Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29973	9					The use of hydrogen as a zero-carbon energy carrier is not considered in Section 9.4, or indeed anywhere in this chapter. This option is being investigated by the UK government (see Chapter 4 of the Heat Strategy published by the UK Department of Energy and Climate Change (2013) at https://www.gov.uk/government/publications/the-future-of-heating-meeting-the-challenge).	Reject: This is a supply issue, not a building energy efficiency issue .
19521	9					U.S.A. BTRD (2008). (Buildings Technology Research and Development Subcommittee), Federal Research and Development Agenda for Net-Zero Energy, High-Performance Green Buildings, National Science and Technology Council (NSTC) in the Executive Office of the President, October.	Noted
19522	9					Hughes, P.J. and J.A. Shonder (1998). "The Evaluation of a 4000-Home Geothermal (Ground-Source) Heat Pump Retrofit at Fort Polk, Louisiana: Final Report", ORNL/CON-460, April.	Noted
19523	9					Hughes, P. J. (2008). "Geothermal (Ground-Source) Heat Pumps: Market Status, Barriers to Adoption, and Actions to Overcome Barriers," ORNL/TM-2008/232, December.	Noted
19524	9					Hughes, P.J., and P. Im (2012). Foundation Heat Exchanger Final Report: Demonstration, Measured Performance, and Validated Model and Design Tool, ORNL/TM-2012/27, January.	Noted
25406	9					Unclear why negative CCE's are shown in Figs 9-11 and 9-12 but not in 9-13.	Rejected: because 9.13 is for retrofit buildings, which are unlikely to have negative CCE
25407	9					Unclear why negative CCE's are shown in Figs 9-14a-b but not in 9-14c.	Rejected: because 9.14c is for retrofit buildings, which are unlikely to have negative CCE
25405	9					While it is no doubt true that the co-benefits significantly outnumber the risks, only one risk "(-)" is indicated in the table. An additional risk that may merit mentioning is performance risk. Investments, incentives, and a host of policy decisions and priorities are set based on stipulated performance (based on models, demonstration projects, or engineering principals). In practice, actual performance varies, sometimes considerably, from predicted performance. There are ways to manage this, e.g. commissioning. One article that deals with these issues is: Mills, E., S. Kromer, G. Weiss, and P.A. Mathew. 2006. "From Volatility to Value: Analysing and Managing Financial and Performance Risk in Energy Savings Projects." Energy Policy, 34:188-199.	Noted. Additional risks added to the text; however we think that performance risks exist in each technology and no particularly to the building sector.
19164	9					General comment. Little attention is paid to cooking fuel, especially in LDCs. Electricity is not a solution. 3 billion+ people do and will rely to a great extent on biomass energy. Efforts should be made to improve end-use efficiency especially with low particulate production. Regarding buildings, mortar could substitute for cement in low-rise buildings. There could be a greater use of wood and wood products for construction and furniture etc. This not only cuts down on energy use, but alsoincreases rural employment. There should be sufficient sustainable biomass to greatly increase use without reducing the forest capital.	Accept: We say more about biomass energy and will refer to the planned biomass annex .
27108	9					The figure fails the unit for total final thermal energy as well as which bars belongs to the residential and which to commercial buildings. From the text (Page 12, Line 11), it seems the bar are interchanged compared to Figure 9.2.	Accepted
34413	9					The message of this figure would be much clearer, if the x-axis was in % of baseline energy use.	Rejected: it would be a rather rough assumption to establish a baseline for new buildings, however, it is done for retrofit
34414	9					Redundant, since same information is in Figure 9.14a and b plus different sensitvities.	Rejected: 9.14 does not show the difference in building types and regions
34415	9					Redundant, since same information is in Figure 9.14c plus sensitivities.	Rejected: 9.14 does not show the difference in building types and regions

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34416	9					Panel c can replace Figure 9.13. Panels a and b can replace figure 12. The color coding in panel b is incorrect: the yellow point should always be on top, the blue always the lowest.	Rejected: the figures cannot be replaced, as the sensitivity figures do not show the difference in the building types and regions. We do not agree with the changes proposed for the color code
22921	9					Japanese Ministry of the Environment developed the quantitative roadmap of countermeasures for global warming mitigation in building sector until 2030. It is complihensive list of measures and expected effects. It will be a good reference. (http://www.env.go.jp/earth/report/h24-03/index.html) The summary of this counteremeasures will be sent as supporting material as "JapanRoadmap.pdf"	Rejected: the source is in Japaneese
30128	9					Why does "affordability of energy sources (lower operating costs)" not apply to commercial buildings or behaviour change? I would have thought that turning off unused lights and appliances for example would achieve cost savings both for domestic and commercial buildings. Similarly, I would have thought that "exemplary new buildings" can contribute to fuel poverty reduction (e.g. low carbon social housing).	Noted: In this table we have highlighted the most important co-benefits/co-risks attributable to basic types of mitigation actions and building types. We agree that lower operating costs apply also to commercial buildings but they are of particular importnace to residential buildings. Indeed behavioural changes contribute also to lower operating costs. Nevertheless the presentation of this co-benefit in the table changed and has been included in energy security issues. Finally, it seems unlikely that households suffering from fuel poverty to move in exemplery new buildings (retrofits of existing buildings is more likely to result in fuel poverty alleviation).
34805	9					Detail: in first cell add "decarbonize energy supply (see Ch.7)" or s.th. along those lines	Accepted
34806	9					Detail: add definition for HVAC as used here for the first time	Accepted
34807	9					Detail: cell 3 ("MitigationOptions"/"SystemEfficiency") add something like "fuel switching (coal to gas, oil to gas, any to electricity)"	Accepted
34827	9					Detail/Location: Please move this table to section 9.3.5	Noted: This is a question of layout. The table is referred to in 9.3.5, to be handled by the publisher.
34828	9					Content: Please consider whether linking this into the efforts on costs & potentials (figure listing options and associated costs by emission intensity [GHG/m2] under development)	Noted: This request is linked to the request to move all cost discussion in 9.3 to 9.6. However, this table deals only with device-level savings, whereas 9.6 deals with integrated savings,
34811	9					DTG (Data Task Group issue): With the effort to provide primary energy use and indirect emission data under way, this data in the figure should be made coheren with the data in the DTG's emissions data base	Noted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34842	9					Detail: y-axis unit should read "EJ/yr"; likewise caption should start "The development of ANNUAL global"	Editorial
34843	9					Detail: title should read "... (EJ/yr)" and title should be part of caption as in final version figures will have no title as part of the graphic	Editorial
35111	9					I found it difficult to read from the figure what is said in the text, i.e. that thermal can be reduced more (easy)	accepted, we will explain in the text that it can be seen from the figure that as a % of baseline emissions the reduction in models which only model HCW the reduction is bigger in general than in models covering all enduses.
34846	9					Detail: There is an error in the caption, IAMs are striped and BUs are solid	accepted
34847	9					Content: There are much more scenarios (as well IAMs as BUs) covered in Figure 9.17, could you not present all of them here, clustering in the three categories in 9.17? If not, please give reasoning in text why/how this subset was selected.	accepted, the same models will be covered in Figures 9.18, 9.19, 9.21, 9.22, and 9.23.
34812	9					Design: Though laying data on top of a world map is visually applealing, given the spatial requirements it should be considered to just align the different plots on a grid - which would add the benefit of better comparability across regions as y-ranges are identical.	Reject. We think that this lay-out communicates the regional differences better and gives diversity of figures in the chapter. The LA in charge of it (Luisa F. Cabeza) will contact the TSU graphic designer to get the figure as good as possible
34813	9					Data: Throughout the report it was agreed to use one of three regional aggregations (RCP5, RCP10, ECON5), I suggest to use RCP10 for this graph	Reject. We think that joining part of EU with Russia is not realistic in today's economy.
34853	9					Content/Reference: Please be clearer about the source, ideally naming it explicitly. The figure actually only includes the IAM sources named in Section 9.9.1 and not the other ones, right?	accepted, sources will be clarified
34852	9					Design: Consider labelling "electricity demand share increase" in the figure at the grey lines to improve clarity.	accepted, grey lines will be labelled
34854	9					Content: I do not see the added benefit from having this on top of Figure 9.20a. As this includes a few scenarios not being included in the 9.20a range, please consider adding these as (bottom-up?) data points in 9.20a. Please use "baseline" throughout, in the caption you have "reference".	accepted, figure 9.20a will be deleted, as it will be contained in Chapter 6.
34855	9					Content: Not knowing the details of the AIM sceanrios, from what is in the figure it seems odd that the demand in the 450ppm sceanrio is higher than in the baseline.	Accepted, the same models will be covered in Figures 9.18, 9.19, 9.21, 9.22, and 9.23. AIM results will be checked.
34856	9					Design: Please improve structure of this figure by labeling which scenarios are sectoral and which IAMs, e.g. with brackets or the like.	accepted, the IAM and sectoral models will be clearly differentiated
34857	9					Content/Important: There seems to be a fundamental contradiciton between the content of this figure and Figure 9.17. While the latter claims that there is more mitigation potential for the BU scenarios this figure shows the contrary, i.e. the IAM scenarios (bottom 4) are mitigating in average significantly more than the bottom-up (BU) scenarios (top 3). This is, if I see correctly, not due to one of the figures including indirect emissions and the other not.	Rejected. Figure 9.17 is about final energy while figure 9.23 is about CO2 emissions.
34814	9					Content: Please consider showing which categories belong to the super-category "thermal" here - this would improve the understanding	Accepted. Clarified in the text, page 9 line 34.
34815	9					Content: Please consider detailing what is behind the "other" category as this is quite substantial	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34817	9					Content: Y-axis units missing	Accepted
34818	9					Design: In case you do not follow the suggestion in "Design/content": Though laying data on top of a world map is visually appealing, given the spatial requirements it should be considered to just align the different plots on a grid which would add the benefit of better comparability across regions as y-ranges are identical	Reject. We think that this lay-out communicates the regional differences better and gives diversity of figures in the chapter. The LA in charge of it (Luisa F. Cabeza) will contact the TSU graphic designer to get the figure as good as possible
34819	9					Design/content: Please consider replacing the 11 panels with two, one for commercial one for residential. Plotting the development over time (using lines connecting the decadal data points) for different regions in one plot would greatly help compare absolute numbers and trends.	Reject. We think that this lay-out communicates the regional differences better and gives diversity of figures in the chapter. The LA in charge of it (Luisa F. Cabeza) will contact the TSU graphic designer to get the figure as good as possible
34820	9					Design: Labels missing (left "residential", right "commercial"); consider to add percentages of in-/decrease for the 2050 figures (e.g. "+210%" for GDP or "-58%" for m2/GDP in commercial plot)	Accepted
34821	9					Content: Please explain what "frozen scenario" means; please discuss in the associated text whether the scenario for which this decomposition is done is representative.	Accepted. The "frozen scenario" wording has been changed to "reference scenario" and better reference to published paper is given.
34822	9					Content: Having global data instead of China specific would be desirable in my view, there seems to be a contradiction between y-axis ("rural") and key (e.g. "Refrigerator - urban")	Accepted: change in contradiction was addressed. Rejected: No data other than China is available.
34823	9					Design/content: Please consider using % of regional demand as absolute numbers in TWh will not say much to most readers	Rejected: authors consider that TWh is more interesting than %
34837	9					Content: Please provide information how many models & scenarios this is based on; please provide ranges between scenarios if possible (and if not at least information on method to compute average); if possible try to change data so that it is presented for RCP10 regions.	Noted. Referenced GEA 2012
20627	9					Cut by 35%.	Noted - the chapter will be shortened.
27120	9					Since the financing opportunities in this section correspond strongly with the costs and potentials in section 9.6, I suggest to put these sections together in a section 9.11 (e.g. called Finances, costs, and potentials). I gives the reader the possibility to find the financial issues quickly without looking deeper into each section.	Reject. 'Financing' and 'costs' are conceptually distinct. Financing instruments are an important part of policy.
20618	9					Cut by 35%.	Noted. The chapter has to be reduced.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34405	9					This section should provide information on historic trends and future expectations regarding the shares of combustible energy carriers and electricity that were used and will be used to satisfy energy demands. It should also clarify how much combustibles and how much power were used and will be used each for (i) space heating, (ii) space cooling and ventilation, (iil) water heating and (iv) appliances, respectively. I assume that power is only used for appliances and for space cooling and ventilation. The GHG mitigation effect of reducing energy use for these building related energy services will very much be affected by the power mix. Direct emissions from buildings result mainly from space and water heating, I assume. So, for space and water heating fuel switching and reducing energy use are options to mitigate direct emissions. Section 9.3 on mitigation options should also make a logical distinction between the use of combustable energy carriers and electricity.	Accept. Since there is not data on global level on this we have referred what we have in the Pathways section.
22791	9					A lot of contents of FOD were removed. Wasn't there any contents to be left?	Noted. Most of contents from FOD were integrated within the contents in SOD. FOD had only data from given years, this data is integrated in the trends shown in SOD.
35117	9					The section should include the figures prodvided by the Data Task Group (new versions will also cover indirect emissions).	Accept
35118	9					Section needs to be based on more than one (good) paper. Try to assess further historic trends.	Noted. We would like very much to have more references on that. Any suggestion is welcome
26631	9					World energy outlook 2012 describes Efficient world senario, which estimate economically viable potential of energy efficiency. Figure 11.2 of the WEO2012 may be useful.	Noted: We refer to ETP2012 scenario in section 9.9
20619	9					Cut by 35%.	Noted. The chapter has to be reduced.
22915	9					Passive construction is not the only way for mitigation. Introducing high energy efficient appliances and careful operation can reduce energy consumption significantly.	Noted: We don't say that it is.
22798	9					This section admires passive construction too much. The effectiveness varies depending on the region, climate etc.	Reject: Passive House and reducing heating loads in general are only one of many measures that we discuss.
27115	9					This section deals in my opinion about the general issue of adjusting control systems and is not specific for new buildings. Therefore, I suggest to put it at the end of section 9.3 or integrate it in section 9.3.10.	Accepted: This section has been renamed "Monitoring and commissioning new and existing building" as it is really about commissioning the control systems over a long period of time. Section 9.10 is about behavioural issues (i.e, the desired temperatures).
27112	9					Except for the start of the section, the section fails to mention any costs. There are only qualitative statements like "… reducing costs …" and "… cost less than …". It complicates the comparability between the various introduced measures.	Noted: This is because we want to focus on ways to reduce costs to the point where they are very small, rather than focusing on costs at one particular point in time.
34824	9					Content/structure: Please consider moving (parts of) this section to the cost&potentials section	Reject: After further discussion with the TSU and CLAs, it has been collectively agreed to keep the structure the way it is.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34420	9					There's strong overlap with the material in section 9.6.2.2. The material from both sections should be combined and further condensed in section 9.6 on cost and potentials. Section 9.3 should focus on a qualitative description of the logical structure and interdependencies of mitigation options in the buildings sector, maybe also making use of a conceptual figure depicting the different levels at which the building sector can be analyzed.	Reject: After further discussion with the TSU and CLAs, it has been collectively agreed to keep the structure the way it is.
34826	9					Content/structure: Please consider moving (parts of) this section to the cost&potentials section	Reject: After further discussion with the TSU and CLAs, it has been collectively agreed to keep the structure the way it is.
34829	9					Content: I suggest to use the Kaya identity formula for appliances introduced in Section 9.2.3	Reject: I don't see the need to re-introduce it.
34830	9					Content: Please try to provide share of halocarbons in total emissions and/or the impact of switching to alternatives with lower GWP, e.g. by giving data in a unit of intensity as in the costs & potentials section if possible	Noted. Some more information on halocarbons (esp, development of substitutes) has been added, but there do not seem to be new global inventories of emissions.
34831	9					Content: Please refer in this section to the LDC box in your chapter.	Accepted
27114	9					This section says that biomass is the single largest source of energy for buildings, but it is the one of the shortest sections in this chapter. Isn't there any more information on this topic? Furthermore, the last sentence is rather vage (What developments? Is energy saved now? If yes, how much? etc.).	Accept: We say more about biomass energy and will refer to the planned biomass annex.
34834	9					Content: It would be desirable to improve this section, if there is data, in three regards: (1) More quantitative data on materials, (2) putting the data in the bigger context (role compared to overall sector emissions), (3) providing more on options.	Reject: We don't have room to say more.
20620	9					Cut by 35%.	Noted - the chapter will be shortened.
34835	9					Content: This section needs to heavily link to Ch.12 (having "This issue is discussed in more detail in Ch.12" is not sufficient); under the (currently not met) condition that Ch.12 provides sound, structured and broad data on general form and infrastructure issues, your chapter should reference the respective sections and then built upon it adding sector specifics. Please avoid redundancy by citing the same studies as cited in Ch.12 but rather refer to the Ch.12 sections and - if needed - summarize the Ch.12 content for your own purpose.	Accepted - this will be done. Details to be determined when Ch 12 contents are known.
34838	9					Content: Please check whether usage of "lock-in" in this section is according to usage in the report (see glossary, framing chapters), as in my understanding the difference between BAU and mitigation scenario can not be labeled "lock-in"	Noted. 'Lock-in' as usually used (e.g. Unruh, Q992000; Unruh, 2002) refers to the economic, social and instituional forces the make systemic change difficult. This is how it is used in the framing chapters (but the glossary definition is, in my view, weak). In this case I think 'BAU minus mitigation' is quite a good measure of the quantified effect of 'lock-in'. I therefore do not propose to make changes unless further guidance is given
20621	9					Cut by 35%.	Noted - the chapter will be shortened.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27117	9					This section deals with one of the core issues of chapter 9: the interaction between climate change and buildings. Therefore, I suggest to integrate this section in the introduction (9.1).	Rejected. The leaders decided to have the section as is, but 9.1 will refer to this point
34839	9					Content/Link : please make use of the work of IPCC Working Group II and reference their report; please avoid doing an assessment on issues covered by WG II without consulting with their respective chapter (having those authors review / contribute to this section)	Noted. The references are reviewed. The WGII does not have any section that can be sited. Siting the entire reports are out of context.
20622	9					Cut by 35%.	Noted - the chapter will be shortened.
27118	9					This section gives an overview of the costs and potentials. In sections 9.3.3.4 and 9.3.4.2 this has already been done for new buildings and retrofits, respectively. Therefore, I suggest to integrate these two sections in section 9.6 to have just one section holding all the costs.	Noted
34411	9					This section would benefit, if a set of two complementary figures could be included. The first should show the specific GHG emissions of different buildings per sqm (the difference to the baseline sqm building would then be the specific technical mitigation potential). The second should provide an indication of the bandwith of costs associated with realizing specific emissions per sqm. Both figures should contain a coherent set of options. They could be complemented by information on the annual global maximum GHG abatement in GtCO2 that could be realized by full application of the individual measure to the buildings stock (graphically a figure next to the label or so). The latter would provide an indication of the global relevance of specific mitigation potentials.	Rejected. It is not possible to add additional figures due to the space limitations
34412	9					A common approach to the structure of the section across sector chapters is strongly recommended.	Accepted
34421	9					The section could be improved by more coherent language with regard to financial terms. Also, the interpretation of cost of conserved energy/carbon in relation to profitability of investments should be clarified.	Noted: not clear what fiancial terms are meant and what part of the text needs improvement. The text on CCE & CCC has been editied and more explanation added
34417	9					Please consider chosing a different figure style for this and the following three figures in coordination with the other sector chapters that do similar sensitvity analysis.	Rejected: the figure style has been carefully thought through and it is not a sensitivity analysis, but the presentation of the data
34419	9					There's strong overlap with the material in section 9.3.4.2. The material from both sections should be combined and further condensed in section 9.6 on cost and potentials. Maybe one or two figures that depict the cost and potential data may be useful to free up space and make the messages more accessible. The underlying data could be moved to a data annex to the chapter.	Rejected: it is important to keep in the technology discussion. In 9.3 it is different figure, focused on technologies, in 9.6 gives a big picture of costs.
20623	9					Cut by 35%.	Noted. We have tried to reduce the length of the text. Howecer, as several reviewers asked for additions/clarifications, this is not always possible.
25403	9					Early work on this is provided by Mills, E. and A. Rosenfeld. 1996. "Consumer Non-Energy Benefits as a Motivation for Making Energy-Efficiency Improvements." Energy, 21 (7/8):707-720.	Accepted. Citation to this reference made.
27119	9					The second part of the section (from "There is a relative …" onwards) can be left out, because it doesn't deal with energy security and buildings directly.	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25397	9					There is a broader array of health impacts associated with kerosene, and corresponding benefits when kerosene lighting is switched to LED lighting. See Mills, E. 2012. "Health Impacts of Fuel-based Lighting." Lumina Project Technical Report #10 - http://light.lbl.gov/pubs/tr/lumina-tr10-summary.html	Accepted: citation to this reference was made.
20624	9					Cut by 35%.	Noted - the chapter will be shortened.
34422	9					This section needs to be strenghtened to make the point convincingly. Currently, it's merely a list of barriers, while the magnitude of their impact remains elusive. Unscientific language like "dramatic improvements", "strong barriers" should be replaced by more accurate terms and a quantification of barriers should be given, if possible, to answer questions like: What is the cost-equivalent that investors face due to the existence of particular barriers?	Accepted
20625	9					Cut by 35%.	Noted - the chapter will be shortened.
35109	9					The section mentions that sectoral scenarios are more optimistic. It would be good to clarify why.	Accepted
19540	9					General comment: The Chaper 9 draft runs 57.5 pages, this reviewer has suggested net page reductions of 16.1, reducing total pages to 41.4. The remaining 1.4 pages of reduction can be achieved through better economy of phrasing and formating throughout	Noted
34403	9					The ES needs structural improvement. It makes inflationary use of uncertainty language. (Uncertainy statements should only be included to support the most important key messages.) It is written in very unscientific language and in an unbalanced way, in particular putting too much weight on potential benefits of energy saving investments and on policies and regulations that trigger such investments without cautioning against risks and potential negative or less positive implications.	Accepted
34404	9					The term potential needs to be specified. In most cases, the term is used to describe what is technically possible (including by implementing policies). Used as such, it describes a technical potential, even if policies need to be implemented to utilitze that potential. In most cases, the term potential is used to describe quantifiable opporunities that may or may not be economically attractive to use. As such, it is not necessarily an economic potential that is described - and this needs to become clear.	Accepted. ES explains such potential, technically feasible but depending on policies and behavior
35116	9					The ES should answer the following questions: (1) What contribution of the building sector is needed? (2) Which are the options to achieve this?	Accepted. Table provides these answers
30342	9	0				General comment. There seems to be a lot of emphasis on PassivHaus compared to other low / zero carbon options. The danger here (as is happening in the UK) is that too much emphasis on that particular solution can drive proscriptive-based building regulations to de-incentivise other solutions, particularly naturally heated and ventilated buildings with high thermal masses. Examples of work on this includes the 'Eco House' books by Sue Roaf et al., and projects by De Montfort, Loughborough, and other UK universities. This also adds the the evidence for performance improvement-led standards, such as LEED and the Dutch building standards. However, as we argue in a report for the Scottish Government (www.scotland.gov.uk/Resource/0038/00389071.pdf and in our book http://www.routledge.com/books/details/9780415684071/) the optimal solution appears to be set performance standards based on using a proscribed set of measures, and allowing developers to freedom to meet the remainder of the target as they choose. This might be achieved with novel solutions or by using one or more previously evaluated 'allowable solutions'. This system has the added benefits of being usable with regulations covering retro-fitting, such as the Residential Energy Conservation Ordinance (RECO, USA), and can be used to drive uptake of specific measures without completely dictating the choice of building systems.	Noted: The Passsive house is a performance standard, not a prescriptive standard. We mention it because it is the most strngent heating standard, but it can be achieved in different ways in different regions.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23479	9	0				It should be noted that the readers of IPCC report would be from different levels and disciplines. Thus the contents should be discussed in a more informative way, not simply to promote or convincing the readers on the technologies potential, factors and challenges should be included. Taking one literature example to be used as strong statement to represent the technology potential is inadequate, especially research/lab based is different from real practice. There is no nomenclature/ abbreviations in this document. Would it be better to use a consistent currency rather than a mixture of $, £,€ throughout the document, especially when comparing the saving/ cost?	Accept nomenclature comment. Others not possible due to short space and IPCC structure
31612	9	0				I am aware that it's quite a challenge to have all information fit into limited number of pages. It is much appreciated that the health benefits of some mitigation measures related to climate change for the building sector are included. However, there are also disadvantages in applying some other mitigation measures that have been reported in literature, such as airtight building construction with lower ventilation rates and technical challenges related to current smart meter technologies.	Rejected. Needs references
24699	9	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. Could not obtain the cited item in order to check it.
24700	9	0				The chapter structure is logical, but does not present the arguments supporting strong policy action and demonstrating the large cost effective (and socially/environmentally beneficial) potential. There is a strong thread that top down modelling and lack of acknowledgement of the powerful barriers has undermined effective policy implementation. Suggest that this needs to be stated more clearly, both sides of the debate be given similar prominence and including further explanation of the macro modelling projects that have tried to factor in bottom-up analysis. Suggested citation: Tellus Institute: http://www.tellus.org/programs/integratedscenarios.html	Reject. We should not necessarily give both sides of a debate equal prominence
22080	9	0				This chapter is weighted towards technologies and costs. It underrepresents behavioural practices (occupant behaviour and use of control systems, post-occupancy evaluation and operation of management systems) as well as current and future developments of smart management systems and building information modelling.	Noted. It has been redrafted but comprises the found literature
22081	9	0				Currently, it's over the page allocation. Sections 9.2, 9.3, 9.7 and 9.10 offer the best opportunity for editing and would all benefit from being more succinct and restructuring to remove repetition.	Noted. We have tried to reduce the length of the text in Section 9.7. Howecer, as several reviewers asked for additions/clarifications, this is not always possible.
22082	9	0				Better links with other chapters (Ch. 6,7 and 9) are needed.	Noted. Will be done for the TOD
25400	9	0				The important role of fuel-based lighting is not addressed in 9.7.2.5 or elsewhere. Kerosene and other fuels are used to provide light for 1 in 5 people on the planet on a daily basis, and frequently for far more who are electrified and experience regular grid disruptions. There is particular potential in this regard for LED lighting in the developing world. Mills, E. 2005. "The Specter of Fuel-Based Lighting," Science 308:1263-1264, 27 May.	Noted: This should be dealt in Section 9.3.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25401	9	0				ICT is mentioned very generally in the Executive Summary as both part of the problem and part of the solution, yet is barely treated in the main body of the text. There is a large literature on the energy use and efficiency opportunities associated with ICT. In addition to data centers, energy intensive facilities such as cleanrooms and laboratories also merit consideration. Mills, E., G. Shamshoian, M. Blazek, P. Naughton, R.S. Seese, E. Mills, W. Tschudi, and D. Sartor. 2007. "The Business Case for Energy Management in High-Tech Industries." Energy Efficiency, 1(1). DOI 10.1007/s12053-007-9000-8.	Noted. We cannot go into any detail for any set of technologies, but we have given it passing mention
20616	9	0				Overuse of abbreviations. Please reduce.	Rejected. Short space
41245	9	0				The authors need to report uncertatinty bands of numbers reported throughout this chapter.	Duplicated comment
41246	9	0				The chapter would greatly benefit society by recommending promotion of higher educations on the global levels in building sciences and practices.	Duplicated comment
41247	9	0				The chapter contents are predominantly on policy studies, but lack of uncertainty analyses; The authors need to improve the balance. For example cut down sections 9.3, 9.6, 9.7, and 9.10; and enrich/enhance sections 9.4,, 9.5, 9.8, and 9.11	Noted. We have tried to reduce the length of the text in Section 9.7. Howecer, as several reviewers asked for additions/clarifications, this is not always possible.
41248	9	0				The chapter states that the new focus on mitigation options are decomposed into four primary mitigation strategy components- (carbon efficiency, ee of technology, systemic and infrastructure efficiency, service demand reduction), but the actual presentation is insufficient and should be more clear.	Accepted
41249	9	0				We suggest that the authors integrate the key take-away messages from the [FAQ] sections with the main text.	Accepted partially, with some FAQs. Others were required by IPCC agreements
41250	9	0				We suggest that the authors avoid using the term "zero energy building" in this report given that the whole world will be reading it; In fact it's not a very good idea to promote the use of such a vague and often confusing/controversial term in the IPCC document (as we know there are already too many definitions - all trying to fix the water leaks out of a leaky basket). Alternatively, the IPCC could develop a robust/clear definition here that would be compatible to others whose work is cited with consistency within this report.	Reject. It is a concept that exists and we need to refer to it.
41251	9	0				Reviews and discussion of the data/technology/policy/practice are still unbalanced between developed and developing countries. We strongly suggest that the authors include more studies on major/emerging economies such as China and India (at the least), whose buildings have significant/increasing impacts on global GHG emissions. The Executive summary should also reflect adjustment of the imbalance.	Noted. We´ve tried hard to give this balance
41252	9	0				Please define what high/low/medium agreement and medium/robust evidence means, and how they are used by the IPCC	Rejected. See IPCC Guidance
41253	9	0				In general, using % to indicate energy savings or energy efficiency improvement is problematic in the presentation (texts/tables) , while the denominator for the percentage is often very vague or not specified at all. We suggest that the authors to clearly present the base for comparisons, to improve the accuracies and rigors of the statements/claims. Such explanations and clarifications (to be added) will serve the reader much better because it will convey more accurate messages.	Reject. For this report, we think that it is better to talk about relative savings potential, and do so throughout.
41254	9	0				The energy savings potential of building-scale and urban-scale green infrastructure (e.g., green roofs, green walls, trees and other urban vegetation) are not addressed in this chapter even though their impact on building cooling is well-established and potentially significant including reduction in surface temperatures (via shading and evapotranspiration) and mitigation of urban heat island effects principally.	Accepted partially (9.5). Other topics in Ch12

