected capital cost of new waste incinerator facilities is $8,232 per kilowatt hour. That is twice the cost of coal-fired power and 60 percent more than nuclear energy. Waste incinerator operations and maintenance costs are ten times greater than coal and four times greater than nuclear. Reference: U.S. Energy Information Administration (Department of Energy), Updated Capital Cost Estimates for Electricity Generation Plants, November 2010. http://www.eia.gov/oiaf/beck_plantcosts/pdf/updatedplantcosts.pdf Moreover, billions of taxpayer dollars are spent subsidizing the construction and operations of incinerators. In 2011, Harrisburg, PA became the largest U.S. city to declare bankruptcy, and the financial blame rests squarely on the shoulders of its staggering debt payments for upgrades at the city's incinerator.Reference: Lewis, Al, Don't trash my city, Harrisburg activist warned, Market Watch, October 19, 2011, http://www.marketwatch.com/story/dont-trash-my-city-harrisburg-activist-warned-2011-10-19?reflink=MW_news_stmp. Also take into account that Detroit taxpayers have spent over $1.2 billion dollars in debt service payments from constructing and upgrading the world's largest waste incinerator.Reference: Guyette, Curt, Fired Up: Detroit Incinerator's Long Simmering Opposition, Detroit Metro Times, April 2008. http://www.metrotimes.com/editorial/story.asp?id=12748. As a result, residents have had to pay high trash disposal fees of over $150 per ton. The city could have saved over $55 million in just one year if it had never built the incinerator. For a fraction of these costs, investments in recycling, reuse and remanufacturing would create significantly more business and employment opportunities. Reference: Seldman, Neil, Recycling First -Directing Federal Stimulus Money to Real Green Projects, E Magazine, 2008.	Accepted - deleted from Executive Summary, statement still appears in waste section but has been qualified

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26942	10	6	30		34	Suggestion of deleting the sentence "waste to energy plants over their lifetime of approximately 30 years are more economic than landfilling". In fact, incinerators are the most expensive method to generate energy and to handle waste, while also creating significant economic burdens for host cities. According to the U.S. Energy Information Administration Annual Energy Outlook 2010, the projected capital cost of new waste incinerator facilities is $8,232 per kilowatt hour. That is twice the cost of coal-fired power and 60 percent more than nuclear energy. Waste incinerator operations and maintenance costs are ten times greater than coal and four times greater than nuclear. Reference: U.S. Energy Information Administration (Department of Energy), Updated Capital Cost Estimates for Electricity Generation Plants, November 2010. http://www.eia.gov/oiaf/beck_plantcosts/pdf/updatedplantcosts.pdf Moreover, billions of taxpayer dollars are spent subsidizing the construction and operations of incinerators. In 2011, Harrisburg, PA became the largest U.S. city to declare bankruptcy, and the financial blame rests squarely on the shoulders of its staggering debt payments for upgrades at the city's incinerator.Reference: Lewis, Al, Don't trash my city, Harrisburg activist warned, Market Watch, October 19, 2011, http://www.marketwatch.com/story/dont-trash-my-city-harrisburg-activist-warned-2011-10-19?reflink=MW_news_stmp. Also take into account that Detroit taxpayers have spent over $1.2 billion dollars in debt service payments from constructing and upgrading the world's largest waste incinerator.Reference: Guyette, Curt, Fired Up: Detroit Incinerator's Long Simmering Opposition, Detroit Metro Times, April 2008. http://www.metrotimes.com/editorial/story.asp?id=12748. As a result, residents have had to pay high trash disposal fees of over $150 per ton. The city could have saved over $55 million in just one year if it had never built the incinerator. For a fraction of these costs, investments in recycling, reuse and remanufacturing would create significantly more business and employment opportunities. Reference: Seldman, Neil, Recycling First -Directing Federal Stimulus Money to Real Green Projects, E Magazine, 2008.	Accepted - deleted from Executive Summary, statement still appears in waste section but has been qualified
20809	10	6	31	6	32	I don't think that this sentence is applicable to all situations. The actual economic convenience of WTE compared to landfilling depends also on the extempt of subsidies or incentives given to the WTE plant, as well as of the inclusion of externalities and of post-closure landfill costs.	Taken into account, see comment 35382
37487	10	6	6	6	6	HFC and SF6	Accepted
24733	10	6	8	6	11	Agree strongly with this statement. This is important to keep if looking to reduce chapter length. Also, suggest note that other complementary policies that have proven effective and could be included are mandatory energy assessments for large companies and mandatory minimum equipment performance standards. Suggest append to the end of line 11: 'Other complementary policies that have proven effective included mandatory energy assessments for large companies (such as the Energy Efficiency Opportunities program in Australia) Citation: Price, L. and Lu, H. 2011. "Industrial energy auditing and assessments: A survey of programs around the world", 2011 Summer Study Proceedings, European Council for an Energy Efficient Economy]	Thank you, will keep text, but due to space constraints no explenatory details can be added
20256	10	6	8	6	11	KEEP this paragraph as it is important information for policy maker.	Accepted, thank you

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
33271	10	6	38			The introduction should highlight a set of key questions that will be answered by the following chapter.	Rejected; the key questions to be addressed are quite clear by the structure of the chapter (section headings) and the overall structure of the whole report. Due to severe space constraints we concentrated on highlighting the focus of the section (industrial emissions), the system boundary and to give as a kind of reader guidance a full overview of direct and indirect mitigation measures in the sector (cf. figure 10.2)
33272	10	6	38			The introduction does provide a brief overview of differences to the AR4. Please consider highlioghting new developments in the literature.	Accepted, we included a very brief mention at the start of the introduction
24310	10	6	1	6	7	Need to add another important barrier in the ES and in the main text -- "lack of technology transfer and international cooperation". Cai W, et al (2009) (Cai W, Wang C, Liu W, et al., 2009. Sectoral analysis for international technology development and transfer: Cases of coal-fired power generation, cement and aluminium in China. Energy Policy, 37: 2283-2291.) investigated China's energy-intensive sectors and found large technical gaps and barriers in mitigation. They think this problem will be greatly eased via enhanced technology transfer and international cooperation.	Rejected - TT does not appear to be a barrier in the reference rather a policy