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41255	9	0				Throughout the chapter, there is oversupply of policy elements as compared to scientific aspects of building sciences. Scientific content and technical rigor need to be enhanced when addressing technologies, principles, magtitudes of savings, economics, impacts, and applicability.	Accepted partially (9.5). Other topics in Ch12
41256	9	0				The Chapter does not properly acknowledge the primary and key relation between climate and energy use and thus the importance of climate-specific energy conservation strategies. Specifically: Page 17-18: Section 9.3.3 Exemplary New Buildings notes that energy use "naturally scales with building floor area" and "population" and provides representative values for energy (use) intensities for exemplary buildings in selected countries, but makes no attempt to normalize these values relative to some reasonable measure of climate. The commonly used measures of climate-related heating and cooling demands, heating degree days (HDD) and cooling degree days (CDD) escape mention in the Chapter with a single exception one specific value of HDD is noted parenthetically on line 3, page 19.	Reject. We are simply making the distinction between two different potential variable driving factors (floor area and population).
41257	9	0				The energy savings potential of building-scale and urban-scale green infrastructure (e.g., green roofs, green walls, trees and other urban vegetation) are not addressed in this chapter even though their impact on building cooling is well-established and potentially significant including reduction in surface temperatures (via shading and evapotranspiration) and mitigation of urban heat island effects principally.	Accepted partially (9.5). Other topics in Ch12
41258	9	0				Although climate responsive or bioclimatic design of buildings is mentioned in passing, there is neither detailed discussion of passive solar heating or passive cooling strategies nor any quantitative evaluation of their potential. For the latter, shading, direct natural ventilative cooling (with or without evaporative cooling), nocturnal ventilative cooling (with or without evaporative cooling), hybrid natural/mechanical ventilative cooling, long-wave radiative cooling, and microclimate moderation via urban geometry, selective surface coatings, vegetative building surfaces, and urban vegetation have been studied and reported in the literature, perhaps most conspicuously in the IEA PASCOOL program. There is neither discussion nor quantitative evaluation of the energy savings potential of "passive" daylighting methods (e.g., building form and orientation, glazed aperture orientation and detail (e.g., shading devices, light shelves, exposure to reflective surfaces, etc.), room form and detail (e.g., sloped ceilings, interior light shelves, diffusing baffles, finishes), and room-to-room d/corridor daylight transmission strategies (aka, borrowed light strategies). The chapter would be enhanced by adding discussion and quantitative evaluation of the energy savings potential of natural or hybrid ventilation for air quality control (i.e., to offset fan power consumption).	Rejected. Short space
41259	9	0				The Chapter does not properly acknowledge the primary and key relation between climate and energy use and thus the importance of climate-specific energy conservation strategies. Specifically: Page 17-18: Section 9.3.3 Exemplary New Buildings notes that energy use "naturally scales with building floor area" and "population" and provides representative values for energy (use) intensities for exemplary buildings in selected countries, but makes no attempt to normalize these values relative to some reasonable measure of climate. The commonly used measures of climate-related heating and cooling demands, heating degree days (HDD) and cooling degree days (CDD) escape mention in the Chapter with a single exception one specific value of HDD is noted parenthetically on line 3, page 19.	Duplicate comment
41260	9	0				The chapter would greatly benefit society by recommending promotion of higher educations on the global levels in building sciences and practices.	Accepted. See 9.10.1.3
41261	9	0				The authors need to report uncertainty bands of numbers reported	Duplicate comment

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41262	9	0				The chapter states that the new focus on mitigation options are decomposed into four primary mitigation strategy components- (carbon efficiency, ee of technology, systemic and infrastructure efficiency, service demand reduction), but the actual presentation is insufficient and should be more clear.	Duplicate comment
41263	9	0				The chapter contents are predominantly on policy studies, but lack of uncertainty analyses; The authors need to improve the balance. For example cut down sections 9.3, 9.6, 9.7, and 9.10; and enrich/enhance sections 9.4,, 9.5, 9.8, and 9.11	Noted. We have tried to reduce the length of the text in Section 9.7. Howecer, as several reviewers asked for additions/clarifications, this is not always possible.
41264	9	0				We suggest that the authors integrate the key take-away messages from the [FAQ] sections with the main text.	Duplicate comment
41265	9	0				Suggest to avoid using the term "zero energy building" in this report given that the whole world will be reading it; In fact it's not a very good idea to promote the use of such a vague and often confusing/controversial term in the IPCC document (as we know there are already too many definitions - all trying to fix the water leaks out of a leaky basket). Alternatively, the IPCC could develop a robust/clear definition here that would be compatible to others whose work is cited with consistency within this report.	Duplicate comment
41266	9	0				Reviews and discussion of the data/technology/policy/practice are still unbalanced between developed and developing countries. We strongly suggest that the authors include more studies on major/emerging economies such as China and India (at the least), whose buildings have significant/increasing impacts on global GHG emissions. The Executive summary should also reflect adjustment of the imbalance.	Duplicate comment
41267	9	0				Please define what high/low/medium agreement and medium/robust evidence means, and how they are used by the IPCC	Duplicate comment
41268	9	0				In general, using % to indicate energy savings or energy efficiency improvement is problematic in the presentation (texts/tables) , while the denominator for the percentage is often very vague or not specified at all. We suggest that the authors to clearly present the base for comparisons, to improve the accuracies and rigors of the statements/claims. Such explanations and clarifications (to be added) will serve the reader much better because it will convey more accurate messages.	Duplicate comment
41269	9	0				We recommend that the authors avoid usage of NZEB. This comments applies to whole chapter.	Duplicate comment
35110	9	0				General Comment: Please try to better carve out key mitigation strategies of the chapter.	Noted: Due to space limitations and because we said a lot on mitigation strategies in AR4, we decided not to repeat this matieral in detail, but rather, to provide summary statements and references, and to focus on achieved overall results, costs, and issues related to policies and implementation .
35112	9	0				While you have a great set of figure in your chapter, please not move forward and try to develop them further so that they support the key messages of the chapter.	Noted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35113	9	0				It does not come across when reading the chapter that the emissions from constructing buildings in coming decades will be a major emitter. This is also due to construction emissions (cement, steel) being associated with Ch.10. By including indirect emission data to your chapter you should have the opportunity to link to Ch.10 and contextualize it with respect to the building sector. Please also try to link the discussion then to competing demands discussed in Ch.12. Ch.12 argues for greater urban density but this would not only mean less opportunities for RES in buildings (as I think you already argue in the chapter) but would also increase emissions from construction, as the higher the buildings the more steel. This should be covered somewhere prominently in my view. If this is done in Ch.10 or Ch.12 that's fine in my view, please in that case link to those sections.	Noted: We discuss what we consider the few most important points on the subject of embodied energy in Section 9.3.9. We will consider adding a cross-ref to Ch 10. We mention urban density in the context of NZEBs
35114	9	0				The discussion on cost is scattered across different sections (9.3.3.4, 9.3.4.2, 9.4.2) - please try to have it all in one place if possible.	Reject. The current structure was confirmed to be acceptable by the TSU and CLAs at the Addis meeting.
35115	9	0				Main General Comment: While the chapter is in general in a good state, it is very weak on appliances, this needs to be a focus moving forward to the Final Draft.	Accept: Some more will be added to the existing Table (9.3) .
35119	9	0				The chapter should cover more developing country issues. While there is surely less literature on it still more can be said. Please try (under the given page constraints) to distinguish between regions.	Accept. We have added more related to developing countries in the biofuels and behavioural sections (9.3.8 and 9.3.10)
30561	9	0				There are some themes not included in the Executive Summary; for instance, those related to bioclimatic arquitecture and Zero Carbon energy services, which I think must be here also, because they're very good instruments for mitigation policy, in order to reduce the worst effects of GHG emissions.	Noted. ES cites elements of traditional lifestyles and architecture, a broader concept
35274	9	10				There is no direct relation between the world map and the figure. It is suggested to delete the world map. Even if the map has to be remained, it should be replaced by a border free map.	Accept. Borders were reconsidered
22793	9	10		10		Abbreviated country names/regions were difficult to understand. The list of abbreviations is necessary.	Accepted
22794	9	10		10		Abbreviated country names/regions were difficult to understand. The list of abbreviations is necessary.	Accepted
41284	9	10	1			1) Referencing a sentence discussing buildings being some percent of total energy use. Please consider adding a reference it a little later in text or write "buildings" next to "commercial" and "residential" and "other" in the legend in the figure. 2) The country/region abbreviations need to be listed somewhere and referenced in the caption. It would be difficult to have to go back to original paper to look up countries/regions. 3)Page 10, Fig 9.2 bar charts on map, while illustrating geographical spread, don't provide meaningful comaprisons (in numbers); a single bar chart or table may do a better job while saving page space (e.g., Could do stacked bars for each region).	1) Accepted. 2) Accepted. 3) Rejected. Authors feel that regions information is essential in the report
19512	9	10	1	10	3	reduce page count by 1.5 (of 18 needed); re-format fig 9.1 to have the 3 pie charts side-by-side so fig 9.1 fits on bottom of p9; then fig 9.2 and 9.3 and the beginning of sec 9.2.2 all fit on p10; then fig 9.4 fits on p11; then fig 9.5 and 9.6 fit on p12; then sec 9.2.3 can begin at top of p13 instead of midway through p14	Noted. A graphic designer is comissioned to reduce figures space take up.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32536	9	1005				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	Accepted small editorial comment. Rejected request to add many additional reference
22085	9	11	1	11	1	Figure 9.3 indicates that the largest energy use in commercial buildings was in the category Other (32%). What is this? It is unclear.	Accepted
34816	9	11	13			Detail: Define DHW as used here for the first time	Accepted
29203	9	11	16	11	16	After "number of households" insert "(h)"; after "number of people" insert "(p)".	Accepted
41285	9	11	3	11	3	In section header : "thermal" energy uses in buildings": what does "thermal" refer to in the previous pie chart (fig 9.3)? One of the listed final uses? A combination? Something else? Please clarify and define at the beginning.	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41286	9	11	3	14	3	This discussion is very interesting, but too long. The author has done tremendous service with this work, but the presentation here as 9.2.2 with the figures simply doesn't seem to fit well. At the least, section 9.2 should be shortened to highlight major findings. Please point out uncertainty bands.	Noted. We would love to have undertainty band, but the available data does not allow to do that. The data is used later in the chapter, so the details are necessary and utilised.
26627	9	11	12		23	This decomposition is quite eye-opening. It may be interesting to compare trends between conventional huge city and emerging city or relationship between "m2/p" and "GDP per capita" .	Rejected. The data is not available
22913	9	12		12		Legend for the bar-chart and unit of vertical axis are necessary.	Accepted
22795	9	12		12		Legend for the bar-chart is necessary. Unit of vertical axis is also necessary.	Accepted
24708	9	12	1			Acronyms make these diagrams difficult to understand i.e. LAM, NAM, PAO, etc. Suggest that these are spelt out in full in their first instance in each chapter, as each is likely to be read independently of the whole document.	Acepted
41287	9	12	1			Please consider the following clarifications:1) What are the units on the y-axis? 2) What is the distinction between solid vs not solid? 3) What do the region abbreviations mean?	Accepted
35275	9	12	2	12	4	This part divides the globe into 11 groups, one of which is CPA (central planned Asia) that includes China, Mongolia, Vietnam and North Korea. However, this grouping is inappropriate for the following reasons: 1) it is not helpful for data conformity since none of this grouping has ever appeared in other parts of the report; 2) climate is a key factor in determining building energy consumption; however, since the four countries mentioned above differ dramatically in climate conditions, grouping them together is not a scientific approach. It is suggested to use the common country grouping approach as in other chapters and revise the text accordingly. There is no direct relation between the world map and the figure. It is suggested to delete the world map. Even if the map has to be remained, it should be replaced by a border free map.	Accepted
20309	9	12	5	12	14	The BaU trend shows quite a strong increase. However for new buildings in many countries low energy or even passive houses are more or less standard already. Is this explicitely incorporated in the BaU scenario. In this case a growing number of households or living space should not translate into a major increase in energy consumption.	Accepted
26389	9	12	9		10	The decrease in the number of persons per household does not decrease energy consumption. People may leave an household, but they still consume energy wherever they end up	Accepted
30571	9	13				legend should be explained (h, p/h, m2/p)	Accepted
30572	9	13		14		legend should be explained (h, p/h, m2/p)	Accepted
41288	9	13	1			It would be useful if the authors mention somewhere that 2010 is the "100%" point to assist people when reading the plots. Giving at least 1 magnitude would be good information to have since only percentages are given (probably the 2010 value for each metric).	Accepted
26628	9	13				same as above	Accepted. The "frozen scenario" wording has been changed to "reference scenario" and better reference to published paper is given.
35276	9	14				There is no direct relation between the world map and the figure. It is suggested to delete the world map. Even if the map has to be remained, it should be replaced by a border free map.	Accept. Borders were reconsidered
41290	9	14	12	14	14	The terms in the equation need better explanations.	Rejected. The explanaition is already in lines 12 to 14
33797	9	14	14	14	14	… kWh per year used per appliance	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41289	9	14	6	14	6	The authors should consider some sort of pie chart. What makes up the rest of household consumption? How is this related to Fig 9.3? Maybe the authors need to provide a set of pie charts at beginning of chapter to set the stage.	Noted. We would love to have this data, but it is not available.
41291	9	15	1	15	1	What is a "white" good? Please define.	Accepted
26577	9	15	12		27	too many references for same point. Take out a few but keep diversity : Ürge-Vorsatz et al., 2009;, WSBCD ; I.26 : GEA, 2012….	Rejected. Important to quote references
20617	9	15	26	15	26	Please add "E.g. in rural and urban China, coal lost shares as the most important heat energy supplier. Especially in urban areas, coal was substituted by natural gas. In rural areas, the trend for coal is similar, however here, coal as the main primary energy supplier was substituted by electricity as a secondary energy supplier which to a large extent is also fuelled by coal. As even high-end ultra-super critical power plants only have an energy efficiency of 45% (co-generation is not used as there is rarely district heating in rural areas), in the end, the coal consumption in rural areas did not change. Coal stoves with a low energy efficiency of maybe 50% were substituted with electricity generated with an energy efficiency way below 45%. Average rural power generation efficiency may be estimated with between 30% and 35%. However, convenience and indoor pollution decreased through the utilization of electricity for heating purposes (Oberheitmann, 2012)". Cite as: Oberheitmann, a: (2012). CO2-emission reduction in China's residential building sector and contribution to the national climate change mitigation targets in 2020. Mitigation and Adaptation Strategies for Global Change, 17, 769-791 (R). DOI 10.1007s11027-011-9343-5.	Rejected: such details Not needed in a buildings chapter- peripheral issue
41292	9	15	4			Axis labels look like "divided by". We suggest that the authors use commas or semicolons to better present what is intended here.	Accepted
26629	9	15	26			Vernacular designs may be close to concept called "Baubiologie" ."Baubiologie" maybe refered to here. http://www.baubiologie.de/site/english.php	Rejected: No need to put this
31608	9	15	26	15	27	Modern knowledge and techniques can be used to improve vernacular designs (Foruzanmehr and Vellinga, 2011) and vice versa.	Accepted: we can add this
23481	9	15	5			The contents does not reflect the Box title. If the contents are to focus on the rural or slum areas, suggest that the title to be changed, or else the contents should give more example on LDC rather than using develpping countries as examples.	Accepted. Title changed to "Least Developed Countries (LDCs) in the context of the developing world"
33798	9	16	17	16	20	equipment standards exist already in the EU - The Eco-design Directive	Noted. We do not imply otherwise.
41294	9	16	20	16	26	We recommend that the breakdown of sections should be at beginning of chapter, not in this section.	Reject. We are giving only the breakdown of 9.3
23490	9	16	23	16	26	They are not reflecting the real contents in the sections of 9.4-9.6	Noted: Except for 9.4, which should say more about additional savings, I disagree

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41295	9	16	28	16	46	The discussion of the "conventional process of designing a building" of this paragraph is naive and partially incorrect. This discussion asserts "the architect makes a number of design decisions with little or no consideration of their energy implications, and then passes on the design to the engineers, who are supposed to make the building habitable through mechanical systems." In developed countries, the US for example, building energy consumption is split nearly equally among the residential and commercial sectors. Architects are not involved in the design of the large majority of homes and many of the smaller commercial buildings at all, thus for these buildings, that may account for as much as 30-50% of the energy consumption in buildings, the "conventional" design process is quite different from what is claimed in this paragraph. Importantly, if the IPCC is to identify strategies to improve energy performance of these buildings, it will be important to correctly identify the design process(s) that is (are) actually followed and the building professionals actually involved (e.g., builders, developers, individual building owners, etc.). In the US, architects commonly assume the lead design role in the design of new and the renovation of existing larger residential complexes, institutional and commercial buildings in both the private and public (government) sectors. However, this apparently is not the case for the public (government) sector in some countries (e.g., the UK) where other models for the organization of the building design process are in place. Finally, in at least the developed countries, it has become commonplace to design these larger buildings using an integrated design process guided by deterministic energy modeling for a slate of energy efficient measures; energy efficient assessment (e.g., LEED); and energy efficient guidelines (e.g., ASHRAE advanced energy efficient guidelines) and incentivized by local, state and national programs. So the assertion above is no longer correct in general.	Rejected. The comment seems to be contradictory, as the reviewer acknowledges that architects are involved even in the design of new houses in the US. It is emphatically not the case that a true IDP process is involved in the design of buildings in developed countries or anywhere else (otherwise, their perfromance would be much better!),
33799	9	16	29	16	33	System optimization is also important. Further, it seems not realistic to claim that a (optimized) combination of devices (system level) can achieve many times more savings than just a sum of the savings by individual devices. The saving can be a fraction higher indeed.	Reject: We do imply that system optimization is important, and the cited reference gives examples that support the claim.
31447	9	16	3	21	30	This section might also discuss mitigation options in the building sector related to the inclusion of harvested wood product (HWP) in the LULUCF accounting rules? Carbon stored in wood constructions offers significant mitigation opportunities. Wood has the best thermal insulation properties and the lowest embodied energy of any mainstream construction material.	Noted: No room, does not suport key messages
33800	9	16	37	16	46	This part could be possibly omitted.	Noted
41293	9	16	4	16	13	This whole text region is better suited to a generic section on "other benefits". This comment only applies in relation to this chapter - maybe not true when all LDC boxes considered. at the very least, ensure that all of these "other benefits" ideas make it to that section at the end of the chapter.	Rejected. Important to note "even in countries/jurisdictions where financial resources for mitigation are limited"
41296	9	16	41	16	46	If chapter length is an issue, we recommend deletion of this text region.	Noted
33801	9	16	47	17	8	The essential steps described are in fact the passive house concept. By design of a house, firstly the so-called Trias Energetica principles should be applied (http://triasenergetica.eu/): 1. reduce demand by EE measures, 2. use RE, 3. use fossil fuels as efficiently as possible. The described essential steps cover the 1st step in Trias Energetica.	Noted. But no need to add more references.
24709	9	16	47	17	14	This is very valuable material. Suggest that it is important to keep when shortening the chapter.	Noted. Thanks

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35277	9	16	14			This part ignores the fact that the applicability of energy-saving technologies is different between developed and developing countries in terms of regions/zones, climate conditions, building types, and lifestyles. It is suggested to include discussions on the applicability of energy-saving technologies. On page 21, line 24-27, it is said that envelop upgrades to multi-family housing in developing countries can achieve 1/3 -1/2 reduction for cooling and 1/2 – 2/3 for heating, which does not reflect the reality in China. Due to the fact that heating is only provided in parts of China for limited time every year, envelop usually cannot lead to significant energy saving, but on the contrary, can even increase the energy used for cooling. Moreover, in the hot summer and cold winter zone, the energy used for heating in the winter is already very low, therefore envelop upgrades will not result in a dramatic energy reduction for heating. It is suggested to replace" (iii) relatively modest envelope upgrades to multi-family housing in developing countries such as China have achieved reductions in cooling energy use by about one third to one half, and reductions in heating energy use by two-thirds" with "(iii) relatively modest envelope upgrades to multi-family housing in developing countries such as China have achieved reductions in heating energy use by two-thirds in cold zone."	Accept: Rephrased - the cited savings are from published studies but are not applicable in regions with no or inadequate heating to begin with.
23488	9	16	14			The subtitles are confusing. Some not reflect the section title. E.g. 9.3.6 Maybe the title could change to 'Low emission refrigerant' instead of 'Halocarbons'. In fact all the subtitles should be revised. So as 9.3.7. The contents are discussing vernacular designs but using 'affordable low-energy housing'. Firstly the affordable houses is not one of the mitigation strategies. Secondly, Vernacular houses to be built in a city not neccessary is 'affordable', could be costly.	Accepted: Title of 9.3.6 has been changed to "Halocarbons and their substitutes" and the title of 9.3.7 changed to "Avoiding mechanical heating, cooling and ventilation systems".
34406	9	16	9	25	6	This section should start with an introduction to the logical structure of different mitigation options in the building sector and how each of them affects direct and indirect emissions from the building sector. For instance, it does not become clear which options help to reduce the use of power (indirect emissions) and which ones help to reduce the use of combustible energy carriers (direct emissions). The GHG mitigation effect of those two classes of mitigation options seems to differ fundamentally from one another. I would suggest to develop a figure that shows the logical structure of mitigation options at different levels of aggregation. One level of aggregation would be the level of individual buildings. A higher level would be the settlement level. A lower level would zoom into energy using activities within buildings. This could help to make the chapter more accessible and draw clear lines (literally) between which options are covered in which chapter.	Noted: An interesting idea, but we don't have the space
34407	9	16	9	25	6	This section and section 9.6 on costs and potentials are by nature closely intertwined. A lot of the text in this section already addresses the cost and potentials of mitigation options in the buildings sector. I would move all quantitative information from this section to section 9.6 and use this section only to qualitatively describe the different types of mitigation options, incl. their mutual interdependencies, and their relevance under different regional or climatic conditions. This would result in a signficantly shortened section 9.3. Section 9.6 may, in turn, increase in size, though much of the material can be further synthesized.	Reject: After further discussion with the TSU and CLAs, it has been collectively agreed to keep the structure the way it is.
22086	9	16				A good summary of key points from AR4, particularly the emphasis on potential of significant mitigation and other opportunities of adopting a systemic/holistic approach to new building. Requires IDP approach to new building design and a shift away from the current linear and fragmented practice. This section doesn't mention developments including building information modelling (BIM).	Noted: Thanks
30564	9	16 of 92	46			Must add: "from the point of view of sustainability and equity.", instead the last point of line 46.	Reject. Focus here is on energy reduction.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30565	9	16 of 92		19 of 92		Again, all examples, cites and references, concern technologies, instead of consumers' behaivoural aspects, although both issues are implied in possible energy savings.	Reject. Section 9.3.10 covers behaviour (and has been expanded)
30563	9	16 of 92	15	16 of 92	26	The Section's name include "behaivoural aspects", but those aspects aren't included at least in the first paragraph of the text; it seems that only in Section 9.3.10 the issue is partially approached, altough instrumentally, loosing the educative and formative-consciousness elements which could change the actions of people, from childs to elders, including teachers, professors, etc. For instance, public goods campaings and televisor spots aimed to encourage better habits and lifestyles, could substitute advertising spaces devoted to increase consumption.	Reject. No options are covered, just listed (including behavioural) in the first paragrapg. The advertising idea is not implementable in most countries (what would replace lost advertising revenue?)
26390	9	17	1		14	This paragraph could be shortened	Reject. We feel that these are important points and would like to keep them.
41298	9	17	15	17	29	The authors should consider adding the following reference: Xu, P., T. Xu, P. Shen. 2012. Advancing Evaporative Rooftop Packaged Air Conditioning: A New Design and Performance Model Development, Applied Thermal Engineering, Volume 40, Pages 8-17.	Reject. We are avoiding references to specific technologies as much as possible
23483	9	17	16	17	23	Perhaps the examples that given in the text should also mention which one is technology improvement and which one is cost reduction. Cost reduction and low cost technolgies are not the same. Some of the given examples are research based and only one case for that particular technology. Again, this is not strong enough to be argued as 'significant', nonetheless these show the technology developement and potential. on the other hand, if the examples are existing buildings then they should be highlighted to show the technology is do-able in real practice.	Reject (in part), accept (in part). We just what to make the point that lots of ongoing technology development is occuring. However, we deleted "significant"
24710	9	17	16	17	25	The wider use of diagnostic tools such as thermal imaging, energy monitoring and blower doors, and tighter construction tolerances have helped to improve efficiency. Suggest that these extra tools should be mentioned.	Reject. We've given enough examples to make our point.
25404	9	17	18			LED lighting is hardly mentioned in the chapter. This would be a natural place to do so. See Schubert and Kim (http://www.sciencemag.org/content/308/5726/1274.abstract)	Noted. Have added a relatively up-to-date reference on LED lighting (Wiggins et al 2010); the reference given by the reviewer is from 2005.
41299	9	17	22	17	22	"which can cut energy use by more than half" It seems odd that the authors add this when none of the other parts of the list have a similar qualification. Please consider revising.	Agreed. The phrase has been replaced with a generic phrase applicable to all the advances listed.
41297	9	17	3	17	8	If chapter length is an issue, we recommend deletion of this text region.	Noted
41300	9	17	37	17	43	Please revise this statement in order to make it more concise.	Accept. "Scale" has been replaced with "increase"
23482	9	17	15			The word 'significant' is a strong word. The contents do not give 'significant' proofs or examples.	Agreed. The word "significant" has been deleted.
34510	9	17	15	17	29	Suggest to increse the natural ventilation technology in 9.3.2.	Reject: No space, and no reference is given.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
31610	9	17	25	17	28	Moreover, viable supporting tools to demonstrate legislative compliance are required. However, current energy performance prediction models used to achieving performance requirements have been shown to have considerable predictive variability (Raslan & Davies, 2010, 2012). Therefore, special care has to be taken in applying models to estimate energy performance in buildings in order to conform/rectify with building codes. Reference: Raslan, R. & Davies, M. (2010), Results variability in accredited building energy performance compliance demonstration software in the UK: an inter-model comparative study, Journal of Building Performance Simulation, 3:1, 63–85 Raslan, R. & Davies, M. (2012), Legislating building energy performance: putting EU policy into practice, Building Research & Information, 40:3, 305-316	Reject: Can't see how this related to the points that we make here

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
31609	9	17	21-23	26	18-25	The benefits of smart meters are uncertain. The current devices and systems may provide no additional benefits to those gained by traditional energy saving methods (i.e. raising an awareness of energy saving measures through education and appropriate communication). Occupier education on matters related to energy saving has been shown to be a low cost way to boost energy savings without the need for smart meters. The UK Energy Savings Trust (2012) note that, on average, individual households unnecessarily spend between £50-£86 annually on energy consumed whilst their appliances were in a 'non-active' state. Switching-off such appliances when non-operational may result in three times greater savings than smart meters are predicted to achieve by 2015 by industry optimists without the huge financial outlay and risks involved in getting such a metering system right. (Redesigning programmable appliances so that they could be switched off for prolonged periods without the need for being reset would also be of great benefit as an energy saving measure). Wireless smart meters and smart appliances consume extra energy as a result of the signals they send – this is seldom taken into consideration when discussing energy issues. The long-term consumer energy savings commonly believed to be achievable through the installation of smart meters generally appear unrealistic. As examples: studies by the US Electric Power Research Institute (2011a, 2011b), which assessed energy usage after smart meter installation (n = 8,000 randomly selected from 130,000), found that very few consumers actually reduced usage after installation in order to save money. Less than 10% of the subjects showed any reduction in peak-usage, and overall energy reduction was found to be statistically insignificant. Those results were shown consistently in both the 3-month pilot and the full-year study, which confirms that none of the treatments resulted in any significant change in average customer usage (Electric Power Research Institute, 2011b). Darby (2010) too notes that there is little evidence that adoption of smart meters would reduce energy demand. The 15-month study by van Dam et al. (2010) additionally found initial energy savings achieved with in-home displays were not sustained medium to long-term. Wireless smart meters and related technologies in the present formats are still a subject of controversy in terms of potential adverse impacts (i.e. data security and national security issues (Anderson & Fuloria, 2010a,b, Fisk, 2012, Skopik et al., 2012), unemployment, human rights, health and environmental issues). There are significant concerns about the generation of such data with regard to potential violation of human rights. Article 3 of the Universal Declaration of Human Rights states "Everyone has the right to … liberty and security of person." It is already recognised that the insights provided by data from smart meters may compromise individuals' freedom to do what they wish within their own homes and may therefore breach this human right (Anderson & Fuloria, 2010a). Claims may additionally arise that the lifestyle information of consumers that smart meter data can provide to third parties may potentially damage people's reputations. Security issues also arise as a result of the data that such meters can provide on home occupation patterns and the type of electrical equipment with the home that may be of use to thieves and other third parties. The transmission of wireless data from smart appliances also raises potential health concerns increasing individual's exposure to a class 2B carcinogen also raises concerns	Noted: The reviewer's extensive comments are greatly appreciated. The reviewers' concerns relate to the use of smart meters as an energy savings measure in the current electricity system. However, smart meters are aslo viewed as means of accommodating flucutating renewable energy sources as they achieve greater penetration into the electricity supply system in the future. Even without saving energy, they are also valuable as a means of reducing peak demand. So, we will add the qualifier, "as a means of reducing peak demand and accomodating intermittent renewable energy sources".
19514	9	17	30	21	10	reduce page count by 1.55 (of 18 needed); do this by replacing the 4 subsections with 2 entitled "Energy savings" and "Incremental cost" and transforming the lengthy text into concise summary tables as was done for sec. 9.3.5; currently 3.55 pages are used so the recommendation cuts this to 2	Reject. We have now been allocated more pages.
41301	9	17	44	19	12	We recommend that the authors consider including energy intensive high-tech buildings, e.g., add refs:1) Hu, SC., A. Shiue, H. Chuang, and T. Xu. 2013. Life Cycle Assessment of High-Technology Buildings: Energy Consumption and Associated Environmental Impacts of Wafer Fabrication Plants. Energy and Buildings, Volume 56: 126-133; 2) Hu, S.C., T. Xu, T. Chong, Y.L. Chan, and R. T.C. Hsu. 2010. Characterization of Energy Use in 300 mm DRAM (Dynamic Random Access Memory) Wafer Fabrication Plants in Taiwan. Energy - The International Journal. Volume 35, Issue 9, Pages 3788 – 3792.	Reject. Too specific to include here, due to lack of space

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41302	9	18	1			We find it difficult to understand this table. Please provide definitions of the regions? Why are they only under HVAC/lighting? What are we comparing? Why are most cells empty? The authors should revise this table, adding data to the cells or delete it.	Accept. Paper has been revised to largely eliminate empty cells
41303	9	18	1			We suggest not to use "typical" in the title of the table.	Recject. Why not use "typical"?
23484	9	18	10	18	35	The paragraph discusses the heating and cooling loads in a mixture way (e.g. discussion starts from heating then cooling then heating again). Suggest the discussions on heating ang cooling to be disscussed separately.	Reject: We discuss heating then cooling in temperature regions, then the effect of PH on both, then move on to hot regions.
41304	9	18	10	18	35	We recommend that the authors consider adding the following reference: Xu, P., T. Xu, P. Shen, 2013. Energy and Behavioral Impacts of Integrative Retrofits for Residential Buildings: What Is at Stake for Building Energy Policy Reforms in Northern China? Energy Policy, Volume 52, January 2013, 667-576	Reject. I checked the paper - it show that recently-emplemented standards reduce the heating requirement in a moderately cold city from 300 to about 100 kWh/m2yr.
27109	9	18	11			What does LDD mean? It's nowhere else mentioned in the text.	Accept: The LDD does not belong - comes from Zotero
41305	9	18	18	18	23	The statement: "Cooling energy use is growing rapidly in many regions where, with proper attention to passive design principles, mechanical air conditioning would not be needed. This includes regions that have a strong diurnal temperature variation (where a combination of external insulation, exposed interior thermal mass, and night ventilation can maintain comfortable conditions) or a strong seasonal temperature variation (so that the ground can be used to cool incoming ventilation air)." We recommend that the authors augment the discussion to include "or (hot) arid regions that allow direct and indirect evaporative cooling or allow hybrid evaporative/mechanical cooling strategies to be implemented."	Accepted
20310	9	18	2			The heating energy requirement for newly built houses in "typical modern" shows a rather extreme value (between 50-450)	Accept: 450 is too high for recent new house. Range is now given as 60-200.
41306	9	18	23	18	35	Some material may be more efficiently (in terms of readability and pages consumed) presented in tabular form. Specifically, following the example of Table 9.3 or Table 9.6, the enumerated details of several sections may be presented in a table (i.e., after presenting a sentence or two describing the general trends observed) including: Possibly lines 23 to 35 of page 18	Noted. We think that it is important to give some specific examples (to compliment summary information in Table 9.2)
26578	9	18	26			what about positive energy buildings ? “most stringent” not clear	Accet. Rephrased to read "The most stringent of these with regard to heating requirements is …"
23485	9	18	28	18	29	This might not always be the case, there are a lot of factors, e.g. the micro climate, size of the buildings etc. Could be discussed by mentioning it as 'potential strategies' to avoid misconception of passive design always work for hot and humid climate, which is not so true.	Reject. We say "can be".
26579	9	18	29			take out two references	Accept. Done