31549	10	6	1	6	7	Need to add another important barrier in the ES and in the main text -- "lack of technology transfer and international cooperation". Cai W, et al (2009) (Cai W, Wang C, Liu W, et al., 2009. Sectoral analysis for international technology development and transfer: Cases of coal-fired power generation, cement and aluminium in China. Energy Policy, 37: 2283-2291.) investigated China's energy-intensive sectors and found large technical gaps and barriers in mitigation. They think this problem will be greatly eased via enhanced technology transfer and international cooperation.	Rejected - TT does not appear to be a barrier in the reference rather a policy
24309	10	6	8	6	9	Suggest deleting from "e.g." to "R&D". They will cause confusion, because, first, the first two examples have never appeared in the main text in the exact words; second, "voluntary actions by industries" also don't represent the commonality in all sectors. More importantly, "voluntary actions" should not be grouped as policies. They are not driven by policies. They are voluntary.	Rejected; in many countries voluntary agreements are explicitly part of the policiy portfolio and understood as "voluntary agreement with the policy"; R&D appears in the main text (cf. Page 54 line 6) as standards does (page 52 line 5)
31548	10	6	8	6	9	Suggest deleting from "e.g." to "R&D". They will cause confusion, because, first, the first two examples have never appeared in the main text in the exact words; second, "voluntary actions by industries" also don't represent the commonality in all sectors. More importantly, "voluntary actions" should not be grouped as policies. They are not driven by policies. They are voluntary.	Rejected; in many countries voluntary agreements are explicitly part of the policiy portfolio and understood as "voluntary agreement with the policy"; R&D appears in the main text (cf. Page 54 line 6) as standards does (page 52 line 5)

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20170	10	60				Co-processing of waste is an option for reducing GHG emissions. Please check the LBNL report on co-processing of waste in the cement industry: Hasanbeigi, Ali; Lu, Hongyou; Price, Lynn. (2012). International Best Practices for Pre-processing and Co-processing of Municipal Solid Waste and Sewage Sludge in the Cement Industry. Berkeley, CA: Lawrence Berkeley National Laboratory. LBNL-5581E. Available at http://china.lbl.gov/publications/co-processing-best-practice	Taken into account. This is already addressed under alternative fuel in the industry chapter.
23684	10	60	10		47	Many municipalities have co- collection of food and yard wastes. This can then be dry digested (Monterrey CA has a facility that has just started operation and these units are more common in Europe- or directly composted. Windrow systems can be effectively used for combined food and yard waste systems. Odor control through covering of windrows with finished composts is a cost effective alternative to enclosed systems. There are also a range of decentralized composting operations that are developing in conjunction with urban agriculture- Growing Power based in Minnesota is one example. This discussion is very centered on high capitol waste management systems and does not give appropriate attention or credit to less engineered systems. For example, use of food scraps for animal feed is a common practice in some areas- potential for composting in peri urban agriculture is not discussed. As the majority of population increase is expected to occur in developing nations with out highly engineered infrastructure- this discussion is very misguided and misses many potential alternatives that provide high energy potential as well as resource conservation potential- a contact for Italy's food diversion and composting program is Massimo Centemero centemero@compost.it	Rejected. The discussion already addresses composting of food and yard wastes. The use of food waste for animal feed is not the focus of the composting section.
19806	10	60	10	60	18	Other than the electricity produced, the life-span of WTE is way longer. Both these factors suggest that WTE is preferable in financial terms.	Noted.
35422	10	60	10	60	18	Suggestion to either delete the paragraph or add content. The text as it stands bases all the argumentation on a single case scenario that is comparing incineration with landfill without taking into account waste composition or pre-treatments. For instance, if a system of source separation of organic waste is implemented and complemented with a pre-treatment process for residual waste the methane emissions will be a lot lower -less climate impact-.	Taken into account. Text has been added to clarify the case of Europe.
35480	10	60	10	60	18	Suggestion to either delete the paragraph or add content. The text as it stands bases all the argumentation on a single case scenario that is comparing incineration with landfill without taking into account waste composition or pre-treatments. For instance, if a system of source separation of organic waste is implemented and complemented with a pre-treatment process for residual waste the methane emissions will be a lot lower -less climate impact-. The wording as it stands it is too US centered. In Europe, thanks to the landfill directive -and especially in view of its next revision in 2014- the amount of biodegradables in landfills are being considerably reduced. It is hence realistic to think that with the removal of biodegradable waste from MSW and the pre-treatment processes that biologically stabilise wet fraction, EU landfills in the future will have very low methane emissions.	Taken into account. Text has been added to clarify the case of Europe.
28997	10	60	10	60	18	This discussion of landfill methane needs to be expanded (and/or cross-referenced with other chapters in the report if this topic is treated elsewhere). Given the importance of methane releases from landfills, the uncertainty around the topic, both technical (e.g., the amount of methane realized in early stages of landfilling before intermediate or final cover is installed) and social (e.g., how many landfills actually have methane capture and how extensive and well maintained are those systems) is very relevant here.	Taken into accoount. Text has been revised to refer to variation in methane collection efficiency in landfills.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26890	10	60	10	60	18	Suggestion to either delete the paragraph or add content. The text as it stands bases all the argumentation on a single case scenario that is comparing incineration with landfill without taking into account waste composition or pre-treatments. For instance, if a system of source separation of organic waste is implemented and complemented with a pre-treatment process for residual waste the methane emissions will be a lot lower -less climate impact-. The wording as it stands it is too US centered. In Europe, thanks to the landfill directive -and especially in view of its next revision in 2014- the amount of biodegradables in landfills are being considerably reduced. It is hence realistic to think that with the removal of biodegradable waste from MSW and the pre-treatment processes that biologically stabilise wet fraction, EU landfills in the future will have very low methane emissions.	Taken into account. Text has been added to clarify the case of Europe.
27870	10	60	10	60	18	The technology of bio-mechanical pre-treatment was not considered at all. Bio-mechanical pre-treatment is reducing emission of GHG significantly.	Rejected. Due to size limitation of the waste section, biomechanical treatment was not discussed.
26988	10	60	10	60	18	Suggestion to either delete the paragraph or add content. The text as it stands bases all the argumentation on a single case scenario that is comparing incineration with landfill without taking into account waste composition or pre-treatments. For instance, if a system of source separation of organic waste is implemented and complemented with a pre-treatment process for residual waste the methane emissions will be a lot lower -less climate impact-. The wording as it stands it is too US centered. In Europe, thanks to the landfill directive -and especially in view of its next revision in 2014- the amount of biodegradables in landfills are being considerably reduced. It is hence realistic to think that with the removal of biodegradable waste from MSW and the pre-treatment processes that biologically stabilise wet fraction, EU landfills in the future will have very low methane emissions.	Taken into account. Text has been added to clarify the case of Europe.
23059	10	60	11	60	12	“Gas collection starts after a landfill cell has been built up to its final height which may take several years.” This statement is not true. Many landfill sites install gas collection concurrent with filling using horizontal collectors, or by the upward extension of vertical wells concurrent with filling. For example, from a recent database compiled by the California regulatory agency CalRecycle, 94% of the total mass of waste in permitted California landfills in 2010 was under active gas extraction. This database is titled “ “Department of Resources Recycling and Recovery (CalRecycle) October 1, 2012 (update) Landfill Data Compilation” by S. Walker, Manager, CalRecycle Engineering Support Branch (ESB) The Microsoft Excel format provides updated CalRecycle compilation of site-specific California landfill data intended to support research and statewide inventories relating to bioenergy, climate change, landfill design, and environmental performance. CalRecycle requests that the information be referenced accordingly.” This publically-available database will also be cited in the next comment. I can readily supply this database upon request.	Accepted. Sentence has been deleted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23060	10	60	12	60	13	The 6 million number for capture is a global underestimate. From the same California database cited in the previous comment (Walker, 2012), we have the following data compiled for 2010 for the state of California alone: 879,000 t of landfill CH4 that was captured and either used for energy or flared (1 t = 1000 kg). This is the sum of site-specific values for landfill gas recovery rates and % CH4 reported to CalRecyle, the California state regulatory agency which permits California landfills. This database is publically-available from CalRecycle upon request. In the U.S. as a whole, there are currently more than 600 projects in the U.S. which recover landfill CH4 for energy use (see www.epa.gov/lmop, the U.S. EPA Landfill Methane Outreach Program, which maintains a database for U.S. sites and tracks U.S. trends); you should also contact the International Energy Agency (Mr. Tom Kerr, who tracks “biogas” internationally, including both landfill gas and anaerobic digester biogas).	Rejected. Data from one country only cannot be used.
20812	10	60	12	60	13	Are these some annual estimates? Please clarify	Taken into account. It has been clarified that these are annual estimates.
23061	10	60	14	60	18	The relative economics of incineration vs. landfill gas recovery are highly site-specific. In the case of the paper cited, the relative assumptions need to be taken into consideration. This is not a universally true statement and should probably be deleted.	Accepted. Text has been clarified.
23062	10	60	14	60	18	Repeat of previous comment. Did not enter correctly and could not delete...The relative economics of incineration vs. landfill gas recovery are highly site-specific. In the case of the paper cited, the relative assumptions need to be taken into consideration. This is not a universally true statement and should probably be deleted.	Accepted. Text has been clarified.
23683	10	60	14			This is unlikely- relative efficiency of decomposition and methane generation potential in a landfill in comparison to a dedicated digester suggest that dedicated digesters are much more efficient- Spokas et al., 2006 measured CH4 capture in different landfillls in relation to fugitive gas release and saw what appear ato be very low efficiencies. The same authors that you quote here have written another study that looked at the relative gas capture rates in landfills in CA- that is more indicative of the efficienty of these systems. Also with the advent of dry digestion technologies, use of existing digestion capacity, potential for decentralized or smaller scale AD facilities- thisstatement merits additional review. Finally there is the issue of high rates of gas release during the period where cells are being filled and gas collection hasn't started	Taken into account.
20813	10	60	17	60	18	See my previous comment on the similar sentence in the Executive Summary	Taken into account. The text has been revised to clarify that for other cases, the economics may be different.
23063	10	60	20	60	34	Older papers from “semi aerobic” Japanese landfills and some of the first papers in the current literature are suggesting that landfill aeration and the semi-aerobic landfilling of waste following mechanical-biological treatmer (MBT) may be associated with increased emissions of N2O. This caveat needs to be added to the discussion. (e.g., (1) Waste Manag. 2013 Feb 27. pii: S0956-053X(13)00058-5. doi: 10.1016/j.wasman.2013.01.028. [Epub ahead of print] Spatial variability of nitrous oxide and methane emissions from an MBT landfill in operation: Strong N2O hotspots at the working face; (2) He, P., et al., J Environ Sci (China). 2011;23(6):1011-9. N2O and NH3 emissions from a bioreactor landfill operated under limited aerobic degradation conditions. NOTE: MBT is a pre-landfilling partial composting step which is widely practiced in northern Europe (esp. Germany and Austria) to reduce organic carbon to levels permitted by the EU Landfill Directive. This practice should also be included in the discussion on waste management.	Accepted. Text has been revised to include reference to N2O emissions from landfill aeration.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37588	10	60	28	60	34	It is unclear as to why such a large section is devoted to landfill aeration. Is this the same as semi aerobic landfillfing? If so, this is still a new technology and has not been widely used. We suggest shortening this paragraph and including a caveat that this technology, while promising, has not been widely tested and proven especially in developing countries.	Rejected. This is a relatively new technology and one of the aims of the AR5 reports is to dicuss new developments in the field. It is clearly stated that this is a promising technology. However, the only part of the comment that may be considered is that it has not been widely applied in developing countries.
23064	10	60	35	60	47	This section confuses aerobic composting and anaerobic digestion with production of biogas (describing the latter as composting in “closed chemical reactors.”) Please clarify the discussion regarding aerobic vs. anaerobic processes in this section. Both processes require source-separated wastes. Please contact the IEA for international information on biogas production (http://www.iea-biogas.net).	Accepted. Text has been revised.