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
31611	9	18	11	18	13	However, the health implications of such measures have not yet been fully assessed. Furthermore, indoor air quality and indoor environmental quality appear not yet to be properly integrated into voluntary and mandatory standards for low and zero-energy buildings. Limiting the exchange of indoor air with outdoor air, particularly in developed countries, may make ventilation problems more common or even worse. Moreover, introducing new materials and weatherisation techniques may lead to unexpected exposures and health risks (Spengler, 2012, Institute of Medicine, 2011). Contrary to this, appropriate ventilation rates may improve health and wellbeing. For example, it has been reported that ventilation rates above 0.5 air changes per hour have been shown to be associated with a reduced risk of allergic manifestations among children in Nordic homes (Sundell et al., 2011). Poor ventilation is also shown to be associated with occupant health problems and/or lower productivity (Institute of Medicine, 2011). A review by Sundell et al. (2011) reports consistent results in multiple investigations and different epidemiologic designs for different populations showing similar relationships between multiple health outcomes and ventilation rates. Higher ventilation rates in offices have been found to be associated with reduced prevalence of sick building syndrome symptoms. It is becoming recognised in practice that the current trend of lowering ventilation rates within airtight envelopes in order to save energy (as exemplified in Passive House construction methods) can cause problems: with poorly executed details for insulation, vapour barriers and other components having been found to contribute to higher levels of condensation which can lead to moisture build up indoors that can allow preferential conditions for dust mites, mould and fungi to flourish (Cousins, 2013). For such initiatives to be effective, a more holistic approach is required - for both new and old building stock - if such problems are to be reduced and biologically sustainable solutions created. References: Cousins, S. (2013), Moisture in buildings: Making homes airtight to save energy could lead to catastrophic moisture build-up. Energy efficiency, Products in Practice, RIBA Journal, March 2013, pp. 25-26. Institute of Medicine (2011) Climate Change, the Indoor Environment, and Health, National Research Council, Committee on the Effect of Climate Change on Indoor Air Quality and Public Health, National Academies Press, Washington, DC. Spengler, J.D. (2012) Climate change, indoor environments, and health, Indoor Air, 22: 89–95 Sundell, J., Levin, H., Nazaroff, W. W., Cain, W. S., Fisk, W. J., Grimsrud, D. T., Gyntelberg, F., Li, Y., Persily, A. K., Pickering, A. C., Samet, J. M., Spengler, J. D., Taylor, S. T. and Weschler, C. J. (2011), Ventilation rates and health: multidisciplinary review of the scientific literature. Indoor Air, 21: 191–204.	Reject: When designed probably, none of these issues are problems in very low-energy houses. I have added the phrase, "It entails a high-performance thermal envelope combined with mechanical ventilation with heat recovery to ensure high indoor air quality."
25399	9	19	11			The correct term is "luminaires" rather than "luminaries"	Accept. Spelling has been changed.
30573	9	19	20	21	4	In the EU regulation NZEB means Nearly zero energy buildings and not "Net zero energy buildings". The abbreviation may cause a confusion in this context. It is difficult to decide if the statements refer to net ZE buildings or nearly ZE buildings. Note that the difference between net ZEB and nearly ZEB can be very high in some of the countries.	Reject: We are not referring to EU regulation, and we define what we mean. Others use NZEB this way too.
33802	9	19	26	19	27	Some jurisdictions… you could mention the EPBD in the EU as an example.	Reject. Since we criticize this idea, we do not want to single out specific jurisdictions.
33803	9	19	29	19	10	Except for an electricity grid, a two-way interaction in district heating (and cooling) grid is also important. Research on these concepts and also first pilots are being carried out.	Noted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27110	9	19	3			What does 5000 HDD mean? It's nowhere else mentioned in the text.	Accept. We just deleted it.
41307	9	19	39	19	41	This paragraph promotes PV without considering the urban heat island impact (UHI) that may result and thereby may compromise efforts to minimize cooling energy consumption. Specifically it is stated: "Attaining net zero energy use is easiest in buildings with a large roof area (to host PV arrays) in relation to the building's energy demand, so a requirement that buildings be NZE will place a limit on the allowed height and therefore on urban density." Yet even for higher PV solar conversion efficiencies of 15-20% and a reasonable assumption regarding PV solar reflectivity of 1-5%, more than 75% of incident solar energy must be lost as heat to the immediate environment of the PV panels that must be expected to exacerbate UHI. Consequently, a more complete consideration would demand considering the benefits and costs of PV ("black" roofs), cool roof coatings ("white" roofs), and green roofs. Furthermore, there is opportunity to integrate PVT systems to reduce localized heat island impact of concerns.	Accepted. We will add another factor to be considered, "impact on energy use of alternative uses or treatments of roofs"
22087	9	19				This is an important paragraph and more needs to be made of it. There is a large and growing literature in which POE has been demonstrated to be absolutely crucial to reducing the performance gap.	Accept. The section has been expanded (and the section name modified)
30340	9	19	13	19	18	This needs to go further. Post-occupancy evaluation needs to be embedded in contracts - ideally by regulation - otherwise it'll be seen as another desirable cost to be cut. Bill Bordass's work on 'Soft Landings' sets out how this could be done (in the UK) at minimal marginal cost. Another key benefit is that by extending the contract beyond point of occupation the developer and client have a greater interest in using the building optimally, whilst it also means developers learn more quickly from their projects.	Noted. We have not prescribed what should be done here, but elsewhere we have identified several elements of the required package (codes, inspection, follow-up monitoring)
23489	9	19	13	19	18	More information should be added. Real cases of post evaluation studies should be included, if the post-evaluation is the focus. Otherwise, discuss more on how control system can help to reduce energy use in buildings.	Acceot. The dicussion has been expanded.
26391	9	19		20		This paragraph could be shortened	Reject. All the points are already stated succintly, and we feel that all the points are important
22088	9	19				Micro-renewable or building integrated, distributed energy or onsite renewables - terminology needs to be consistent with Ch.7.	Reject. I only see the term "on-site renewable"
25335	9	2		59		The structure of the article is alright with its wide and indepth coverage on the topic with relevant quoted literature.	Noted: Thanks
24701	9	2	1	4	3	In order to cut the length of the chapter some of the material on urban energy infrastructure could be moved to another chapter. Suggest that where good material on specific elements of the chapter is available free from a quality source via internet, that the chapter provide concise information and refer readers to the other source(s)	Rejected. Not clear
22089	9	20	1	20	2	The value for COP cited here seems overly optimistic relative to other studies. This may present an overstatement of potential of technology at scale.	Reject. This is indeed the COP given in the cited study, where an explanation is also given.
33804	9	20	10	20		incremental costs of 5-16% - new and renovated buildings? Please, check with the 5-8% at the page 8, line 14.	Noted. Should be 6-16% here and earlier
26580	9	20	10			take out google reference!, and two older references	Accept. Only Harvey (2013) is cited now.
27111	9	20	16			The currency changes between dollars, euros, and pounds. Is this deliberately done? It reduces the comparability.	Noted. Yes, it is deliberate - so that the case studies mean more to people from the regions being featured.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26581	9	20	20		21	take out Anderson et al., 2006; Hasan et al., 2008;	Reject. All the references are needed to support the given range (but I have cut more references than requested elsewhere)
41308	9	20	21	20	21	Typo: Replace "However, there a number of ways " with "However, there are a number of ways"	Accepted
33805	9	20	30	20	31	increasing experience and large-cale implementation...	Accept. Good addition.
22091	9	20	30	20	31	Costs will decrease with increasing experience but the importance is underplayed in the text. As written, it is not a summary of the science but a statement based on judgment. It needs to be substantiated with literature.	Noted. Yes, this is our judgement, but it is well accepted that there are experience or learning curves, whereby *all else being equa) costs decrease with experience.
34511	9	20	31	20	34	Suggest to modify the sentence "For residential buildings in regions where cooling rather than heating is the dominate energy use, the key to low cost is to achieve designs that can maintain comfortable indoor temperatures while permitting elimination of mechanical cooling systems." to "For residential buildings in regions where cooling rather than heating is the dominate energy use, the key to low cost is to achieve comfortable indoor temperatures and reduce the use of mechanical cooling system through passive design."	Reject. "reduced use" implies that a system is still installed, which reduces the capital cost savings compared to not needing cooling system altogether.
33806	9	20	48	20	50	Even when low-energy buildings cost more… here may be mentioned that the LCA-approach should be considered, innovative financial constructions developed, also to avoid the split-incentive barrier…	Noted. To talk about payback is to implicity consider the life-cycle costs. Policy options, including pertaining to financing, are discussed later in this chapter.
24711	9	20				Suggested reference: Sustainability House (2012). Identifying Cost Savings through Building Redesign for Achieving Residential Building Energy Efficiency Standards. March 2012, prepared for the Australian Department of Climate Change and Energy Efficiency, http://www.climatechange.gov.au/publications/nbf/~/media/publications/nbf/identifying-cost-savings-thru-building-redesign-for-achieving-energy-efficiency-standards.pdf. [This study has showed how existing house designs could have thermal efficiency upgraded from 6 to 7 stars or better at zero or negative cost]	Noted: I could not find an email address for the reviewer. An email address was requested from the TSU, but was not provided. In any case, many similare results are in the primary cited reference that we rely on (Harvey, 2013)
30344	9	20	10	20	10	"Google Scholar Linked Page"	Accepted: The phrase "Google Scholar Linked Page" has now been removed from the section.
20311	9	20	20			On costs and energy savings of passive houses compared to conventional buildings in new construction for Austria see also Köppl, A., C. Kettner, D. Kletzan-Slamanig, S. Schleicher, H. Schnitzer, M. Titz, B., Wolkinger, A. Damm, K. Steininger, R. Lang, G. Wallner, A. Karner, H. Artner, (2011), EnergyTransition 2012/2020/2050. Strategies for the Transition to Low Energy and Low Emission Structures, commissioned by the Austrian "Klima- und Energiefonds", Vienna, 2011.	Noted: I checked this source, but it relies on other studies that I could not access and evalulated. However, many similar and verified results are in the primary cited reference that we rely on (Harvey, 2013).
30341	9	20	41	20	43	Suggest cutting this example to save space. Savings vary widely and 67% would seem too specific a figure to quote in this context.	Reject. The point being emphaiszed here is not the specific savings, but that it was delivered at zero additional cost
22090	9	20	5	21	10	This section could be shortened.	Reject. Cost, and reducing cost, is a key issue.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34410	9	20	5			There's strong overlap with the material in section 9.6.2.1. The material from both sections should be combined and further condensed in section 9.6 on cost and potentials. Section 9.3 should focus on a qualitative description of the logical structure and interdependencies of mitigation options in the buildings sector, maybe also making use of a conceptual figure depicting the different levels at which the building sector can be analyzed.	Reject: After further discussion with the TSU and CLAs, it has been collectively agreed to keep the structure the way it is.
22914	9	20	5	23	3	Cost should be put together with 9.6.4.2	Reject: After further discussion with the TSU and CLAs, it has been collectively agreed to keep the structure the way it is.
22796	9	20	5	21	10	9.3.3.4 is similar to 9.6.4.2. Those should be put together and save a space. More space is necessary for behavioural aspect.	Reject: After further discussion with the TSU and CLAs, it has been collectively agreed to keep the structure the way it is.
41309	9	21	11	21	15	We suggest that the authors consider including a reference for developing countries, e.g., Xu, T., J. Sathaye, H. Akbari, V. Gard, S. Tetali. 2011. Quantifying the Direct Benefits of Cool Roofs in an Urban Setting: Reduced cooling energy use and lowered greenhouse gas emissions. Building and Environment. Volume 48, Pages 1–6.	Reject. This section is about retrofitting, and does no discuss specific technologies or measures.
41310	9	21	11	22	25	Some material may be more efficiently (in terms of readability and pages consumed) presented in tabular form. Consider put in table format - 9.3.4.2 Incremental cost: possibly much of pages 21 and 22	Reject. We need some flesh to the discussion
41311	9	21	12	21	12	Please clarify what do you mean by "entire" building stock? Is retrofitting every single building in a country really a necessary part of any program? Please rephrase the sentence.	Noted. "Entire" means every building. Why not? Even heritage buidings can be improved in some wats
34825	9	21	14			Content: I think this should say "a large fraction of the total building stock existing today will still exist in 2050" - the way you have it now contradicts claims in Ch.12, see Müller 2013 reference there.	Accepted.
41312	9	21	16	21	35	We suggest that the authors consider adding a reference for developing countries, e.g., Xu, P., T. Xu, P. Shen, 2013. Energy and Behavioral Impacts of Integrative Retrofits for Residential Buildings: What Is at Stake for Building Energy Policy Reforms in Northern China? Energy Policy, Volume 52, January 2013, 667-576	Dulicate comment
41313	9	21	21	21	34	The number of specific, circumstantial strategies, like the few listed here, that may result in cost savings are practically endless. The chapter should instead place a primary emphasis on general strategies. Therefore, we see no compelling reason to include these lines in the chapter. Furthermore, the last sentence (lines 31-34) is self-evident and need not be included.	Reject. We give ranges for a number of different categories of buildings.
41314	9	21	25	21	31	Some material may be more efficiently (in terms of readability and pages consumed) presented in tabular form. Consider put in table format - 9.3.4.1 Energy savings: possibly lines 25 to 31 of page 21.	Duplicate comment
33807	9	21	3	21	3	… linear and fragmented design and building (this construction phase should be considered, too) process…	Reject. The cited reference, and this sentence, are only talking about design.
25393	9	21	44			These buildings were located across the United States (not just in California)	Accepted (text modifed)
33808	9	21	5	21	10	Do you mean here that the present design and building process is fragmented (separate steps by many parties) and that an umbrella party should lead and coordinate the process in order to save costs and assure a fluent cooperation…?	Noted. This is probably what the cited source means.
19515	9	21	11	23	3	reduce page count by 0.35 (of 18 needed); do this by transforming the lengthy text into concise summary tables as was done for sec. 9.3.5; currently 1.35 pages are used so the recommendation cuts this to 1	Reject. Most of the text is a qualitative discussion that does not lend itself to presentation through a table, and it is too important to cut.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30345	9	21	12	21	15	"Programs to retrofit the entire building stock of a country would be an important part of any program to reduce the energy requirements of the building stock," - suggest this is a significant understatement of the importance of retrofitting, especially in EU and OECD countries were substantial (>50%) proportions of the existing building stock will still be in occupation in 2050. For the UK, a 2010 [CHECK] report by the Sustainable Development Commission puts this figure at around 70% - however in our experience this figure is frequently quoted by experts but without the original source because the figure is easy to arrive at (+/- 5%) using basic and well-known figures / assumptions / rules of thumb (e.g. the 1% replacement rate) - i.e. whilst not exact it is fit-for-purpose and robust enough for decision-making. Presumably similar figures exist for other EU / OECD countries (at least). A further risk is in assuming buildings are replaced on an 'oldest first' basis. Aside from historic buildings, decision-making (in relation to climate change or otherwise) needs to focus on replacing the poorest performing buildings, regardless of age (e.g. poor quality post-war / 1960's mass-build housing). The risk here relates to loss of skills needed to maintain and renovate older / traditional buildings that, with sufficient expertise, could be retro-fitted to higher performance standards than more modern build. The impact of this loss of knowledge and skills is already a serious cause of concern in countries such as Scotland, which has a high proportion of traditional (but potentially energy efficient) buildings. Many of these are already classed as 'hard to treat' based on technical barriers that would not have been classed as such 50 years ago. References: Roaf, S., Baker, K.J., & Peacock, A., 2008. Evidence on Hard to Treat Properties. Scottish Government. Bond, D., et al, 2013. Evidence for the All Party Parliamentary Group for Excellence in the Built Environment Inquiry into Sustainable Construction and the Green Deal. Consultation response prepared by the Natural Energy Efficiency and Sustainability (NEES) Project for the UK Government, April 2013. See www.neesonline.org	Noted. No room to say more.
40713	9	21				The effectiveness of the passive building depends on region and climate.[?]So, please state about it.	Reject. The text makes a passing reference to the Passive House standard, which is a heating load that is independent of climate (so of course it represents a larger savings the colder the climate)
26392	9	21				This section seems to focus on best practice examples, i.e., the tail distribution of energy efficiency improvements. Can we get a more general picture of energy savings through retrofits?	Reject. We want to discuss what can be achieved with best practice, but it has been achieved often enough and in representative enough peoples that we expect these savings to be generalizable.
41315	9	21	36	23	3	1) We would like to know what's most cost-efficient. If the authors cover this later in the chapter, then please reference that section here. 2) We don't understand what page 22 line 17 - "based on a" is referring to. Please explain. 3) We would appreciateit if the authors would provide the "marginal cost" in dollars	Noted. We don't have marginal costs in most cases. Garbled text has been removed
41316	9	21	36	23	3	Some material may be more efficiently (in terms of readability and pages consumed) presented in tabular form. Consider put in table format - 9.3.4.2 Incremental cost: possibly much of pages 21 and 22	Duplicate comment

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34512	9	21	36	23	3	The incremental cost description for existing building retrofit is too optimistic for developing countries. Reference: LI Dongyan(2009). Fiscal and tax policy support for energy efficiency retrofit for existing residential buildings in China's northern heating region,Energy Policy, 37,2113-2118. "The mean estimates of the minimum retrofit cost are 300yuan/m2.In the current policy frame work, the central government provides only about one-sixth of the total retrofit cost. If the local government does not support the EERERB financially, the remaining five-sixths can be shared only by heating enterprises and residents. However this is a hardship in an area where underdeveloped provinces and cities are pre dominant. Such an expense is bound to create enormous financial pressure on local government. Especially in China's current public finance system, in which a sub-provincial Tax-sharing Fiscal system has not really been established(Jia Kang,2007), local governments, in particular the county governments, do not have sufficient fiscal strength to meet their financial responsibilities, and general transfer payments from upper level government is insufficient. The lower the level of government, the less revenue power it has. Under this condition, if the central government asked the provincial government to match the specific transfer payment for EERERB, the fiscal pressure would certainly convey to the lower levels of government, thus further deteriorating the status quo of ''financial revenue powers and expenditure responsibility up side down''. Ultimately, local governments would lose the motivation to implement EERERB."	Noted: There is nothing in this comment that contradicts what we say about cost, but we will consider adding some lines about even relatively low absolute costs being beyond the financial means of possible funding agents in some countries. Maybe link this to CDM discussion.
22797	9	21	36	23	3	Cost should be put together with 9.6.4.2	Reject: After further discussion with the TSU and CLAs, it has been collectively agreed to keep the structure the way it is.
30343	9	21	37	21	48	Pushing MVHR this strongly risks locking us into using electricity to regulate the thermal perfomance of our buildings. MVHR is just one of several possible solutions to reducing building energy consumption. Another is designing buildings around natural heating, lighting, ventilation and cooling. I'm not sure the strength of opinion and evidence on alternatives to MHVR is being presented equally - and many experts would argue any solutions that don't themselves use electricity are preferential in themselves.	Reject. MVHR is an integral part of achieving the Passive House standard in moderate to cold climates, and yields a large net savings in primary energy use in such climates.
30574	9	22				Last row: EF for gas heater and electric heat pump should not be compared. The primary energy content of the electricity used by the heat pump can be cca. 3 (country specific value). That means that EF should be devided by 3 when comparing to gas. However if EF for heat pumps means SPF (seasonal performance factor) its value can be 5-6.	Reject: In the long run, under CO2 phase-out scenarios, electricity will be decarbonized and the primary-secondary disctinction will be meaningless. COP will be relevant to how much electricity needs to be supplied, vs how much C-free fuels will be needed without heat pumps.
23486	9	22	14	22	16	if 'saved', why '-0.07Euro/kWh/yr'? If the '-' (or '+') sign is not representing additional cost, perhaps the '-'and '+' signs need to be explained, else would be misinterpreted.	Noted. kWh are saved, but the cost is negative (meaning, money is saved too)
27113	9	22	17			Part of a sentence is missing: "… measures based on a."	Accept. Garbled part has been deleted
41318	9	22	17	22	17	Please replace " select retrofit measures based on a." with " select retrofit measures based on it."	Noted (fixed in a different way)
41319	9	22	17	22	17	This sentence is missing word(s) at the end. Please correct.	Accepted
26393	9	22	19			3% discount rate and, especially, a 3% fuel escalation rate read like very pro-conservation assumptions	Noted. We are just citing the assumptions in the cited paper. 3% is a common social discount rate.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41317	9	22	2			1) We believe it would be helpful to reference the table before it appears in the text. 2) We believe that the "savings potential" column seemed to have a lot of information in it that may not be particularly useful to the readee (e.g. the countries). We wonder whether a simpler value per cell in this column would be more valuable, allowing comparison across rows. 3) Please clarify what each baseline means by adding notes.	Accepted. Specific countries are deleted and more information added that is tied to climate
33809	9	22	22	22	22	archetype existing building - do you mean a model, typical and widely spread building? In each country, there are several of such reference buildings. Or do you mean old, even monumental buildings?	Noted. The former.
26630	9	22				These technology items and estimations are too disperse. Items should be sorted into categories, such as room heating & cooling, water heating, cook, appliances. Assumptions for respective estimations of savings potential should be described.	Reject: We don't think that the items listed in Table 9.3 need to be grouped into categories.
30346	9	22	13	22	25	Suggest some cutting here to save space. Whilst these studies are important the resulting figures have little weight where they are modelled estimates (which are rarely borne out by post occupancy evaluation) and / or are likely to be too building or location-specific for general / high-level reporting and decision-making.	Reject. Space is no longer on issue.
26582	9	23	12		16	sentence not readily understandable	Noted. Can't see why
31448	9	23	13	23	14	We find this conclusion somewhat misleading, since we think that the CFCs and HCFCs contained in current equipment and stored as waste will represent a challenge for many years to come.	Accepted. Sentence deleted.
31449	9	23	17	23	18	This part should also deal with natural refrigerants (CO2, NH3 and hydrocarbons).	Accepted. Material referring to these has been added.
34794	9	23	17	23	21	Also, HFOs having a GWP of 4-6, are possible substitutes for HFC-245fa and HFC-365mfc in rigid polyurethane foams. (UNEP TEAP Report-Decision XXIII/9 Task Force, 2012, page 57-67 ; UNEP TEAP Rigid and Flexible Foam Report. 2011 May. page 43-44)	Accept. This has been added.
27834	9	23	17	23	19	HFC-free refrigerators (refrigerant and foam) exist for a long time. So please delete the sentence: "For example, hydro-fluoro-olefins (HFOs), having a GWP of 4-6, are possible substitutes for HFC134a (GWP=1430) in residential refrigerators (Bansal et al., 2011b), while foam insulations with non-halocarbon expanding agents have recently become available."	Noted. Unless a reference is found or given by someone else, we cannot make this point. In any case, HFOs are being developed as an alternative for use today.
31450	9	23	19	23	21	Measures to avoid the use of AC or refrigeration in the first place should also be mentioned in this context (e.g.. redesign of buildings).	Accepted. This point has been added.
41321	9	23	44	23	44	We didn't see biomass in Fig 9.9. Please consider adding biomass to this figure.	Accepted. Reference to Fig 9.9 has been deleted.
34832	9	23	44			Detail: Please insert proper reference to Bioenergy Appendix in Ch.11	Accepted
41322	9	23	46	23	47	"SHW" should be written as "DHW" (i.e., for domestic hot water) and "compare to" should be written as " compared to."	Accepted. Changed to "hot water"
34833	9	23	46			Detail/Def: Please define SHW as used here for the first time	Accepted. (SHW is deleted)