23065	10	60	35	60	47	This section confuses aerobic composting and anaerobic digestion with production of biogas (describing the latter as composting in “closed chemical reactors.”) Please clarify the discussion regarding aerobic vs. anaerobic processes in this section. Both processes require source-separated wastes. Please contact the IEA for international information on biogas production (http://www.iea-biogas.net).	Accepted. Text has been revised.
20814	10	60	35	60	35	Title should read "Composting and anaerobic digestion"	Accepted. Title has been revised.
25995	10	60	35	60	47	Composting for job creation in small villages is shown in the book "Guia para Elaboracao de Projetos MDL", Guide for CDM Projects Preparation, by M. N. Da Silva et all, published by Fundacao Banco do Brasil. www.fbb.org.br	Rejected. Due to size limitation of the waste section, discussion cannot be expanded to job creation.
37589	10	60	35	60	47	In addition to composting, we suggest the authors include a section on anerobic digestion of MSW, which is another promising waste diversion technlogy, especially when composting is not applicable or practical.	Taken into account. Anaerobic digestion has been added to the discussion.
20815	10	60	38	60	41	There seems to be a lot of confusion in the description. Composting and AD are two completely different biological processes. And I would refer to them as "biological" and not "chemical" processes.	Accepted. Text has been revised.
20816	10	60	41	60	43	The recent increasing trend of anaerobic digestion for food waste, observed in countries like Germany, Austria, Spain, Italy, should not be neglected, but rather emphasised! Switching from composting to AD for food waste treatment is very favourable for GHG emission reduction, as reported for example in "Waste opportunities — Past and future climate benefits from better municipal waste management in Europe" (European Environmental Agency, 2011) and in Grosso et al. (2012) “The implementation of anaerobic digestion of food waste in a highly populated urban area: an LCA evaluation” Waste Management & Research 30, 78-87	Taken into account. The waste hierarchy figure has been changed to include anaerobic digestion.
28998	10	60	44	60	47	Figures such as those in these sentences on windrow composting should have a supporting reference. Surely the US EPA or the US Composting Council has the appropriate references.	Noted. Reference has been added.
35421	10	60	6			It is more accurate to replace "landfills" with "disposal".	Accepted. Text has been revised.
35479	10	60	6			It is more accurate to replace "landfills" with "disposal".	Accepted. Text has been revised.
26889	10	60	6			It is more accurate to replace "landfills" with "disposal".	Accepted. Text has been revised.
26987	10	60	6			It is more accurate to replace "landfills" with "disposal".	Accepted. Text has been revised.
23687	10	61				The minimal discussion of source seperated organics here is not appropriate.	Rejected.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23685	10	61				Here again- energy value in food scraps from source separated materials is much higher- Fats oils and grease is one example, co-digestion see US EPA report on digestion of commercial food waste at E. Bay Mud wastewater utility- see City of Toronto that has anaerobically digested food residuals. It makes much more sense to look at components of MSW rather than bulk values- contacts include Dave PArry parrydl@cdmsmith.com, Ian Dickinson re Toronto ian.dickinson@aecom.com	Taken into account. Table has been deleted.
20819	10	61				A further paragraph should be added on the topic of energy recovery efficiency. This is a very critical parameter, which plays a major role in determining the actual GHG reduction achievable with this technology. In this sense a reference to the so-called "R1 formula" reported in the EU Directive 2008/98 should be added. The Directive defines a performance threshold for waste incineration plants to be considered as a recovery (R) rather than a disposal (D) operation. In order to achieve this threshold, combined heat and power operation (CHP) is advisable, while plants producing only electricity, an advanced thermal cycle is required, with at least 23-24% conversion efficiency. The true performance of WTE plants with regards to GHG reduction is also related to the type of displaced energy, coal being the most favourable.	Taken into account. Text has been revised.
20817	10	61		61		RDF calorific value should be added to the table. This can be in the range 10-20, as reported in CEN/TS 15359:2006, which defines the RDF classification. Please also note that in the EU, RDF is now defined as SRF - Solid Recovered Fuel	Taken into account. Table has been deleted.
23066	10	61	1			This section only discusses incineration/high temperature combustion processes for waste and should thus be titled “incineration”, not “energy from waste”. “Energy from waste” implies that landfill gas utilization and anaerobic digester biogas utilization will also be discussed.	Rejected. Other options of recovery of energy is included as examples in the discussion.
20363	10	61	1		26	There is no discussion on the (low) efficiency of energy recovery from incinerators or WTE plants, and resulting reductions in GHG emissions. Moreover, plastics are a fossil source of carbon (and CO2), and therefore cannot be discounted as a reduction. The current discussion of WTE is very superficial and does not address GHG issues. Delete?	Accepted. Text has been revised.
19808	10	61	13	61	14	This is an old reference. CDM alone must have brought many new WTE plants by 2012.	Taken into account.Text has been revised to show the time frame discussed by the reference
23686	10	61	18			And controlled anaerobic digestion has negligible emissions and allows for nutrient capture and use of digestate- and gas here can be used for both electricity as well as for fuel	Taken into account. Anaerobic digestion has been added to the discussion under Composting and anaerobic digestion.
23067	10	61	5			This general table with the energy content of many fuel sources could be omitted in this "waste" section as there are many references in the literature which indicate that municipal solid waste (due to paper, wood, garden waste, and food water) has an energy content equivalent to a low grade coal.	Accepted. Table is deleted.
19807	10	61	5			Natural gas appears twice in the table.	Taken into account. Table has been deleted.
24770	10	61	5			Natural gas appears twice, and the value for crude oil seems very low. Please refer to the values, for example, in Oak Ridge National Laboratory, (2011), Biomass energy data book: Edition 4, Appendix A- Lower and Higher Heating Values of Gas, Liquid and Solid Fuels, http://cta.ornl.gov/bedb/appendix_a/Lower_and_Higher_Heating_Values_of_Gas_Liquid_and_Solid_Fuels.pdf	Taken into account. Table has been deleted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
37590	10	61	6	61	19	It is unclear to the reviewer why waste to energy (WTE) is being described in a section titled Landfilling and methane capture from landfills. WTE is a pre-landfill technology, where the waste is combusted prior to landfilling. We suggest that this section be strengthened to provide a more robust description of landfilling and landifll capture. The WTE sentence should be moved to the"Energy Recovery from Waste Section" below. Futhermore, there is little value is comparing the capital investment required to build a sanitary landfill versus a WTE plant. They are different technologies and use different waste streams, making it a apples to orange comparision.	First part of comment: Rejected. WTE is discussed under a separate title and not under landfilling and methane recovery from landfills. Second part of comment: the comparison is done on a MSW ton basis.
20818	10	61	9	61	9	When referring to MBT, "compost" should not be mentioned. Compost for utilisation in agriculture can be produced only from clin organic waste separated at the source.	Rejected. Some MBT plants claim that their compost is used
35423	10	62				The figure 10.12 about percentages per waste treatment is partial and misleading as it doesn't include the the waste arisings for every country. Indeed, one would see that countries at the bottom of the graph generate a lot less waste per capita than those at the top, showing a correlation between those who generate more waste and those who for instance use more waste to energy. In fact, countries on the top, despite having more advanced waste treatment techniques happen to be more unsustainable than those at the bottom as far as MSW is concerned because of low waste arisings. For sake of clarity and fairness it is suggested to use the graph 3 of the following study: Jofra M., Ventosa I., 2013. "Incineration overcapacity and waste shipping in Europe: the end of the proximity principle?"	It is true that waste generation per capita is not included in arriving at the ratings of various countries. Waste generation per capita is a function of economic level plus lifestyle/culture in a country. E.g the Report will meniton that US generates about 50% more tons per cpaita than EU amd Japan. Chapter 10 is on the environmental impacts of industry and the waste management industry has no control/influence whatsoever on the waste generation in a country. Figure 10.12 compares how different each country manages the waste generated.A comment to this effect will be included.
35481	10	62				The figure 10.12 about percentatges per waste treatment is partial and misleading as it doesn't include the the waste arisings for every country. Indeed, one would see that countries at the bottom of the graph generate a lot less waste per capita than those at the top, showing a correlation between those who generate more waste and those who for instance use more waste to energy. In fact, countries on the top, despite having more advanced waste treatment techniques happen to be more unsustainable than those at the bottom as far as MSW is concerned because of low waste arisings. For sake of clairity and fairness it is suggested to use the graph 3 of the following study: Jofra M., Ventosa I., 2013. "Incineration overcapacity and waste shipping in Europe: the end of the proximity principle?"	Noted.
26891	10	62				The figure 10.12 about percentatges per waste treatment only tells a part of the story since it doesn't include the the waste arisings for every country. Indeed, one would see that countries at the bottom of the graph generate a lot less waste per capita than those at the top, showing a correlation between those who generate more waste and those who for instance use more waste to energy. In fact, countries on the top, despite having more advanced waste treatment techniques happen to be more unsustainable than those at the bottom as far as MSW is concerned because of low waste arisings. For sake of clairity and fairness it is suggested to use the graph 3 of the following study: Jofra M., Ventosa I., 2013. "Incineration overcapacity and waste shipping in Europe: the end of the proximity principle?"	Noted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26989	10	62				The figure 10.12 about percentatges per waste treatment is partial and misleading as it doesn't include the the waste arisings for every country. Indeed, one would see that countries at the bottom of the graph generate a lot less waste per capita than those at the top, showing a correlation between those who generate more waste and those who for instance use more waste to energy. In fact, countries on the top, despite having more advanced waste treatment techniques happen to be more unsustainable than those at the bottom as far as MSW is concerned because of low waste arisings. For sake of clairity and fairness it is suggested to use the graph 3 of the following study: Jofra M., Ventosa I., 2013. "Incineration overcapacity and waste shipping in Europe: the end of the proximity principle?"	Noted.
23068	10	62	1	62	2	Please remove the header “The Sustainable Waste Management Ladder” and the line following, the green arrow to the right, and the unexplained note “USA SOG 2008”. Please cite just the Eurostat data.	Taken into account. Figure has been revised.
37591	10	62	1			This figure would be more clear if the U.S. was just added as another country bar rather than being displayed in the background.	Taken into account. Figure has been revised.
27871	10	62	1	62	2	The Sustainable Waste Management Ladder is not in line with the Waste Hierarchy from page 57. Incineration is estimated higher than Recycling (Netherlands in front of Germany).	Taken into account. Figure has been revised.
34796	10	62	13	62	13	"Industrial wastewater has usually both high biochemical oxygen demand and suspended solid" to be replaced with" "Industrial wastewater has usually both high biochemical oxygen demand and chemical oxygen demand" Reason: "Many process industries’ wastewater could have less carbon- contributing suspended solids but more dissolved carbon- contributing materials. Chemical oxygen demand is a better terminology to characterise wastewater for methane emissions."	Accepted. Text will be corrected
23689	10	62	14			How about direct anaerobic digestion of high strength organics?	Accepted. A mention will be included in the section.