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24498	9	23	4	23	9	Water saving can reduce energy consumption and CO2 emission. For instance, in Japan, it is estimated that one forth of CO2 emission at household comes from water related activities such as kitchen, bath and toilet and it is close to the amount of passenger car use. When heating for hot water at houses can be saved by 20% in Japan, which is rater easy to be realized by using water efficient appliances, reduction amount is reached to 5 million tons. Impact of water saving at houses and building is nor negligible and may be a unrealized potential for reducing emission. Toyosada and others analyze the case of China (Coty of Dalian) (below) and said benefit of water saving is much higher in China than Japan. Date and report is limited but is better to draw attention. (referenece) “Evaluation of the potential of CO2 emission reduction achieved by using water-efficient housing equipment in Dalian, China”, by K.Toyosada, Y.Shimizu , S.Dejima , M.Yoshitaka , K.Sakaue, CIB W062 Symposium 2012. “Water saving business – may contribute CO2 emission”, Takashi Hongo, Nikkei Sangyo on 19 April 2013.	Accepted. Will add a reference to water saving fixtures in general
24712	9	23				This section does not mention of using hydrocarbons as a replacement refrigerant for HFCs - the assumption is that the vast majority of domestic refrigerators made in Europe already use HC.	Accepted. Reference to HFC HC subsitutes added.
19516	9	23	22	23	42	reduce page count by 0.15 (of 18 needed) by deleting sec 9.3.9; in my opinion the vernacular architecture information would be better served if it were integrated into "sec. 9.3.3 Exemplary new buildings" and the "Energy savings" and "Incremental cost" subsections suggested for 9.3.3; then this separate 0.45 page section could be deleted, for an estimated net reduced page count of 0.15	Reject: After further discussion with the TSU and CLAs, it has been collectively agreed to keep the structure the way it is.
41320	9	23	22	23	42	Affordable low energy housing presents a short discussion regarding the value of "vernacular" architectural where it is claimed that low energy design "principles are embedded in vernacular designs throughout the world." Unfortunately there are plenty of examples of "vernacular" architecture for which this is not true, thus this paragraph could be rewritten to present a more nuanced position. This might be achieved by simply rewording the clause above as: low energy design "principles are sometimes embedded in vernacular designs throughout the world." Furthermore, a more emphatic position regarding improving the viable vernacular traditions through a clear understanding of the thermodynamic and heat transfer principles should be stressed. Perhaps this could be achieved by modifying the last sentence to read: "A clear understanding of the heat transfer phenomena involved combined with modern knowledge and techniques has proved effective in improving vernacular designs." Earlier, from page 15, line 26 to page 16, line 13, a more complete consideration of the value of vernacular architecture, approaches to improve vernacular traditions, cultural challenges to do so, and co-benefits of doing so is presented that could be cited.	Accepted. The section is about, and the title has been changed to, "Avoiding mechanical cooling systems"

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41324	9	24	16	24	19	Building materials lifecycle may be difficult to substantiate. For example, the claims made that "wood"based wall systems entail 10-20% less embodied energy than concrete systems" and that "concrete"framed buildings entail less embodied energy than steel-framed buildings" are presented as generalizations that can (and will) be questioned. These claims may be refuted because: A variety of higher and lower-embodied energy concretes are currently available (including Pozzolanic concrete using volcanic ash), thus the claim above would at least have to be specific with regard to concrete type. The durability of concrete can be great (e.g., some Roman structures made with volcanic ash (pozzolana) and/or brick dust (i.e., activated silica) are on the order of 2,000 years old), concrete curing techniques and concrete mixes can be manipulated to produce high strength concretes that thereby reduce the amount of concrete needed for a given structural application, prestressing concrete structural elements will, in general, reduce the amount of concrete needed for a given structural application, and the form and detail of concrete structures play a primary role in structural efficiency and thus the amount of concrete needed. Furthermore, designers have somewhat greater freedom in designing optimal (e.g., funicular curved) forms in concrete than in steel.	Accepted: We have changed the text to read "indicates …. 10-20% less than traditional concrete systems"
25805	9	24	3	24	30	It should be mentioned that the relative ratios in total lifecycle energy to embodied energy particularly of high energy performance buildings should be stochastically considered particularly given the wide range of embodied enrgy values for building materials (See: Acquaye, A. A., Duffy, A. P., & Basu, B. (2011) "Stochastic hybrid embodied CO2-eq analysis: An application to the Irish apartment building sector." Energy and Buildings 43(6): 1295-1303)	Reject. Lack of space
25807	9	24	4	24	8	Following opeing statement end on line 8; it should be added that: Current state-of-the-art suggests the use of hybrid lifecycle assessment principles in methodologicalassessments of embodied energy in building and building materials (See: Koh et al (2013) "Decarbonising product supply chains: design and development of an integrated evidenced-based Decision Support System." International Journal of Production Research; 51 (7), 2092-2109	Reject. Lack of space
33810	9	24	44	24	45	increasing the thermostat settings from 24 to 28 degrees - performance efficiency in offices at 28 degrees is dropping and in many countries, the comfort levels are given by regulations (Building Code). It is a nice example, but not very realistic in practice.	Noted. The savings would still be large at 26 or 27 C.
41323	9	24	8	24	30	Some material may be more efficiently (in terms of readability and pages consumed) presented in tabular form. Consider put in table format -9.3.9 Building materials lifecycle: lines 8 to 30 of page 24	Noted. Some tables use more space than texts
24713	9	24				This section could be more broad in its coverage of behavioural issues. For example, different cooking practices can use widely varying amounts of energy.	Accepted. We have restored previously deleted material and added material about cooking energy differences for identical recipies and equipment.
41325	9	24	31	25	6	The section "9.3.10 Behavioural impacts" should be developed more and enhanced. A conspicuous omission of this section is that of occupancy (i.e., in not only matching energy consumption for lighting, heating and cooling to real-time and anticipated occupancy, but to strategically manage energy loads). There appears to be considerable energy savings potential in intelligent control of building energy & lighting systems using more sophisticated methods of occupancy detection and/or monitoring, yet this is not even mentioned in this section of Chapter 9.	Accepted. This section has been greatly expanded.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41326	9	24	31	25	6	We suggest the authors should enhance this point in the section by adding the following references: "To enable a building to efficiently manage its energy load, adapt to its occupants' behaviors, and be an intelligent inhabitant of the "smart grid," engineers must possess a detailed understanding of a building's spatio-temporal properties. That requires ongoing observation of the state of the building." [Andreas Savvides, Director of Yale's Embedded Networks and Applications Lab (ENALAB)] â€¢ Jung, Deokwoo, and Andreas Savvides. 2010. "Estimating Building Consumption Breakdowns Using on/OFF State Sensing and Incremental Sub-Meter Deployment." In, 225. New York, New York, USA: ACM Press. doi:10.1145/1869983.1870006. â€¢ Savvides, A, and M Caramanis. 2011. "Cyber-Physical Systems for Next Generation Intelligent Buildings." At the WiP Session at 6¦. â€¢ Teixeira, T, G Dublon, and A Savvides. 2010. "A Survey of Human-Sensing: Methods for Detecting Presence, Count, Location, Track, and Identity." ACM Computing Surveys.	Noted.
41327	9	24	31	25	6	The broad generalization presented in this section: "Centralized chillers, while being up to twice as efficient as older room air conditioners, provide continuous rather than selective cooling to the entire building volume. As a result, they use up to 9 times more energy than small decentralized units that are used selectively (S Zhang et al. 2010)." Beware that this is not only drawn from a single study - a recurring fault of this Chapter. It is clearly not generally true! Please check with engineers/building scientists about applicability and state the limitations and revise accordingly.	Accepted. The factor of 9 seems to be too large. Replaced with "much more"
41328	9	24	31	25	6	Centralized, district or campus chillers can intelligently communicate with these end-users to optimally manage load and thereby realize additional energy savings beyond that possible with control-independent room air conditioners. Finally, centralize chillers, especially when they employ wet-heat rejection (e.g., wet cooling towers), and state-of-the-art mechanical cooling equipment (e.g., multistage DX) may be expected to provide overall coefficients of performance (COP) that are far greater than simply twice that of a room air conditioner. Ironically, in the very next section of the chapter, district chilling is promoted. The authors need to acknowledge the pros and cons of district heating/cooling and applicable contexts/regions.	Noted. Room air conditioners themselves are getting more efficient. However, the point here is that relative energy use can be reversed by behavioural factors
41329	9	24	31	25	6	We suggest that the authors include behaviors in design and practice that can be influenced by regulation/standards as well. We suggest that the authors add a reference: Xu, P., T. Xu, P. Shen, 2013. Energy and Behavioral Impacts of Integrative Retrofits for Residential Buildings: What Is at Stake for Building Energy Policy Reforms in Northern China? Energy Policy, Volume 52, January 2013, 667-576	Rejected. Interesting paper, but the revised section 9.3.10 already makes the key points
41330	9	24	31	25	6	The section "9.3.10 Behavioural impacts" should be developed more and enhanced. A conspicuous omission of this section is that of occupancy (i.e., in not only matching energy consumption for lighting, heating and cooling to real-time and anticipated occupancy, but to strategically manage energy loads). There appears to be considerable energy savings potential in intelligent control of building energy & lighting systems using more sophisticated methods of occupancy detection and/or monitoring, yet this is not even mentioned in this section of Chapter 9.	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41331	9	24	31	25	6	We suggest the authors should enhance this point in the section by adding the following references: "To enable a building to efficiently manage its energy load, adapt to its occupants' behaviors, and be an intelligent inhabitant of the "smart grid," engineers must possess a detailed understanding of a building's spatio-temporal properties. That requires ongoing observation of the state of the building." [Andreas Savvides, Director of Yale's Embedded Networks and Applications Lab (ENALAB)] â€¢ Jung, Deokwoo, and Andreas Savvides. 2010. "Estimating Building Consumption Breakdowns Using on/OFF State Sensing and Incremental Sub-Meter Deployment." In, 225. New York, New York, USA: ACM Press. doi:10.1145/1869983.1870006. â€¢ Savvides, A, and M Caramanis. 2011. "Cyber-Physical Systems for Next Generation Intelligent Buildings." At the WiP Session at â€¦. â€¢ Teixeira, T, G Dublon, and A Savvides. 2010. "A Survey of Human-Sensing: Methods for Detecting Presence, Count, Location, Track, and Identity." ACM Computing Surveys.	Duplicate comment
41332	9	24	31	25	6	Section 9.3.10 behavioral impacts can be enhanced with more literature reviews. We feel it spends too much time on thermostat alone. There are many other factors and means of behavioral impact/changes worthy of inclusion in this section.	Accepted.
26632	9	24				Fluorocarbon contained in insulation material could be significant problem. UNEP/WMO Scientific Assessment of Ozone Depletion 2010	Noted. We already mention insulation
29560	9	24	25	24	25	Insert this sentence at line 25, after "…House standard (Harvey, 2007). Proietti et al., 2013 analyze environmenta and energy compatibility of different solutions of thermal insulation in building envelope and they present a detailed carbon footprint of a product which is a reflective foil in comparison with other types of insulating materials. The use of phasechange materials...." - Additional reference full citation: S. Proietti, U. Desideri, F. Zepparelli, P. Sdringola, Carbon footprint of a reflective foil and comparison with other solutions for thermal insulation in building envelope, Applied Energy – ICAE2012 Special Issue, Elsevier. doi: 10.1016/j.apenergy.2013.01.086	Reject. Too specific to include here, due to lack of space
19517	9	24	3	24	30	reduce page count by 0.65 (of 18 needed) by deleting sec 9.3.9; rather than invite controversy it would be better to avoid statements like wood is better than concrete, concrete is better than steel, etc. These generalizations depend on parameters such as the steel recycle content and concrete service life, which vary widely around the world; further, nothing in this section suggests that changing the world's construction materials (even if this were possible) would amount to a significant climate change mitigation strategy; the point about high performance buildings being higher on embedded energy but still significantly lower on life cycle energy can be made in sec. 9.3.3	Reject. I think that there is useful informtion here. I have, however, changed "confirms" to "indicates" with regard to the emboided energy of wood.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41333	9	25	13	25	14	In section "9.4.1 Urban form and energy supply infrastructure" the following claim is made: "Greater compactness has trade"offs within individual buildings in regions with significant cooling demand, as it tends to increase the urban heat island effect." This is a familiar and common claim made based largely on the significant urban microclimate work of Oke. Yet, while supported empirically in a number of studies of cities in temperate zones, it is not supported by studies of extremely compact urban environments in hot-arid Northern African and Middle Eastern towns and cities (e.g., see Johansson, Erik. 2006. "Influence of Urban Geometry on Outdoor Thermal Comfort in a Hot Dry Climate: A Study in Fez, Morocco." Building and Environment 41 (10): 1326â€“1338.) A detailed consideration of the heat transport processes at play especially long wave radiative exchanges and in some cases evaporative cooling and their dynamic interaction with the built environment (buildings, infrastructure and vegetation) and climate provides a more nuanced view of the dependence of urban microclimate on urban form that substantiates the empirical data recorded for these urban cool islands. Furthermore, this deeper understanding has led to strategies to foster urban cool islands in compact urban geometriesâ€“ e.g., through the use of selective surface finishes, urban geometries that favor self-shading of urban street canyons and pooling of cool air masses, and strategic use of vegetative evapotranspiration, shading, and breeze induction (via thermals). Please revise.	Accepted. Will add caveat
25742	9	25	26	25	28	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). In addition, this part should also explain the huge potential of heat pump technology to reduce GHG emission from building sector, as described in (IEA/OECD, 2010, page6-64) and (IEA, 2011, page16). These literatures are listed in the No17 line of this table. <Reference> [1] Pedro J. Mago, Amanda D. Smith (2012). Evaluation of the potential emissions reductions from the use of CHP systems in different commercial buildings, Building and Environment 53, 74-82	Rejected (for the same reasons as in the review of the FOD). Cogeneration is generally a more efficient approach than separate generation of heat and power, where ther is an appropriate heat laod, That is the point we make.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20804	9	25	26	25	28	DELETE. Deletion of this entire sentence is needed. This is wrong, and different from the reality. Distributed energy systems are not more efficient than centralized power plants. These depend on the situation. Centralized power plants are more efficient (e.g. efficiency of gas burning engine CGS is about 40 to 45%, while Japan's cutting-edge thermal power plant has efficiency of about 58% <MACC1, 500 centigrade>). In addition, there are only a few applications where usages of heat and electricity can be balanced, and so on. Please refer the following reference. <Reference> [1]" Evaluation of Total Energy Efficiency of CGS on the Basis of Energy Concept"(2008). Journal of the Japan Institute of Energy 87, 285-290(2008) . Fukuda et al. < Fukuda et al. introduced “heat factor” for the evaluation of the total energy efficiency of cogeneration system in Japan. According to their analysis based on energy basis, the “heat factor” for Japan is calculated to be 0.24-0.28, which is much smaller than the factor for US and Europe, which are 0.5 or higher. This result implicates the difficulty of the use of the thermal output of cogeneration in Japan, which has little heat demand compared to the US and Europe. By comparing the adjusted total efficiency of cogeneration with the grid power plant (all average, fossil fuel average, state of art LNG combined cycle), they found that it was inappropriate to regard cogeneration as highly efficient just by the simple total efficiency. The adjusted total efficiency was calculated to be nearly equal or a little higher than the average fossil fire power plant depending on the type of demand, and much smaller than the state of art LNG combined cycle for all demand assumed in their study.>	Rejected (for the same reasons as in the review of the FOD). Cogeneration is generally a more efficient approach than separate generation of heat and power, where ther is an appropriate heat laod, That is the point we make.
33811	9	25	27	25	27	gas engine - do you mean a gas-fueled boiler for space heating and possibly hot tap water?	Rejected - we mean an engine and that's what we say
22916	9	25	3	25	6	Energy efficiency by personarization(decentralization) of air-conditioning (with lighting) is important indication. But "up to 9 times" doesn't seems to be general situation. No corresponding reference in bibliography. (S Zhang et. a	Accepted - Zhang needs to be referenced .)
22799	9	25	3	25	6	The reference can't be found in References section.	Accepted - Zhang needs to be referenced
33812	9	25	30	25	31	non-fossil heat sources - biomass in district heating of Scandinavian countries is also an example.	Noted
33813	9	25	39	25	39	seasonal thermal storage	Noted. It is diurnal stroage and this has been clarified in the new draft
33814	9	25	41	25	41	and heat or cold from surface or underground water source heat pumps…	Accepted - this is clearer.
25743	9	25	41	25	41	This part should be kept in the final version report because heat pump technology has huge potential to reduce GHG emission from building sector, as described in the Section 9.4.1.2 of SOD, (IEA/OECD, 2010, page6-64) and (IEA, 2011, page16). These literatures are listed in the No17 line of this table.	Noted - we cannot guarantee it retention of any particular text in further editing
33815	9	25	42	26	17	I feel this chapter Electricity infrastructure could be shortened as it focuses quite a lot on heat pumps.	Rejected - Decarbonisation of buildings by electrification is an import, complex and controversial issue, very relevant to the transformation pathways and best addressed here.
26394	9	25	43			This first sentence of this paragraph is unnecessary	Noted.
19525	9	25	7	28	6	provide minor edits so the overall length of sec 9.4 remains at 3 pages including the new sec. 9.4.1.3 entitled "Ground energy sources and heat sinks"	Rejected - ground energy sources are not part of infrastructure and this section has severe length constraints.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30347	9	25	23	25	41	As noted, this debate is heavily contested, however this section omits a critical argument in favour of community / district heating, that of making use of existing sources of 'waste' heat, especially in / near urban areas. In our 'Housing Futures' report (referenced previously) we call for a Heat Planning Law that would mandate the use of all 'waste' heat from non-domestic buildings as part of the planning application process - whether the application is for a new non-domestic building that will produce excess heat (e.g. a power station or power plant for a shooping centre) or for any new development within range of an existing heat source. Although such a proposal would lead to significant emissions savings compared to business as usual, the case for DH should be (and can be) made purely on the need for significant investment in new flexible and robust infrastructure (for new build and retrofit). This means installing pipes capable of carrying a known heat load from a gas or biomass CHP unit today, but could in future carry different heat loads from different sources (e.g. anaerobic digestion), or even different fuels (e.g. biomethane). Our group is working with Scottish Power on a community heating project and our partners assure us that this is not only possible, but is highly desirable for them as it would not only allow greater certainty over what could be achieved in future, but also bring forward financial savings by discounting future capital investment in upgrading infrastructure. However being able to do this would require additonal incentives and / or regulation, and long-term thinking and financial planning by government.	Noted - use of waste heat is mentioned explicitly in line 25.
20312	9	25	42			From an exergy point of view it is questionable whether electricity should be used for low temperature processes like heating. For highly efficient buildings a combination of solar and heat pumps can be an option.	Accepted - most analyses of increasing electricity use for heating rely on heat pumps, so the exergy disbenefit may not occur.
41334	9	25	42	26	17	This seemed like a long section especially since the final sentence said "literature remains unclear". Because of this, it seems that this is a logical place to shorten the text.	Rejected - Decarbonisation of buildings by electrification is an import, complex and controversial issue, very relevant to the transformation pathways and best addressed here.
30566	9	25 of 92	21		22	Must add: "or zero"after lower; add also ", or no fuels at all.", instead the last period of line 22.	Rejected. This refers to grid electricity, so 'lower' is appropriate
25744	9	26	1	26	10	This part should be kept in the final version report because heat pump technology has huge potential to reduce GHG emission from building sector, as described in (IEA/OECD, 2010, page6-64) and (IEA, 2011, page16). These literatures are listed in the No17 line of this table. In addition, this part should also explain the potential of heat pump technology using underground water. Heat pump system using underground water is effective where underground water is abundant.	As comment no 25743
25745	9	26	14	26	17	This part should be deleted completely because electrification of heating is not always more costly than other heating systems. Whether electrification of heating is costly or not depends on circumstances.	Accpted. As drafted this is confusing
33816	9	26	18	26	25	This paragraph focuses only on electricity, but smart energy infrastructure includes heating and cooling grids, too.	Noted.
41335	9	26	18	26	35	The authors need to address adverse energy efficiency of energy conversion aimed for peak load management (not necessarily saving energy or reduce carbon emissions).	Rejected - primarily an issue for Chapter 7
41336	9	26	21	26	22	"lower carbon off peak electricity". Do you mean off as a preposition or off-peak? Please clarify.	Editorial. Mean 'off-peak'
33817	9	26	30	26	35	seasonal storgae in a building (PCM, TCM) or on a district level - for example an (exhausted geothermal) double fed by solar energy during warm seasons	Noted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25394	9	26	41			Per Mills (2011) the application of commissioning often results in negative-costs whereby capital costs for HVAC are reduced such that the costs of other energy-efficiency improvements are more than offset	Accepted - this can be strengthened with reference to 9.3
34836	9	26	8			Content/Link: please also refer if possible to Ch.6 work	Accepted. This needs to be consistent with 9.9
19518	9	26	18	26	25	recommend deleting the existing sec. 9.4.1.3; this information can simply be the last paragraph of section 9.4.1.2	Accepted. The main discussion of smart grids will be in Chapter 7.12.3
22917	9	26	18			This section describes about low carbonization by harmonizing electricity infrastructure and demand side. So, it is easier to explain with the words "Demand response".	Noted. But smart grids will affect building integrated supply as well as demand.
19519	9	26	26	26	26	recommend adding a new sec. 9.4.1.3 entitled "Ground energy sources and heat sinks"; Insert the following text: The effective use of ground energy sources and heat sinks through use of ground-source heat pumps offers significant potential for energy savings and peak load reduction for buildings (U.S.A. BTRD, 2008). The favorable temperatures of the ground compared to outdoor air sustain themselves naturally, assuming proper design of the source/sink heat exchange. These systems are proven at the building, neighborhood, or community scale (Hughes, et. al, 1998); and apply to retrofit and new construction, only consume energy when and where space conditioning and water heating are needed with decentralized indoor systems, and prevent lock-in of suboptimal incrementalism because they are inherently deep-savings (Hughes 2008). A recent study on use of building construction excavations and utility trenches for ground heat exchanger installation (Hughes, et. al, 2012) suggests that for new developments, there are also significant cost savings potentials through integration of ground-source with underground electricity and water infrastructures.	As per comment no 19525
22918	9	26	26			For electric power load levelling, thermal storage by ice or water is common. It seems strange describing only "changing building envelope temperature" and "latent heat using phase change materials" as example.	Accept. The text is changed to include this concept
40714	9	26	26			Active thermal storage using water and ice should be tread here, as they are the one of the most common type of thermal storage system.	Accept. The text is changed to include this concept
22800	9	26	26			For electric power load levelling, thermal storage by ice or water is common. It seems strange describing only latent heat using phase change materials.	Accept. The text is changed to include this concept
26783	9	26	34	26	35	This gives the impression ground source heat pumps are only in the process of being studied for seasonal energy storage. In reality there are large commercial systems operating doing just this. For example, look to companies such as ICAX (http://www.icax.co.uk).	Accept. The text is changed to include this concept
19520	9	26	26	26	26	Citations for the new sec. 9.4.1.3 entitled "Ground energy sources and heat sinks":	Rejected - ground energy sources are not part of infrastructure and this section has severe length constraints.
26395	9	26				This paragraph is only little informative	Accepted - there is limited peer reviewed data. Candidate for curtting
26633	9	26				Building mortality is often modeled into Weibull distribution as described in Methodology for the survival analysis of urban building stocks Building Research & Information Volume 35, Issue 5, 2007	Noted
41337	9	26	44	27	4	This section doesn't seem to fit within the 9.4 section title. Please put it somewhere else in the chapter or in a "box".	Rejected. We feel this fits logically at the end of sections on infrastructure
30567	9	26 of 92	21			Must add: "or zero", after lower.	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30568	9	26 of 92	43			Must add: "or zero" after low, twice in the line.	Rejected. This first refers to grid electricity, so 'lower' is appropriate; the second to buildings where we avoid the phrase 'zero energy building'
35278	9	27				There is no direct relation between the world map and the figure. It is suggested to delete the world map. Even if the map has to be remained, it should be replaced by a border free map.	Rejected. The map clarifies regional differences. Possibly controversial borders were removed.
25746	9	27	12	27	14	This part should include "heat pump technology" into the examples of "Efficiency". Heat pump technology has huge potential to reduce GHG emission from building sector, as described in the Section 9.4.1.2 of SOD, (IEA/OECD, 2010, page6-64) and (IEA, 2011, page16). These literatures are listed in the No17 line of this table.	Rejected. Electrification of heating cannot be said to have unambiguous benefits for energy security.
20805	9	27	12	27	14	REVISE. The sentence of "including use of ICT, on-site renewable energy generation and cogeneration, integration through smart grids" should be revised to "including high-efficient centralized power plants, use of ICT, on-site renewable energy generation, cogeneration, and integration through smart grids". In order to improve energy security by energy efficiency, high-efficient centralized power plants are valid. First, fuel consumption and import are decreased by them. Second, there are merits of supply source distribution through various types of fuels (gas, oil, coal, uranium, etc.). These two elements greatly improve energy security. Examples of high-efficient centralized power plants are highly-efficient thermal power plants, nuclear power plants, etc. Please refe the following references. <Reference>[1]G. Pepermans, J. Driesen, D. Haeseldonckx, R. Belmans, W. D'haeseleer "Distributed generation: definition, benefits and issues". Energy Policy, Volume 33, Issue 6, April 2005, page 787-798. http://www.sciencedirect.com/science/article/pii/S0301421503003069 [2]CIRED (1999). "Disperse Generation" Preliminary Report of CIRED Working Group No.4 http://www.cired.be/WG04-Report%20.pdf. Please refer [1]page 794 right column lines 17-42 ,and [2]page 5 left column lines 10-14. <Pepermans et al.[1] discussed the issue of energy security of distributed generation. They say in some discussion, energy security in linked to the diversification of primary energy supplies, in others it is interpreted as the reliability of the electricity system. Under the first interpretation, energy security improves as the diversification of primary energy supplies increases. In this case, the advantage of distributed generation are limited, as most technologies – with the exception of systems based on renewables –directly or indirectly depend on natural gas. Under the second interpretation, it is felt by many authors, for example by the IEA (2002), that distributed generation can contribute to reduce the risks and costs of blackouts. Here, distributed generation is seen as an instrument that helps to reduce the private costs and risks for electricity customers of system failures. Others, like CIRED (1999) [2], claim that distributed generation does not contribute to system security. On the contrary, it would have a negative effect. Such a negative impact on the system security occurs when the share of non-dispatch able generation capacity increases. Examples of such units are wind turbines, photovoltaic systems and cogeneration units that are closely tied to heat demand. The latter units cannot be centrally controlled because of the natural variability of their power supply. As a consequence, there is an increased need for regulating (backup) power.>	Rejected. Centralised fossil power plants are not a mitigation technology
41338	9	27	20			1) Please make the figure larger. 2) Is red in addition to green or total green+red?	Noted. We feel the use of stacked bars makes this clear