34797	10	62	14	62	14	"Industrial wastewater has usually both high biochemical oxygen demand and suspended solid" to be replaced with "Industrial wastewater has usually both high biochemical oxygen demand and chemical oxygen demand" Reason: Same as Row 3.	Accepted. Text revised

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34798	10	62	16	62	16	"municipal wastewater treatment. The characteristics of the wastewater and the off-site GHG" to be replaced with "municipal wastewater treatment. The characteristics of the wastewater, level of anaerobicity in treatment and the off-site GHG" Reason: "GHG emissions from wastewater depends upon level of anaerobic condition maintained in treatment; higher the anaerobic level, more methane will be produced (e.g. facultative lagoon versus anaerobic lagoon)."	Accepted. Text revised
20820	10	62	2	62	2	In the caption of Fig. 10.14, "Disposition" should be replaced with "Management"	Accepted. Text revised
37592	10	62	4	63	33	It would be helpful in this section to separate the discussion of municipal and industrial wastewater treatment. The primary sources of methane in developing countries (Nigeria, China, Indonesia) are attributed to municipal wastewater disposal processes (no treatment, latrines, septic systems). The section could also benefit from some additional discussion of the role that biosolids handling in developed countries plays in methane generation and the opportunities that exist for anaerobic processing combined with CHP (biogas utilization) to manage energy costs at these plants. Overall this section seems a bit scattered and it seems that the waste section in general could benefit from a more organized approach that considers the factors that affect methane production in this sector (waste loading, temperature, treatment technology).	Accepted. Text revised
37593	10	62	7	62	8	These systems are very energy intensive and often represent some of the largest municipal and commercial energy users.	Accepted. Text revised
34801	10	63	14	63	14	"wetlands are a less carbon intensive technology than the conventional wastewater treatment" to be replaced with "wetlands are a less carbon and energy intensive technology than the conventional wastewater treatment" Reason: "Lesser energy required to operate wetlands is a key driver which reduced indirect (Scope 2 and 3) GHG emissions."	Accepted. Text revised
23691	10	63	25			These systems all require water to transport the wastewater and a high energy systems- again decentralized systems are a much more appropriate model	Some of the mentioned advanced technologies can also be used in decentralized systems. New references have been included
23690	10	63	3			Human HSO systems as discussed are likely comparable to animal systems- look here to alternative models for treatment of animal wastes. Craig Frear at Washington State University has excellent examples here that would be applicable	Rejected. The reference is not specified. Several technologies were mentioned for the treatment of conventional sewage.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34799	10	63	5	63	5	"more concentrated in the amount of oxygen demand per volume of sewage in comparison with" to be replaced with "more concentrated in the amount of biochemical and/ or chemical oxygen demand per volume of sewage in comparison with" Reason: "Oxygen demand is open to numerous interpretations- CBOD, BOD, COD, etc."	Taken into account. Text has been revised.
34800	10	63	9	63	9	"treatment and the reuse of the treated effluent for agricultural reuse could be a sustainable solution" to be replaced with "reduction and the reuse of the treated effluent for agricultural reuse could be a sustainable solution" Reasone: "	Tthe sentence refers to wastewater that has already been generated
27872	10	64	7	91	33	Most links don't work. Please correct it.	Accepted
27873	10	66	33	66	36	Link is wrong. Please use: http://www.bmu.de/en/topics/economy-products/ressourceneffizienz/german-resource-efficiency-programme-progress/.	Accepted
27125	10	68	1	68	2	Update in teh biography (see comment above). The new reference should read: CEPI (2012). Annual Statistics Report. Confederation of European Paper Industries, Brussels, Belgium.	Accepted
27127	10	68	1	68	2	Update in teh biography (see comment above). The new reference should read: CEPI (2012). Annual Statistics Report. Confederation of European Paper Industries, Brussels, Belgium.	Accepted
23051	10	7				In the current figure, flows from “Waste Industry” only go to “scrap” or to “landfill/disposal.” In reality, there is a great deal of a) internal industrial recycling of materials and b) internal industrial use of waste materials with useful energy content (e.g., subsequent discussions in Chapter 10: Sections 10.4, 10.9.1, 10.11.1-10.11.3). Most of this is not done externally by the “waste industry”(e.g., waste companies) but internally within specific industrial operations. Moreover, “scrap” does not encompass the diversity of the secondary materials markets, as “scrap” only implies putting end-of-life-cycle materials into new products (e.g., scrap paper or ferrous metals). Therefore, I would recommend modest revisions to the figure: changing waste industry to “industrial waste”, changing the word “scrap” to “secondary materials”, and changing “landfill/disposal” to “energy use/disposal.”	Taken into account - figure has been revised
23052	10	7				The 2010 wastewater total is higher than the solid waste total in this figure. This is not consistent with AR4 proportions but is consistent with Table 10.2 in this chapter. Please check the basis of these numbers and compare with the basis of the AR4 numbers.	Final figures show that in 1990 "Landfill and Waste Incineration" was 8.8% of total industrial emissions while "Wastewater" was 8.7%. These values have changed to 7.0% for "Landfill and Waste Incineration" and 8.1% for "Wastewater" in 2010.
34795	10	7				Figure 10.1 will look better with ‘manufacturing’ in one line rather than in two lines now.	Figure will be improved by graphic designer
33274	10	7	13			Width and colour of the arrows in this figure are not defined. Please provide a legend or an explanation in the caption.	Figure will be improved by graphic designer

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
33275	10	7	13			The figure shows six options for GHG emission mitigation. Section 10.4 refers to this figure and discusses five options (as 'Product' and 'Intensity of use' seem to have been summarized in one). This discrepancy should be resolved and I'd suggest to modify the figure accordingly.	Accepted - text revised
37490	10	7	13			It would be helpful to have a table (associated with Figure 10.1) that has definitions of manufacturing, industry, materials industry, etc.	Accepted, definitions now included in last paragraph of the introduction
19777	10	7	19	7	20	"one third of overall emissions". In the executive summary (point 1) the respective figure is 18.4% or 24%.	Accepted - the various mentions of this in the text are now consistent
25982	10	7	19	7	21	Now it says thas industry emits one third of global emissions. Please, compare with line 2 of page 4.	Accepted - the various mentions of this in the text are now consistent
35411	10	7	22			Suggestion to delete "thereby reducing emission intensity"; whereas it is true that waste is processed to replace natural raw materials and fossil fuels in industries, the reduction of emission intensity is only true for recycling, not for energy from waste incineration or landfill gas capture. Producing energy from waste in incinerators is more energy intensive than producing energy in coal plants according to Hogg, D,. 2006, "A changing Climate for Energy from waste?"	Accepted. See comment 35467
35468	10	7	22			Suggestion to delete "thereby reducing emission intensity"; whereas it is true that waste is processed to replace natural raw materials and fossil fuels in industries, the reduction of emission intensity is only true for recycling, not for energy from waste incineration or landfill gas capture. Producing energy from waste in incinerators is more energy intensive than producing energy in coal plants according to Hogg, D,. 2006, "A changing Climate for Energy from waste?"	Accepted. See comment 35467
26878	10	7	22			Suggestion to delete "thereby reducing emission intensity"; whereas it is true that waste is processed to replace natural raw materials and fossil fuels in industries, the reduction of emission intensity is only true for recycling, not for energy from waste incineration or landfill gas capture. Producing energy from waste in incinerators is more energy intensive than producing energy in coal plants according to Hogg, D,. 2006, "A changing Climate for Energy from waste?"	Accepted. See comment 35467
26976	10	7	22			Suggestion to delete "thereby reducing emission intensity"; whereas it is true that waste is processed to replace natural raw materials and fossil fuels in industries, the reduction of emission intensity is only true for recycling, not for energy from waste incineration or landfill gas capture. Producing energy from waste in incinerators is more energy intensive than producing energy in coal plants according to Hogg, D,. 2006, "A changing Climate for Energy from waste?"	Accepted. See comment 35467
35469	10	7	32			Suggestion to delete the sentence "waste to energy plants over their lifetime of approximately 30 years are more economic than landfilling" because it is no substanitated or contextualised and as such is misleading. The assertion doesn't discriminate between the country conditions -climate, waste composition, affluence- or between or modern landfilling in comparison to different levels of WtE from landfills or incinerators especially in scenarios of changing recycling rates. Experience shows that with the increase of recycling rates incineration becomes less practicable unless it involves waste imports. For instance, in the latest plan of waste infrastructures in Gipuzkoa, Spain, (2012) the cost of infrastructures with waste to energy incineration was a 40% more expensive than the alternative solution which included landfilling of waste after pretreatment and biological stabilisation. In Europe there are several examples that invalidate this sentence and hence, for the sake of fairness, it would be better to delete it.	Accepted - deleted from Executive Summary, statement still appears in waste section but has been qualified. See comemnt 35382

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26879	10	7	32			I suggest deleting the sentence "waste to energy plants over their lifetime of approximately 30 years are more economic than landfilling" because it is no substanitated or contextualised and as such is misleading. The assertion doesn't discriminate between the country conditions -climate, waste composition, affluence- or between or modern landfilling in comparison to different levels of WtE from landfills or incinerators especially in scenarios of changing recycling rates. Experience shows that with the increase of recycling rates incineration becomes less practicable unless it involves waste imports. For instance, in the latest plan of waste infrastructures in Gipuzkoa, Spain, (2012) the cost of infrastructures with waste to energy incineration was a 40% more expensive than the alternative solution which included landfilling of waste after pretreatment and biological stabilisation. In Europe there are several examples that invalidate this sentence and hence, for the sake of fairness, it would be better to delete it.	see 35469
26977	10	7	32			Suggestion to delete the sentence "waste to energy plants over their lifetime of approximately 30 years are more economic than landfilling" because it is no substanitated or contextualised and as such is misleading. The assertion doesn't discriminate between the country conditions -climate, waste composition, affluence- or between or modern landfilling in comparison to different levels of WtE from landfills or incinerators especially in scenarios of changing recycling rates. Experience shows that with the increase of recycling rates incineration becomes less practicable unless it involves waste imports. For instance, in the latest plan of waste infrastructures in Gipuzkoa, Spain, (2012) the cost of infrastructures with waste to energy incineration was a 40% more expensive than the alternative solution which included landfilling of waste after pretreatment and biological stabilisation. In Europe there are several examples that invalidate this sentence and hence, for the sake of fairness, it would be better to delete it.	see 35469
29666	10	7	5	7	7	This formulation is unnecessarily complex. The basic formula should be simplified to (emissions/material * material/product * product/service * demand for service). 'Emissions/material' and 'demand for service' can then be broken out into their respective and more detailed components.	Accepted - new simplified version appears in FD
24736	10	7	5	7	7	Suggest presenting the formula more clearly with variable names and units, followed by definitions.	Accepted - new simplified version appears in FD
31683	10	7	5	7	7	This eqution is difficult to assimilate and ambiguous as presented in this draft.	Accepted - new simplified version appears in FD
37489	10	7	5	7	7	This equation is hard to follow in multi-line form with long expressions in the quotients. Please make the quotients shorter/smaller and put the expression all on one line, which would allow one to better follow the math. This could be done by using symbols, abbreviations, or smaller text.	Accepted - new simplified version appears in FD
27842	10	7	5	7	7	The formula should be brought into a better readable form (please use mathematical symbols where possible, not text).	Accepted - new simplified version appears in FD
20225	10	7	8	7	11	Note that sector-specific policies may impede rather than complement economic instruments such as carbon pricing -- hence increasing costs.	Noted, however the reviewer provides no references and we have no space to go into the details of the interactions between sector-specific and overarching policies. We made sure the key finding about policies in the ES remains neutral about this
28985	10	7	11	7	12	The following statement would benefit from a supporting reference from the literature: "As limits to energy efficiency are approached at least by some energy intensive industries, the latter options will become more important."	Rejected; this is only a introduction. Broader discussion of limits is located in section 10.4

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24311	10	7	19	7	19	"Industrial emissions alone represent around one third of overall global GHG emissions" is not consistent with the text in page 10 line 5 which says "Direct GHG emissions from industry and waste/wastewater represented 18.4% of total global GHG emissions in 2010 (24% if AFOLU emissions are not included)...". This figur should be rechecked and adjusted as appropriate.	Text revised to say: Industrial emissions represent 30% of global GHG emissions in 2020 (nearly 40% if AFOLU emissions are not included).
31550	10	7	19	7	19	"Industrial emissions alone represent around one third of overall global GHG emissions" is not consistent with the text in page 10 line 5 which says "Direct GHG emissions from industry and waste/wastewater represented 18.4% of total global GHG emissions in 2010 (24% if AFOLU emissions are not included)...". This figur should be rechecked and adjusted as appropriate.	Text revised to say: Industrial emissions represent 30% of global GHG emissions in 2020 (nearly 40% if AFOLU emissions are not included).