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22919	9	27	32	28	2	It is difficult to understand with Figure 9.9. What is the deference between "state of the art" and "sub-optimal". Explanation for IEA regions is also needed.	Rejected. State of art is the optimal. IEA regions were described in the report
22801	9	27	32	28	2	It is difficult to understand with Figure 9.9.	Rejected. Unclear
30938	9	27	5			This question is missing a word or words. Should it read: How [do] decisions…? Or: How [long do] decisions…? A question that is more reflective of the answer provided should be considered.	Accepted
30939	9	27	6	27	7	What lasts for 50-100 years? Buildings? This is a bit unclear and could benefit from rewording.	Accepted
33818	9	27	7	27	7	..requiring carbon-intensive infrastructure… - innovative ways of using the given infrastructure can be developed, the infrastructure can be upgraded and being used for transport of non or low-carbon fuels (based on solar, biomass, etc.)	Noted. Inclusion of content on gas infrastructure will be added if space allows
27116	9	28	22			What is the relative change of 0.3 Gt C in percent?	Accepted; - % change 2000-2100 based on the Isaac vanVuuren 2009 paper. As you may have read - the authors don't explicitly mention an % change, instead opting to note that the 0.3Gt increase is equal to 50% of residential sector CO2 emission in 2000. I have paraphrased this statement.
25402	9	28	25	28	40	This paragraph goes back and forth between WG2 and WG3 topics. The relevance of the adaptation discussion to mitigation should be made clearer.	NOTED.I have redrafted the paragraph to clarify the relevance of the adaptation discussion to mitigation.
19714	9	28	41	28	41	It is better to write solar radiation management, otherwise it is not clear.	Accepted. The term solar radiation management was added.
41340	9	28	41	29	4	The last paragraph of section "9.5 Climate change feedback" discusses radiation management considering only physical changes to roof and pavement surfaces (e.g., cool or selective surfaces). Vegetative changes to these surfaces (e.g., green roofs, green walls, urban trees & vegetation) can have similar impacts and thus should be included in the discussion.	Reject. Vegetation absorb solar energy and their reflectivity is typically less than 0.20. They do not contribute cooling the globe by reflecting radiation back to space.
27835	9	28	41	28	41	The wording suggests that effective SRM technologies are already at hand. A more cautious wording would be advisable. Please reformulate, e.g.: "There m i g h t a r i s e also several opportunities...".	Noted. The lead authors reviewed the text and decided to leave it as is.
34840	9	28	41	29	4	Link: Please refer to Ch.6 section on GeoEng ensuring consistency with their section and possible cross-referencing	Noted. Reference is made to Ch.6 and Ch 12.
26584	9	28	44		45	take out references previous to 2010	Reject: Some of them are very important.
41339	9	28	7	29	4	To us, it seems like three large paragraphs is too much for this discussion. Unless this section specifically asked for in commissioning of the report.	Noted. It is unfortunated that one page is allocated to this section. The lead authors reviewed the text and decided to leave it as is.
26583	9	28	8		19	take out references previous to 2010	Reject: Some of them are very important.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29557	9	28	44	28	44	"temperatures by up to 0.7 K (Campra et al., 2008; Akbari et al., 2008; Oleson et al., 2010; Rossi et al., 2010; Millstein" - Additional reference full citation: F. Rossi, A. Nicolini, “Analysis of Global Warming Mitigation by White Reflecting Surfaces”, Proceedings of a meeting held 6-10 June 2010, Vail, Colorado, USA	Rejected. The reference is from a meeting (non-reviewed).
19509	9	28	7	29	4	reduce page count by 1 (of 18 needed) by deleting sec 9.5; WGIII is to focus on mitigation; WGII has this covered	Rejected.This is not covered in WGII and is essential to chapter 9
22920	9	29		31		Information of Figure 9.10 is included in Table 9.4. So the figure can be removed.	Rejected. Figure allows for comparison
22802	9	29		31		Information of Figure 9.10 is included in Table 9.4. So the figure can be removed.	Rejected. Figure allows for comparison
24434	9	29	10	29	11	As a quantitative study that addresses the question "what is the overall potential if we consider the applicability, feasibility and replacement dynamics", you can refer to the paper below: K. Wada, K. Akimoto, F. Sano, J. Oda, T. Homma, Energy-efficiency opportunities in the residential sector and their feasibility, Energy, Vol.48 Issue 1, pp.5-8, December 2012.	Noted: we will consider referencing of the source
35279	9	29	26	29	27	It is suggested to further explain the abbreviation of CN, TW, HK in the figure as CN- Mainland of China; TW- Taiwan, POC; and HK- Hong Kong SAR.	Accepted: footnote was added
41342	9	29	26			1) Please make the figure larger. 2) What do the numbers on symbols mean? 3) Is there any significance to the x-axis for each identity? 4) What does "mitigation potential" mean?	Rejected: The figure cannot be made bigger due to space limitations, it says in the notes that numbers mean the case from the table below
41341	9	29	8	29	11	1) The sentence structure is unclear. 2) Please define "stock."	Noted: the sentence was edited; by "stock" the building stock is meant
34408	9	29	5	36	4	Both figure 9.10 and the corresponding table 9.4 are somewhat problematic. First, the table itself is quite ambiguous in many ways. For instance, it does not become clear which parameter is changing: power use, hot water use, GHG emissions or yet something else. The same is true for figure 9.10. Secondly, the mixes of measures assessed (against whatever criterion) include, for instance, energy supply measures such as solar PV, the potential of which should be discussed in chapter 7, and effects on mobility patterns, which should be discussed in chapters 8 and/or 12.	Rejected: it is the point of the table to present a variety of measures. PV and other solar are included, because these are building-integrated technologies: one hand they are on supply side, on the other they are related to carbon efficiency, therefore, should not be skipped
26255	9	3	8	3	8	9.2.2 Trends and drivers of thermal energy uses in buildings could be shortened to 9.2.2 Thermal energy uses in buildings	Rejected, despite a reasonable comment. Full title explains better the intention
26256	9	3	9	3	9	9.2.3 Trends and drivers in energy consumption of appliances in buildings could be shortened to 9.2.3 Energy consumption of appliances in buildings	Rejected, despite a reasonable comment. Full title explains better the intention
35280	9	30		31		It is suggested to further explain the abbreviation of CN, TW, HK in the figure as CN- Mainland of China; TW- Taiwan, POC; and HK- Hong Kong SAR.	Accepted: the footnot added
26585	9	30				ADD FRANCE: add to 2nd cell TECHNICAL EFFICIENCY : national legislation for building energy consumption cap	Rejected: the comment is not clear

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23487	9	31				It is a table that not easy to read/understand. There is no obvious difference between 'technical' and 'system' efficiencies but rather a mixtures of building codes/ lables/ standards with the technology improvements, perhaps they can be separated. What does it mean by 'end-uses'? There is no footnote on the abbreviations. Why 'elect' and 'PV' are used while these two have the same outputs? The potential values of % change are in vary durations. if the purpose of this table is to show the potential, would it be better to compile the information into short, medium and long terms? It is because the the value of % change may cause misintrepretation if not taking the duration into account.	Rejected: we do not agree with the opinion that there is no difference between technical and system efficiencies, as these are two different identities, essences of which are described in the beginning of the chapter. All the abbreviations in the table are spelled out in the Notes under the table. % of potentials vary in durations, as different publications analyse different time periods and the purpose of this table is to summarize these efforts
33819	9	31	31			DK - ..will be reduced by 30% in 2005, 10, 15, 20 … this is not clear	Accepted: the text was edited
20313	9	32	10	32	38	The paragraph refers several times to high performance new construction: How is this defined?	Rejected: it is a widely used concept, which means new buildings with high performance
26587	9	32	10		38	quite repetitive with previous section on cost… merge with 9.3.3.4 Incremental cost?	Rejected: it is important to keep in the technology discussion. In 9.3 it is different figure, focused on technologies, in 9.6 gives a big picture of costs.
26586	9	32	11			take out Harvey and Ürge-Vorsatz, forthcoming; NOT PUBLISHED	Accepted: it should be replaced with Harvey 2013, from Annual reviews
41343	9	32	22	32	26	These 2 sentences in particular need to be cleaned up to make them more understandable. 1) you cant say Although....., Figure displays..... need to say Although....., the cost estimate does [something] as shown in figure. 2) sentence structure unclear, not sure what "also very high positive costs occur refers to - the first part of the sentence or the 2nd.	Accepted: the sentence has been editied
19527	9	32	1	32	8	reduce page count by 0.05 (of 18 needed) by reducing the text in sec. 9.6.2 from 0.15 to 0.10 page	Rejected: the comment is not clear
30348	9	32	19	32	19	Editing error - second half of a sentence left in?	Accepted: the text is corrected
30349	9	32	31	32	38	Suggest this is a key section that could be brought out more. Very important conclusion that needs to be disseminated as widely as possible!	Noted
19528	9	32	9	34	3	reduce page count by 1 (of 18 needed) by reducing sec. 9.6.2.1 from 2.6 to 1.6 pages; delete all text except that necessary to introduce Table 9.5 and Fig 9.11 and 9.13; delete Fig 9.12 (I agree with the author, this just causes many problems so why do it); save space by putting the remaining two figures side-by-side; and shrink Table 9.5 through better formatting	Noted: the text was reduced where possible
34409	9	32	9			There's strong overlap with the material in section 9.3.3.4. The material from both sections should be combined and further condensed in section 9.6 on cost and potentials.	Rejected: it is important to keep in the technology discussion. In 9.3 it is different figure, focused on technologies, in 9.6 gives a big picture of costs.
34514	9	33		33		There is no case from developing countries, IBR building, for instance, the incremental cost is about 500 RMB/m2, and energy efficiency achieves 63%.	Rejected: the full reference is need to include the case into the table