30274	10	74	12			On page 74, line 12 updated and corrected reference: Gutowski TG, Sahni S, Allwood JM, Ashby MF, Worrell E. 2013. The Energy Required to Produce Materials: Constraints on Energy Intensity Improvements, Parameters of Demand. Philosophical Transactions of The Royal Society A 371. Available: http://rsta.royalsocietypublishing.org/content/371/1986/20120003.full	Accepted
25772	10	75	37	75	38	This reference information should be revised as follows. HPTCJ (2010). Survey of Availability of Heat Pumps in the Food and Beverage Fields. Heat Pump and Thermal Technology Centre of Japan. Available at: www.hptcj.or.jp/e/publication/tabid/360/Default.aspx	Accepted
37491	10	8	1	8	2	Direct GHGs are not just limited to combustion of fossil fuels. GHGs come from the combustion of *all* fuels, including biomass and wastes. It is commonly assumed that GHGs from combustion of biofuels is carbon neutral, but this depends on sustainable management of bioresources, which doesn't occur in a deforestation scenario. Thus, the authors should consider including the combustion of all fuels as direct GHGs, and then state that GHGs from a subset of those fuels are often treated as being subsequently sequestered, but that subsequent sequestration doesn't always occur. This statement is more scientifically valid that simply ignoring the combustion of non-fossil fuels.	Accepted partially (wording changed to "carbon-based fuels", without further explanations)
24737	10	8	10	8	16	Suggest a graph or bar chart of the sectors. Some comparison to global economic and population growth could also place the figures in perspective.	Accepted, see new figure, as per answer to comment 37493
37493	10	8	10	8	16	This information would be more efficiently conveyed in a figure, with values indexed to a base year of 1 so that all trends could be viewed on the same graph. Text is hard to follow with so many materials and statistics.	Accepted, see new figure
37494	10	8	11	8	14	"From 1970 to 2011, the global annual production of metallic minerals such as iron ore, copper, silver, and gold increased by 264%, 168%, 154% and 82% respectively (USGS, 2012); in the same period, world cement production grew by 495%; aluminium 357%; ammonia 251% (USGS, 2012); steel 153% (WSA, 2012a) and paper production 224% (FAO, 2012)." (p. 8, lines 11-14) What accounts for the higher growth of iron ore production (264%) than steel production (153%)? Pig iron?	Reject. Numbers are right. Only a proportion of iron ore is used to produce pig iron. Iron ore accounts for all the material.
20327	10	8	17		30	I do not see the importance of this paragraph in the context of the purpose of Chapter 10. Delete?	Reject. Service sector has to be covered in this chapter as per decision of IPCC plenary
37495	10	8	21	8	31	It would be useful to reference the DOE Critical Materials Strategy (http://energy.gov/sites/prod/files/DOE_CMS2011_FINAL_Full.pdf) in this section, especially with regard to the criticality assessment of elements related to clean energy technologies.	Accepted but finally left out due to space limitations
19778	10	8	26	8	26	consider adding "hybrid vehicles" as they are a different classification to "electric vehicles" which is way more massively produced and uses rare-earth based batteries (even if smaller than the ones that electric vehicles use).	Accepted - text revised

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22097	10	8	26	8	28	Progress in electric and hybrid vehicles is highly relevant to the European automotive industry and transport emissions (analysed in Ch.8)	Accepted, see 19778
19779	10	8	27	8	27	consider substituting "energy storage" with "electricity storage" since this is more relevant to rare earth based batteries	Accepted
37492	10	8	3	8	3	How is the demand growing in terms of shifting between energy intensive to non energy intensive industries?	Rejected. There is no space for further explanantion.
37496	10	8	34	8	35	Has the production decreased continually year on year (in developed countries)? Can the decrease in production be better described. Has anyone sector been affected more than others?	Rejected. There is no space for further explanantion. Table 1 explains for most important products. Added "as a general trend"
35286	10	8	37	9	1	It is rather confusing to compare Asia, China, middle-income countries and Africa all together. It is suggested to revise this sentence to: “The increase in industrial production and consumption has been concentrated in Asia, whereas Africa has remained marginalized.”	Accepted
37497	10	8	38	8	39	Please define what the the "main industrial outputs" attributed to China. Are these the outputs in Table 10.1?	Rejected. There is no space for further explanantion. Table 1 explains for most important products.
33276	10	8	8			The section could visualize large trends as figures, e.g. the information in the first paragraph.	Accepted, see new figure, as per answer to comment 37493
24312	10	9	1	9	2	In 2011, 1.49 billion tons of steel (210 kg/cap) were manufactured and 45.9% was produced and consumed in mainland China, not 50%.	Accepted
31551	10	9	1	9	2	In 2011, 1.49 billion tons of steel (210 kg/cap) were manufactured and 45.9% was produced and consumed in mainland China, not 50%.	See 24312
37498	10	9	1	9	5	Similar units should be used (why is billion tons steel used and million metric tons cement?) Also, something seems wrong with the materials per capita numbers (or they are not clearly defined and I am misreading). For example, if 1.4 billion tons steel = 210 kg/capita in China, how does 2,000 million metric tons cement (~ 2 billion tons) = 1,463 kg/capita in China? (1.4 billion is close to 2 billion, but 210 kg/cap is factor of 7 different from 1,463 kg/cap).	Accepted. Units were corrected. Both are now in billion of tons (metric tons). Figures per capita are fine. 1490 million tons of steel correspond to world production only 683.3 Mt correspond to China. Numbers were corrected to refer to China
37503	10	9	11	9	17	These sentences are confusing; can these be reworded for clarity? In particular,it's not clear what this means: "A rise in the proportion of trade has been driving production increase and relocation through process outsourcing besides population growth, and urbanization led activity growth."	Accepted - text revised
37504	10	9	19	10	3	These sentences on the service sector can be omitted in my opinion to reduce chapter length. These points are interesting, but not central to the discussion about industrial emissions.	Reject. Service sector has to be covered in this chapter as per decision of IPCC plenary
19780	10	9	20	10	3	this section can be considered for removal as it is not highly relevant.	Reject. Service sector has to be covered in this chapter as per decision of IPCC plenary
37500	10	9	3	9	3	Metric tons (Mt) is used earlier so this abbreviation should be introduced at first use, not here.	Accepted - editorial
37499	10	9	3	9	4	The authors should consider including the percent of global cement produced by China (in parallel to the steel sentence). eg: "2000 Mt in 2011, 'which was '59 percent of the global total,' followed by...	Accepted but finally left out due to space limitations. Can be derived from the table.
33277	10	9	6			AAGR for iron ore missing.	Accepted. Included
37501	10	9	6			Why no average annual growth rate for iron ore?m Please consider and revise as necessary.	Accepted. Included
37502	10	9	8	9	11	We suggest adding sector specific benchmarking to summary discussion.	Rejected. Benchmarking is in different section of chapter (10.11)