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20314	9	33	4			Evidence on Austria can be found in Köppl, A., C. Kettner, D. Kletzan-Slamanig, S. Schleicher, H. Schnitzer, M. Titz, B., Wolkinger, A. Damm, K. Steininger, R. Lang, G. Wallner, A. Karner, H. Artner, (2011), EnergyTransition 2012/2020/2050. Strategies for the Transition to Low Energy and Low Emission Structures, commissioned by the Austrian "Klima- und Energiefonds", Vienna, 2011.	Noted: the data on concrete cases have not been found, only estimations for the whole building stock
33820	9	34	3	35	6	Costs can be lowered if the EE retrofit is done at a so-called natural moment. This are retrofits and maintenance scheduled for the stock by housing cooperations. If additional EE or RE measures are taken at that moment the costs are shared and can be lower. E.g. when the roofing needs to be exchanged, the additional insulation can be placed or solar collectors and modules can be placed on the roof...	Noted
41344	9	34	10	34	11	The section needs consistency between texts and figures. The paragraph should be shortened. Mentioning Figs 9.11 and 9.12 when discussing retrofits, but those figures were for new buildings.	Accepted: the text and cross-references to the figures have been changed
20315	9	34	3			The term "Shallow" retrofits is not very clear. The argument could be, that a a change of heating systems without an insulation of the building envelope may lead to some energy savings, but in perspective of the service life of buildings this could be counterproductive: insulating the building nevelope later could result in an oversized heating system. This is again argued in Köppl, A., C. Kettner, D. Kletzan-Slamanig, S. Schleicher, H. Schnitzer, M. Titz, B., Wolkinger, A. Damm, K. Steininger, R. Lang, G. Wallner, A. Karner, H. Artner, (2011), EnergyTransition 2012/2020/2050. Strategies for the Transition to Low Energy and Low Emission Structures, commissioned by the Austrian "Klima- und Energiefonds", Vienna, 2011.	Rejected: it says in the text that by "shallow" retrofit it is meant the retrofit, which achieves only 10-30% of energy savings
30940	9	35	23	35	24	The focus here on "ambitious" climate change mitigation goals is not qualified in the answer. The GEA "efficiency" pathway should be better explained such that the average reader can follow this answer. Is this efficiency pathway what defines "ambitious"? Further why only provide an answer for ambitious climate change mitigation goals and not more broadly? Clarity on the question and response is required here.	Noted. FAQ 9.4 deleted
25395	9	35	78			The best version of this publication (peer reviewed) would be Mills, E. 2011. "Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions in the United States." Energy Efficiency, 4(2):145-173. The full report (2009 reference) need only be used if it includes information not in the aforementioned 2011 item.	Rejected: the comment refers to Line 78, which does not exist, so, it is not clear which place in the text the comment refers to
19526	9	35	7	36	4	reduce page count by 1.55 (of 18 needed) by deleting sec 9.6.3; in my opinion appropriately caveating the text in the subsections of sec. 9.6.2 eliminates the need for this section	Rejected. Section 9.6.3 should not be deleted
34418	9	35	7			The magnitude of impacts from the different factors analyzed should be described.	Rejected: due to space limitation it is not possible to add additional explanations, but, we believe that figures give good impression of the level of variations
41345	9	36	1			We could not fnd where this is referenced in the text. Please also make the figure larger.	Rejected: figure 9.14 is referenced on page 35, line 21
41346	9	36	11	36	18	This is the right place for this text to go in context. The authors should remove the same text in the earlier two places in the chapter.	Accepted
24714	9	36				This section should come much earlier, as it puts the extensive material on cost-effectiveness into context, and may avoid the need for other material. By integrating the multiple benefits of building related mitigation into the discussion early, the need to spend so much time going into the energy-related savings is reduced.	Rejected: The structure of the Chapter at the 1st-level heading has been decided by IPCC and can not be changed.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19529	9	36	6	38	25	reduce page count by 1.3 (of 18 needed) by reducing sec. 9.7.1 from 1.85 to 0.55 pages; keep the 1st paragraph delete Table 9.6, delete the sentence starting at row 4 of page 38 so the 2nd paragraph begins "The IPCC AR4 .."; then delete row 14-25 of page 38 because these should be divided up and integrated into the appropriate subsection of the next section (9.7.2)	Noted: The table can not be deleted as a similar table will be presented in all sectoral chapters. Text has been redrafted
34348	9	36	6			Please consider replacing the first sentence 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 (9.7.1-9.7.3) as well as public perception thereof (9.7.4) 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 9.6 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
30350	9	37				High upfront investment' line needs referencing - but terminology (high, upfront) and applicability (moist categories) seems at odds with other evidence presented. Needs more explanation / context?	Accepted. Text redrafted.
26588	9	37				Add: to social categ : (-) rebound effect ; risks of inequality between old and new	Accepted: rebound effect has been included in the Table. Rejected: It is not clear why mitigation actions result in inequality between old and new.
25396	9	37				Disaster resilience should be added. See Mills, E. 2002. "Climate Change, Buildings, and the Insurance Sector: Technological Synergisms between Adaptation and Mitigation." Building Research and Information. 31 (3-4):257-277.	Accepted
34373	9	37	1			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. Done.
24715	9	37	2			Suggest clarify: the avoided capital costs of energy supply infrastructure and heating/cooling equipment within buildings;and how much the effects of economies of scale, learning effects and ongoing technology development could reduce the costs of building related mitigation (these have been found to be substantial for residential buildings in a number of Australian studies)	Noted: these issues are very important but not very relevant to the co-benefits and co-risks of mitigation actions. They rather influence the economics of mitigation actions and to some extent have been discussed in other parts of the chapter. Specifically the avoided capital costs of energy supply infrastructure are included in the energy security issue.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41347	9	38	1	38	2	1) Is there really only one risk? If not, please add other risks to the list. 2) The authors should consider comparing to the benefits/risks in other chapters, unless that's done in summary chapter.	Noted: 1) Some additional risks added; 2) Chapter 6 presents a summary of co-benefits and co-risks from all sectoral chapters.
30941	9	38	14	38	25	This answer requires revisions. As it stands it is simply a long list of co-benefits without much more to link these benefits to the question posed: providing attractive opportunities for policy integration? Consideration to a response that is more easily read and responds to all components of the question should be considered.	Noted. FAQ 9.4 deleted
34349	9	38	2			Please consider adding: "...mainly limited to higher investment costs (and sometimes lifecycle costs) and related affordability issues (see section 9.6).	Accepted
34350	9	38	24	38	25	It is unclear on which basis this has been calcuated and if this is in line with the way the chapter 3 framing presents welfare effects of co-benefits (see 3.5.3). In the respective line in section 9.7.2.5, for instance, it is not clear on which kind of welfare analysis and implicit assumptions this result is based.	Noted. FAQ 9.4 deleted
25806	9	38	27	39	22	As rightly pointed out, some mitigation options may positively or negatively affect employment and. However, only the positive impacts of energy efficiency and GHG mitigation measures in the building sector have been highlighted. Hence, identifying some mitigation options that negatively impacts on jobs may be very useful.	Noted: This discussion on negative impacts on employment mainly concerns RES technologies (some references are cited), while this Section focuses on energy efficiency. The review of the literature done shows that energy efficieny measures in buildings are associated with positive effects on employment. Unfortunatelly there is no space for a more analytical discussion on this issue.
20316	9	38	28	38	28	Whether construction jobs in the building sector can be termed "green" jobs is questionable	Noted: We agree that not all jobs in the construction sector are considered as green. In the context of this assessment a job is characterized green if it is associated with construction activities that result in reducing energy consumption in buildings.
25747	9	38	29	38	36	This part should be deleted completely because variable RE resources cause the need for system balancing, as described in the section 7.6.1 (page 32, line 3). The higher planning reserve margin will result in more costly structure as a whole power system. This is because it is necessary to install additional equipments for power grid stabilization if variable power sources such as wind power or photovoltaic were installed into power grid, as described in (DeCarolis, 2006, page 395 and 403). This literature is listed in the No15 line of this table.	Rejected: This part of the text focuses primarily on energy efficiency measures and secondarily on RES implementations in buildings. We don't think that these interventions cause important prower grid stabilization problems. On the other hand, a growing literature shows that these interventios result in positive macro-economic effects.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20317	9	38	37	38	38	On employment effects of trensforming the building sector in Austria Köppl, A., C. Kettner, D. Kletzan-Slamanig, S. Schleicher, H. Schnitzer, M. Titz, B., Wolkinger, A. Damm, K. Steininger, R. Lang, G. Wallner, A. Karner, H. Artner, (2011), EnergyTransition 2012/2020/2050. Strategies for the Transition to Low Energy and Low Emission Structures, commissioned by the Austrian "Klima- und Energiefonds", Vienna, 2011.	Accepted
19530	9	38	27	39	24	reduce page count by 0.45 (of 18 needed) by reducing sec. 9.7.2.1 from 1.35 to 0.90 pages; this can be accomplished by reducing text in half, keep the parts needed to introduce Fig. 9.15	Accepted
26511	9	38	32	38	33	To include among references cited: (ILO 2012) Source: International Institute for Labour Studies (2012), Working towards sustainable development: Opportunities for decent work and social inclusion in a green economy	Accepted
30569	9	38 of 92	1			Instead the period around the middle of the line, must add: "; in brief, sustainable energy supply must be encouraged, which is much more than energy security and would go farther towards sustainable development, the preferrable goal of humankind future."	Noted: The comment is not clear. In any case the text changed.
41348	9	39	4	39	22	The authors should consider cutting this text region if they need to shorten the chapter.	Noted: this section was shortened; however some of the text proposed for deletion is important for our key messages.
30351	9	39	1	39	22	Section seems a little muddled - room for cutting here. However suggest it also needs to mention transferrability of technical / manula skills from more tradional industries to renewable technologies and green buildings - e.g. machine tools to wind turbines (German post-war experience etc).	Accepted: Section revised. Mention for new skill requirements done.
19531	9	39	25	40	23	reduce page count by 0.60 (of 18 needed) by deleting sec. 9.7.2.2; it appears energy security benefit quantification has not progressed enough to merit mention in this document	Accepted. The text has been shortened substantially.
26258	9	4	17	4	17	9.7.3.1 Health co-benefits due to improved indoor conditions could be shortened to 9.7.3.1 Improved indoor conditions	Rejected, despite a reasonable comment. Full title explains better the intention
26259	9	4	18	4	18	9.7.3.2 Health and environmental cobenefits due to the reduced outdoor air pollution could be shortened to 9.7.3.2 Rreduced outdoor air pollution	Rejected, despite a reasonable comment. Full title explains better the intention
25390	9	4	5			New work on black carbon from kerosene lanterns indicates that the contribution is higher than previously believed, which implies an increase to the numbers cited here. See xxx (Jacobson/Brookings). If this publication post-dates your cutoff, note the earlier source literature cited. Lam, N. L.; Chen, Y.; Weyant, C.; Venkataraman, C.; Sadavarte, P.; Johnson, M. A.; Smith, K. R.; Brem, B. T.; Arineitwe, J.; Ellis, J. E.; Bond, T. C., (2012a) "Household Light Makes Global Heat: High Black Carbon Emissions From Kerosene Wick Lamps," Environmental Science & Technology , 46, (24), 13531- 13538.	Rejected. Implicit as indoor pollution. Reviewer did not quote where this should be added
26257	9	4	7	4	7	9.6.3 Assessment of key factors influencing robustness and sensitivity of costs and potentials could be shortened to 9.6.3 Robustness and sensitivity of costs and potentials	Rejected, despite a reasonable comment. Full title explains better the intention
25391	9	4	9			Describing electricity as a "clean fuel" is inaccurate and misleading. Its production is of course often not "clean". Nor is it a "fuel".	Accepted
19511	9	4	1	4	3	reduce page count by 1 (of 18 needed); recommended deletions will allow 'Contents' to fit on 2 pages	Noted
26589	9	40				take out bottom of page explanation (.4) FOR Figure 9.16. Potential productivity gains (%) associated with better indoor environmental conditions in 26 buildings.	Accepted. The figure deleted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30129	9	41	2		3	I would query the basis for the statement "Energy conservation and management, which relies solely on the patience of office users significantly lowers productivity in the workplace". Of the two references provided, one (Tawada) seems to be available only in Japanese, and there is no mention of the above statement in the English abstract. The other (Wargocki) is from a guidebook produced by the Federation of European Heating and Air-Conditioning Associations: it is not peer-reviewed, and there could be a conflict of interest involved (i.e. they are stating that new HVAC equipment is preferable to behaviour change and energy management). I would recommend deleting this statement.	Accepted
30130	9	41	40		42	The statement "However, there is no empirical evidence to support large or negative rebound effects for energy efficiency in buildings. Modestly declining energy intensities in developed countries with strong policies for energy efficiency in buildings are indicative of the opposite conclusion" may not be accurate. The European Environment Agency's State of the Environment Report for 2010 shows that total energy consumption in buildings has been steadily increasing over the last few decades, despite improved energy efficiency of space heating and electrical appliances. Surely the trend in total energy consumption is is a more appropriate indicator of rebound than energy intensity? Of course it is not possible to identify how much economic growth (and related consumption growth) is due to improvements in energy efficiency (i.e. indirect rebound as savings are re-spent elsewhere) and how much is due to other factors, but I do not believe we can cite improved energy intensity as evidence against significant rebound. The important conclusion (not mentioned here) is that policies to improve energy efficiency may not result in emission reduction unless accompanied by policies to restrain increased consumption, e.g. an overall carbon cap or an effective carbon tax. There is some discussion along these lines in section 9.10.2.1 so it could be worth linking to that section.	Rejected. Trends in energy demand are not a good indicator of the level of rebound effect.
30352	9	41				As noted in the Sorrell (2007) and subsequent (2013) papers by the same team, there is an assumption here that the estimates of the rebound effect for residential energy savings assumes homes will be heated to some level (and some level of comfort) prior to an intervention. From our experience (to be covered forthcoming work on energy efficiency and fuel poverty) we are questioning this estimated impact on aggregate energy consumption for those households (particularly in poor households, and / or those in rural and exposed locations in Scotland). The reason for this is (currently largely anecdotal) evidence that such households may not be heating their homes at all. This is either due to a lack of heating systems or (more likely) because the cost of using their (inadequate) heating systems is significant compared to the thermal comfort benefits - i.e. models assume any primary heating systems will be in use, whereas (we would argue) on-site assessments are likely to find some are not in use at all and / or secondary heating sources (e.g. traditional log / coal fires) are used in preference. These assertions are (so far) restricted to our experience of fuel poverty in Scotland and need greater quantification in order to account for their impact on Scottish emissions and likely savings from domestic retrofits - however there is an uncertainty here that may not be adequately factored into current models and projections.	Noted. I have no checked the whole of AR5 on rebound. There are siignificant sections in Ch 5, 8, 9 and 15. These have much overlap and some contradictions, so it needs a X-cut in my opinion. This comment can be noted as it does not require action.
20520	9	41		42		The indirect rebound effect from electricity efficiency measures will increase as the electricity supply is decarbonised (Chitnis et al, 2013). This is because the rebound effect from improvements in electricity efficiency is sensitive to the GHG intensity of electricity expenditure (ibid). Moreover, since emissions from UK electricity generators are capped by the EU ETS, electricity efficiency measures effectively lead to backfire already (Chitnis et al. 2013). This counter-intuitive observation demonstrates the importance of measures such as border carbon adjustments to discourage this type of carbon leakage (Chitnis et al. 2013). Reference: Chitnis, M., S. Sorrell, A. Druckman, S. K. Firth and T. Jackson (2013). "Turning lights into flights: Estimating direct and indirect rebound effects for UK households." Energy Policy 55: 234–250.	Noted. This section is being substantially revised to address chapter overlap. Indirect rebound issues will not be addressed in this chapter.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30166	9	41				Another reference for the indirect rebound effect (also in the range stated) see: Thomas and Azevedo, 2013b. http://www.sciencedirect.com/science/article/pii/S0921800912004715	Noted. This section is being substantially revised to address chapter overlap. Indirect rebound issues will not be addressed in this chapter.
19532	9	41	13	42	2	reduce page count by 0.2 (of 18 needed) by reducing sec. 9.7.2.4 from 0.75 to 0.55 pages; this can be accomplished with minor revisions to the text	Noted. This section is being substantially revised to address chapter overlap.
41349	9	41	13	42	2	1) If this is a risk, it should be put in the table? 2) This can be much shorter/concise if the authors need to shorten the chapter. 3) The main point is the last sentence!! don't cut that sentence!	Noted. This section has been shortened by referring to the discussion of more general issues related to rebound effect in Chapter 5.
34351	9	41	13			It is still not clear to me in what way the rebound effect is well placed in this section that is supposed to assess the literature on effects of mitigation measures on additional objectives (where is the additional objective affected in the rebound effect?). In addition, there is some general text that would rather fit into chapter 5, such as lines 16-19 as well as 32-39.	Noted, as baove
26779	9	41				It should be mentioned that fuel pverty leads to significant costs for state owned health services, for example, in the UK there is an estimated cost of £859m per annum due to cold homes, many of which is can be reasonably assumed are cold due to fuel poverty: http://www.fcrn.org.uk/sites/default/files/2009_Annual_Report_of_Chief_Medical_Officer.pdf	Accepted: This issue is mentioned in Section 9.7.3.1. A reference to the suggested study done.
33821	9	42	22	42	24	Improvement of indoor air quality is not always a result of EE interventions. Balanced ventilation can worsen the indoor quality when the ventilation system is not appropriately maintained and used. Furthermore, it is assumed that the outdoor air quality is generally better than the indoor air quality. It is possible that due to low-tech and/or suboptimal ventialtion systems, the air quality can be insufficient and the pollution can decrease by using a modern ventilation system. So, the reference situation is of importance.	Accepted: Text revised. Regarding the 2nd point, please note that in this paragraph we focus on the indoor environment.
30132	9	42	22		39	I have commented on this in chapter 5: More efficient biomass stoves have clear benefits for health and GHGs, but we need to be more careful when talking about switching to "cleaner" fuels (assumed to mean electricity, gas and LPG), in view of the fact that biomass is usually considered carbon-neutral, unlike these alternatives . Does the statement refer to the fact that biomass produces black carbon, and that this can outweigh the carbon emissions from the "cleaner" fuels, or that it is often unustainably harvested and therefore not carbon neutral? If so, this should be clearly explained in the text and references given.	Noted: This paragraph refer to tha fact that biomass produces black carbon (indoor air pollution)
34352	9	42	26	42	36	Please liaise with the Bioenergy Appendix authors to coordinate the coverage of side-effects of mitigation options related to cookstoves.	Noted: in Bioenergy Appendix there is no discussion on the po-tential co-benefits associated with mitigation options related to cookstoves. So, we don't see any overlaps on this issue.
41350	9	42	31	42	31	Please revise and check the numbers - The estimate of 4 million premature deaths annually due to household air pollution is from the recently released Global Burden of Disease study for 2010: http://www.thelancet.com/themed/global-burden-of-disease. WHO was involved in the study (not the primary source).	Accepted: citation on this reference made.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30131	9	42	9			Sorry I don't have time to check the reference, but are you sure that adolescents are vulnerable to low temperatures? I would have thought that sick or disabled people would be more worthy of a mention in this sentence?	Noted: We checked the reference - fuel poverty affects adolescent well-being. This paragraph is not only about health impacts.
30353	9	42	12	42	13	There is a further assumption inherent in this statement, in that installation of new measures (e.g. retrofitting to PH standards) will result in optimal or near-optimal use by occupants. This is unlikely to be the case, especially for fuel poor households, due to human / behavioural factors such as lower levels of education and the 'hassle factor' of adapting to new heating systems. One proposed solution to this (e.g. as trialled by Irvine Housing Association, Scotland) is providing 'user manuals' for new low energy housing and retrofitted heating systems, however the effectiveness of these is limited by the same barriers - particuarly literacy levels. Another possible solution is employing staff to teach occupants in their homes and run periodic checks to ensure the lessons have been learnt, however obviously this adds a (measureable) additional cost per intervention - especially over larger less dense residential areas - which may limit applicability beyond well-resourced housing associations and other social / private landlords.	Accepted: this issue is now reflected in the text. /
20318	9	42	3			The (politically) used term of energy or fuel poverty is from my point of view ambiguous: it could be conceived that fuel poverty is different from poverty in general. But ist is "only" one characteristic of poor households. Poverty can translate into unhealthy living conditions, as it can translate into other aspects like not being able to pay the rent, afford enough food etc. From a social policy perspective it could be counterproductive to isolate one aspect of poverty.	Noted: I agree that fuel poverty is one dimension of the general poverty faced by households. On the other hand, improving the thermal performance of buildings (usually by the owner of the building) results in reduced energy demand for achieving a given level of thermal comfort conditions; thus energy expenditures become to some extent affordable by poor households. There is no much space here to open this discussions, however energy access by the poor is discussed extensively in other Chapters of the report.
26772	9	42	21	43	21	depression and anxiety should be included in the issues with a higher than average prevelence amongst people in fuel poverty - Green, G., & Gilbertson, J. "Warm Front, Better Health: Health Impact Evaluation of the Warm Front Scheme", 2008, Sheffield Hallam University.	Accepted
19533	9	42	21	43	21	reduce page count by 0.2 (of 18 needed) by reducing sec. 9.7.3.1 from 1.05 to 0.85 pages; this can be accomplished with minor revisions to the text	Noted: as several other comments asked for specific additions we tried to keep the text at 1 page.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41351	9	43	22	43	42	1) Please provide more numbers/values in related to "quantification" of health, etc. 2)Please clarify last sentence -$2010 2 and $2010 7 and $2010 46- millions? billions?	Noted / Accepted: 1) More quantitative results ragarding the health/environmental impacts attributed to outdoor air pollution will be given in Chapter 6. In general there are few studies presenting quantitative results specifically for the buildings sector; 2) Text has been clarified.
41352	9	43	43	44	6	There are lots of great ideas for policy makers in this list, but is there any way to prioritize them? Which are most cost-beneficial? Which are the easiest to implement? This is an important section for policy makers.	Noted: unfortunatelly we don't have sufficient background information for such a comparative evaluation. To our view this is a gap of knowledge.
33822	9	43	7	43	8	Is this due to fuel poverty or due to sub-optimally designed and operated energy systems, and low energy quality of buildings? Anyway, the number of 10,000 seems really high.	Noted: the corrsponding text deleted in the revised version of the Chapter.
30354	9	43		44		In addition, improved water efficiency reduces costs and emissions from utilities sector. Possible question is how this can be used to incentivise water (and therefore energy) efficient buildings without re-attributing emissions away from the utilities sector.	Accepted. A reference to this point made; however we don't have enough space to discuss this issue in more detail.
41353	9	44	1	44	6	We suggest the addition of the following reference addressing similar issues: Xu, T., J. Sathaye, H. Akbari, V. Gard, S. Tetali. 2011. Quantifying the Direct Benefits of Cool Roofs in an Urban Setting: Reduced cooling energy use and lowered greenhouse gas emissions. Building and Environment. Volume 48, Pages 1–6.	Accepted
34353	9	44	10			"Faster policy uptake is especially important" sounds policy-prescriptive to mee!	Accepted. The text deleted
34354	9	44	13	44	16	For such an important finding, it is in my opinion not sufficient not to explain how this result has been derived and under which assumptions (see my comment to page 38, lines 24-25).	Accepted. The text deleted
30133	9	44	19		21	This sentence does not read well and the meaning is not clear.	Accepted. The text deleted
41355	9	44	22	44	22	Change "improves" to "may improve". The statement is incorrect. Some energy efficiency measures that are commonly implemented in buildings have adverse effects on air quality, indoor temperature, etc.	Accepted
41356	9	44	31	44	34	We recommend that the authors add cultural factors as one barrier (as well as stimuli).	Accepted
34515	9	44	35	44	37	Suggest changing "developing countries" to "less developed areas".	Accepted
41357	9	44	37	44	41	This section on opportunities comes in between two sections on barriers? The authors should consider moving opportunities to the beginning or end of the chapter.	Accepted
34355	9	44	37	44	41	These 'opportunities' have been assessed under the heading of potential co-benefits already. Hence, they are not 'conditions' that facilitate the implementation of mitigation measures but outcomes with respect to additional objectives.	Accepted
34841	9	44	37			Link: Please add more specific links to Ch.10 and 12	Accepted
41354	9	44	7	44	21	1) We don't understand the last sentence - "attributable?" 2) sentence on line 13-17: What don't understand what the authors are trying to convey: benefits can "be" some percentage of the cost?	Accepted
34383	9	44	7			Please delete 'Integrating co-benefits into decision-making frameworks' according to decisions made in Wellington and Vigo.	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19510	9	44	22	45	5	reduce page count by 0.65 (of 18 needed) by deleting sec 9.8; all this is covered in policy section	Rejected. Goes beyond policies. Harmonized with 9.7.4., public perception
30497	9	44	22	45	5	The type of barriers in building sector is mentioned here, but more detailed explanation on some barriers is needed, such as on "weak patent protenction" and "inadequate technology transfer".	Noted. Text changed, but no space to explain. Sources provided.
30355	9	44	24	44	24	Technology -> Technologies	Accepted
41358	9	45	1	45	5	Note: subsidies in energy supply may become a hidden barrier because it artificially lowers energy prices - making financial incentive for retrofit/enabling program/behavioral change less effective in reducing energy use. (Xu et al. 2013)	Accepted
26396	9	45	28		29	The conclusion about sectoral versus IAM models reads too rapid. To be better justified, it should at least be linked to the top-down versus bottom-up debate. It could also be illustrated by examples drawn from the Energy Modeling Forum 25 report.	Accepted. I agree with this. We need to make the point very strngly that the IAMs explicitly exclude options where costs exceed beenftos and therefore are not fit for purpose in this sector
41360	9	45	30			Please improve the figure clarity. The legend does not make sense. The caption "277 Low 230 Med 158 High" makes no sense. We are not sure what this plot is showing since we can't understand legend or caption.	accepted, the caption will be clarified.
41359	9	45	6	45	6	Please define "sectoral" somewhere or give example or refer elsewhere in report.	Rejected. Sectors are those which the AR5 is framed.
19534	9	45	6	49	8	reduce page count by 1.5 (of 18 needed) by reducing sec. 9.9 (incl. the 3 subsections) from 4.5 to 3 pages; the page allocation to this chapter does not allow the luxury of repeat from Chapter 6; Fig. 9.19 adds nothing beyond Fig. 9.17 so drop it along with associated text, plus reduce remaining text so 0.75 page is dropped from Sec. 9.9.2; the remaining 0.75 page reduction must come from Sec. 9.9.3, primarily by dropping the least useful figure and downsizing the format of the remaining ones	Noted
34845	9	46	23			Detail: add "by 20XY" after "energy demand"	Accepted
41361	9	46	7	46	23	Please improve the clarity. The figure could be explained better as well.	Noted
34844	9	46	7			Editing: delete "suggested by"	Accepted
26590	9	47				Figure 9.19 not necessary as it confirms something already said…	rejected, 9.19 contains the same information as 9.18, but it is much easier to read the difference between baseline and policy scenarios
41362	9	47	12	47	28	We think this is important, but it needs more clarity. 1) define "stagnate" and "stabilization" before they're used first time 2) "These scenarios" in line 17 refers to which ones?	Noted
34848	9	47	16			Detail: suggest to add at end of line "and/or negative emissions in other sectors"	Noted. Text changed
34849	9	47	18			Detail: insert "bottom-up" after "lowest"	Noted. Text changed
34850	9	47	20	47	23	Content: These sentences are wrongly phrased. It should say, if I am not mistaken: "Scenarios show a general trend to electificatoin, independent of the mitigation goal. A key strategy for the building sector to lower emissions is to use decarbonized electricity. This is in line with the strageties outlined in Chapter 6."	Noted. Text changed
34851	9	47	24	47	25	Content: I suggest to make analysis of Figure 9.20b more crisp: "Figure 9.20b shows that not only all demand growth in buildings is happening in electricity but that there is a switch to electricity from existing other sources."	Noted. Text changed

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30356	9	47	26	47	27	Disagree with this statement. See Scottish policy on decarboniosing the built environment (see Scottish Government, 2013, Second Report on Proposals and Policies (RPP2)). There is a policy priority to move housing, particuarly in rural areas and the islands) towards lower carbon energy supplies based on the high availability of renewable resources (in particular wind, wave and small scale hydro) and the (claimed but disputed) availability of biomass. However this overlooks two important problems. First is the relative cost of electricity compared to gas and coal, and the impact such a switch would have on fuel poverty levels, which is a particular problem for households in rural and exposed areas. However the second is the possible impact on the fabric of traditional buildings of switching to electric heating due to the change in the heating and cooling loading cycle / thermal regime. In Scotland at least and due to a lack of evidence, it's impossible to say that such a change does not risk causing a deleterous effect on building fabric, and therefore comment on any knock on impacts on maintenance costs (and the increased operational and embodied emissions) that such a change could cause. There is a clear political advantage to driving this change, however it comes with at the cost of a 'known unknown' risk.	Accepted
41363	9	48	2			Please clarify the legends.	accepted, the caption will be clarified.
24716	9	48	9			Acronyms make these diagrams difficult to understand e.g. GCAM, IMACLIM, etc. Suggest that these are spelt out in full, as it is likely that the diagrams will be read independently of the whole document.	Rejected, these are the conventional names of the models. Instead their scenario names will be spelt out in full in the figure.
41366	9	49	10	50	13	Please add reference: Xu et al. 2013 covering relevant issues.	Accepted
22092	9	49	15	49	15	"First-cost hurdle" is not defined yet but presented as a key barrier to energy efficiency. Term needs to be defined.	Accepted
22093	9	49	20	49	22	DUKES reference cannot be used to substantiate this statement. The variation in UK residential gas consumption cannot be cited as the result fo policy (specifically boiler efficiencies and insulation). Variation in gas consumption is as much to do with variation in temperatures and the increasing price of gas and other economic constraints placed on consumers since 2008 as the relatively slow permeation of efficiency measures through the housing stock. Either needs substantiation with literature or removed.	Rejected. Important to keep this in to ensure the message 'policy can work'. Author to find relevant references. Will check with Eoin Lees if he has a good reference for this.
24717	9	49	4			This Fig reinforces the SPM discussion about the wide gap between large-scale model results and bottom up studies. The top down models tend to focus on decarbonising energy, which we know is expensive, while the bottom up work shows large benefits from saving end use energy. This comes back to the assumptions underlying the top down models. Suggest it could be included in the SPM	accepted, prior to including in the SPM the figure will be updated.
24718	9	49	4			Acronyms make these diagrams difficult to understand e.g. GCAM, IMACLIM, etc. Suggest that these are spelt out in full, as it is likely that the diagrams will be read independently of the whole document.	Rejected, these are the conventional names of the models. Instead their scenario names will be spelt out in full in the figure.
41364	9	49	4			The text notes that electricity decarbonization didn't have a big effect. But is seems like it had a big effect from this plot. Please reconcile.	Noted. Checking, the attribution will be made again based on a new set of scenarios to make the point.
19535	9	49	10	50	41	reduce page count by 1.25 (of 18 needed) by deleting sec. 9.10.1; duplication must be reduced to achieve the page budget, everything in this section either is or could be seamlessly integrated into the sec. 9.10.2 subsections; sec. 9.10.2 already starts out nicely by saying "Since recent reports have reviewed building-related policy instruments comprehensively, this chapter provides insights only into recent developments in emerging or important instruments."	Accepted - some amalgamation possible; we can try to shorten 9.10.1

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41365	9	49	10	50	41	9.10.1 could be shorter, and more general. It should also note that the setting of building codes, appliance standards, taxation policy and oversight of financial innovation is often not within the same governmental body, and is often located with policy makers with divergent interests. Some discussion in the text should speak to each of these kinds of decision makers, and to a national role in coordinatinating these efforts.	Accepted. Paolo: we already agreed to shorten this section. Interesting to include a line on different governmental bodies not coordinated in implementing EE polices.
30357	9	49	26	49	26	Other sources (e.g. the UK's Sustainable Development Commission) have put this figure at 70%. We have replicated the calculations using various tweaks to the (basic) assumptions and have found numerous suitably robust ways to reach a ballpark figure, all of which are around 60-70%. Suggest a possible edit here to reflect both the uncertainty and the robustness of the ball park figures. Key message should be that it's an important figure and robust (enough) for both research and decison-making purposes. Our research group has come up with the tagline 'the Sustainable Urban Environments of tomorrow already exist - they are today's urban environments'.	Noted, but no action needed. UKSDC is not peer reviewed; perhaps could be accepted as reference.
24703	9	5	10	5	43	This is very valuable material. Suggest that it is important to keep when shortening the chapter.	Noted. Language changed
41270	9	5	10	6	18	This comment reflects an example of the general comment made for the whole chapter: Problematic presentations using % to indicate energy savings or energy efficiency improvement, while the denominator for the percentage is often very vague or not specified at all. Suggest the authors to clearly explain the denominator (base parameters) to improve the accuracies and rigor of the statements.	Accepted
40711	9	5	14	5	17	Low emission buildings are not applicable for all type of buildings paying back well within the building lifetime, especially for high buildings. Therefore, it would be better to limit houses and low buildings.	Noted
24702	9	5	2	5	3	This sentence highlights the importance of adding to the explanation of emissions by sector in the SPM. In the SPM, it is stated that buildings generate 7% of global GHGs. Here, it is stated that buildings use 32% of global final energy and 30% of energy related GHGs. If it is assumed that building use around half of global electricity, the SPM could attribute 7+12=19% of global GHGs to buildings. Roughly, if energy emissions are around 60% of global GHGs, then Chapter 9 is saying 0.6x30%=18% of global emissions relate to buildings, so the two statements are consistent, but confusing.	Noted
20615	9	5	21	5	21	Please explain the abbreviation "ICT" in the text.	Accepted
32190	9	5	21	5	21	What is ICT ?	Accepted
33793	9	5	22	5	22	…to optimize energy efficiency by means of smart control…	Noted. Implicit
24704	9	5	24	5	48	This section emphasises the major market failures and barriers that block mitigation in the buildings sector. It also states that pricing signals have had very little effect in this sector: this is at odds with the SPM acceptance of top down modelling based on assumptions of rational behaviour. Suggest that they need to be made consistent, and that this section is the more accurate text to go with.	Noted
27832	9	5	24	5	28	This is an important statement: Existing barriers must be overcome by political intervention.	Noted
33794	9	5	27	5	28	Suggestion for adding this sentence in the summary: “Beyond all the benefits of energy savings such as CO2 reduction and costs, policymakers (in developed countries) should act on the social aspects such as ‘energy-poverty’. An increasing number of low income households will be faced with high energy bills, debt-problems and house deportation.“ source: Wisse Veenstra, 2012, fuel poverty in the Netherlands, publication of Agentschap NL, http://www.rwsleefomgeving.nl/onderwerpen/lokaal_klimaatbeleid/	Rejected. Policy prescriptive
20254	9	5	30	5	32	there is controversy over the negative cost potential - wording need modification.	Rejected. Liaised with other chapters
26570	9	5	31		33	take out sentence	Rejected. No reason explaining

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27833	9	5	31	5	33	What does "marginal supply" mean in this context?	Rejected. It means additional BAU construction, but there´s no space in the ES for wide explanations
41271	9	5	35	5	38	Syntax Error: strike out "and therefore" so sentence reads: "As many new buildings will be added to the stock in developing countries, including energy intensive appliances, and therefore adequate building codes and energy requirements on appliance ecodesign are necessary to address mitigation objectives [medium agreement, medium evidence]."	Accepted.
41272	9	5	44	5	46	Not accurate - incorrect pricing could do more damage (and very effective) than program/regulations. Refer to Xu, P., T. Xu, P. Shen, 2013. Energy and Behavioral Impacts of Integrative Retrofits for Residential Buildings: What Is at Stake for Building Energy Policy Reforms in Northern China? Energy Policy, Volume 52, January 2013, 667-576.	Accepted.
26571	9	5	46		48	take out	Rejected. No reason explaining
34401	9	5	10	5	23	This section reads like advocacy for energy efficiency investments in the buildings sector. It does not clearly distinguish between what is technically possible and what is economically attractive. There is a lot of emphasis on making clear that even strong reductions in energy use compared to business as usual CAN BE economically attractive. Howver, it would be good to convey under what conditions energy efficiency investments MAY NOT pay off as well as to highlight sources of uncertainty that may negatively affect the economic attractiveness of such investments. It should also convey how investors can determine which degree/depth of energy saving is economically most attractive.	Accepted
34402	9	5	25	6	2	This section spends too little space explaining the nature and type of barriers that prevent the uptake of the negative cost potential for energy saving investments or - put differently - that make otherwise economically attractive options remain idle. Instead it jumps straight into measures to overcome unspecified barriers (which at best shine through at times). This structure in combination with the general language of that paragraph reads makes it read like a very policy-prescriptive message.	Noted. Language changed but there are severe space constraints
30336	9	5	8	5	9	Risk of conflation of 'electricity' with 'clean fuels'?	Noted. Language changed
22911	9	5	14	5	17	"Recent developments in technology and know-how enable construcntion and retrofit of very low- and zero-energy buildings, often at little marginal investment cost, typically paying back well within the building lifetime" is not valid for all building types. It should be restriceed for residential or low-rise buildings"	Accepted
22789	9	5	14	5	17	"Recent developments in technology and know-how enable construcntion and retrofit of very low- and zero-energy buildings, oftedn at little marginal investment cost, typically paying back well within the building lifetime" is not for all building types. It should be described as "In residential or low-rise buildings, recent developments in technology ...	Noted
31604	9	5	38	5	40	If the term 'cost effective' includes health benefits, only careful application of appropriate energy efficiency measures which consider indoor air/environmental quality will be actually cost effective. For example, adverse health effects from lowering ventilation rates may increase exposure to indoor air pollution, particularly from indoor sources (e.g. VOCs, mould, CO, NO2, etc.).	Noted. Language changed
33823	9	50	1	50	1	… any national policy package…	Rejected - could be a combination of policies at different governance levels.
34516	9	50	1	50	2	change "spefically" to "specifically"	editorial
24719	9	50	46			Suggested further examples of innovative policy approaches in Australia: http://www.sustainablemelbournefund.com.au/ http://www.dtf.vic.gov.au/CA25713E0002EF43/pages/dtf-projects-greener-government-buildings http://www.nabers.gov.au/public/WebPages/Home.aspx	Noted. FAQ 9.5 deleted
41367	9	50	46	50	47	"in developing countries" should be outside of the parenthesis.	Accepted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41368	9	50	48	51	7	This discussion is vague and needs more quantification and more references. In fact, many measures can be more cost effective. Here are suggested revisions for the paragraph: Among these, regulation based instruments can be the environmentally effective, due to the strong barriers that are common in the building sector. For example, appliance standards can be cost and environmentally effective, while progressing building codes can be very effective in changing behaviors, designs, and practices that result in large energy savings and emission reductions and be cost effective to various extents. Although the costs associated with code implementation and enforcement can vary and be high in some regions, implementing many efficiency measures outside the context of building codes are found to be cost effective in reducing energy use and associated carbon emissions in residential buildings in various climates. Consider this useful reference - Xu, P., T. Xu, P. Shen, 2013. Energy and Behavioral Impacts of Integrative Retrofits for Residential Buildings: What Is at Stake for Building Energy Policy Reforms in Northern China? Energy Policy, Volume 52, January 2013, 667-576.	Accepted.
27836	9	50	9	50	9	Regarding the English term for EnEV which is used in Germany - the term "Energy Saving Ordinance" is used instead of "Energy Conservation Act".	Accepted. to be revised; editorial: we will change the name a sin the comment
30358	9	50	2	50	2	Spelling edit - 'specifically'	editorial
22094	9	50	27			There is a large body of literature on the effectiveness of information instruments which is not conclusive. This statement needs substantiation with literature.	Agree this needs to be done; will search for some refernces on effectoveness of information instruments
26634	9	50				CRC Energy Efficiency Scheme in UK may be also emerging policy instruments for commercial sector. https://www.gov.uk/crc-energy-efficiency-scheme	Reject - basically an energy tax
25398	9	51	10			The phrase "due to the rebound effect" is out of place here. Much of what is documented elsewhere in this chapter clearly indicates that there are a myriad of reasons that "technical efficiency improvements are needed". Meanwhile, the rebound effect is "in the noise" in many cases, as stated in section 9.7.2.4 Given that the chapter is considerably over length, this long section is something that could be pared back.	Noted. To be revised. We could skip the first sentence, but a section to discuss sufficiency policies in needed, we do not achieve the CO2 emission just with technological solutions
21404	9	51	16	51	22	delete these 2 sentences - It is not acceptable to mention personal carbon allowance in IPCC report	Rejected - IPCC reports are not censored in thie way suggested
33824	9	51	2	51	3	suppliers'obligations are a part of the EU ESD directive and will have to be introduced in each MS.	Rejected - Article 7 of the ESD allows fro alternatives and some EU Member states intend to use this provision.
33825	9	51	25	51	27	Could you explain very briefly how the energy saving feed-in tariff works?	Rejected. References provide this information in detail.
22095	9	51	28	51	37	This section only discusses EU EPBD and progressive regulation in member states towards net zero energy/carbon. What evidence in ROW of adoption of regulation of energy standards?	Agree in principle with should do this. Can non-EU authors help?
27837	9	51	35	51	35	Please use the term "nearly zero energy" instead of "net zero energy"	Noted. Outcome depends on further discussions of terminology.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41369	9	51	5	51	7	The authors should refrain from simply claiming appliance is more cost effetive than building codes. Many more measures are more cost effective than appliances in many regions.	Accepted, appliances standads tend to be the most cost effective emasure due to the very short pay back time for some technologies
41370	9	51	8	51	22	Please change the paragraph header to replace "sufficiency" with "reduced demand."	Rejected. The concept of sufficiency is wel understood and has a different meaning of reduced demand. Rejected
26397	9	51				Among usual energy efficiency instruments (taxes, subsidies, regulations), energy or carbon taxes are the only one that addresses sufficiency. This has been demonstrated analytically by Giraudet and Quirion (Revue d'économie politique, 2008) and numerically by Giraudet, Guivarch and Quirion (The Energy Journal, 2011)	Rejected. Regulations that affect demand for energy services (e.g. constraints on thermostat settings) also address sufficiency, as do any information policies designed to affect non-economic drivers of consumption; we could have penalities (taxes), quota (personal allowances), incetives (ES FiT), and as you says regulation on maxium indoor temperature, heating hours, maximum heating days in a year (all in force in Italy since the '70s)
30360	9	51		51		Please ignore! Suggested tabulating some of this (and prev /next?) sections to save space and then spotted one later.	Noted
35281	9	51	28			This part lacks cases from developing countries. In fact, developing countries such as China have devoted even larger efforts in promoting green building than many developed countries. It is suggested to include China's practice and exploration in energy-efficient building and green building as a case, in reference to the literature below. "Since 2005, to realize the energy-saving goal stated in the 11th FYP and implement the various policies and measures, leading groups of key officials were established at the responsible government agencies at all levels. In 12 provinces (city, district),an energy-saving coordination leading group that involves the departments of finance, construction, and the development and reform commissions has further been established (Zhou, 2011).Corresponding agencies have also been set up at each city."(Zhou Nan, Assessment of Building Energy-Saving Policies and Programs in China During the 11th Five Year Plan, Lawrence Berkeley National Laboratory, 2011) Available at: http://china.lbl.gov/zh-hans/publications/building-policies-11th-FYP	Accepted. China example to be added.
30359	9	51	30	51	30	Should be "EPBD Recast" - and give full title?	Noted, editorial
33826	9	52	1	52	4	You describe , in fact, the ESD, so it can be handy to mention it by name…	Noted, although it is the EED not the ESD. As noted in response to 486 above, this sentence needs some amendment to be strictly accurate; we have to review the text to bring in line with the EED

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27838	9	52	1	52	5	An assessment of the possibility of establishing a 'white certificate' scheme at Union level has shown that, in the current situation, such a system would create excessive administrative costs and that there is a risk that energy savings would be concentrated in a number of Member States and not introduced across the Union. The objective of such a Union-level scheme could be better achieved, at least at this stage, by means of national energy efficiency obligation schemes for energy utilities or other alternative policy measures that achieve the same amount of energy savings.	Rejected. The text does not refer to an EU level scheme.
33827	9	52	10	52	14	Do approaches like Cradle-to Cradle or Cradle-to-Grave maybe fit in this paragraph?	Rejected. Construction material emission should be captured by the industry chapter. To have polices acting on reducing the demand for high carbon building material could be complex as theer are impacts on structural safety of buildings
26591	9	52	13			add : construction, coordination of skills	Noted. Covered at lines 20 to 21
41371	9	52	9	52	21	We believe that there is a need to elaborate more on the topic of building science education in higher-education worldwide. We would recommend that the authors add a few more sentences to echo such needs here and in the summary section.	Accepted
30361	9	52	14	52	14	Would add Post-occupancy Evaluation (PoE) specifically here. See work by Bill Bordass at the UKGBC and many others.	Accepted. Needs further discussion. POE is important, but not clear how it is encouraged or mandated by policy
33828	9	53		53		2nd row, 2nd column: you could mention the EU Eco-design Directive	Accepted. In principle we should mention that most of the OECD countries have MEPS.
33829	9	53		53		6th row, 2nd column:You could mention the exmple role of the public sector (EED)	Rejected - not itself a procuremnt programme Paolo: we could accept it as Art. 6 of the EED is about energy efficency public procurement
33830	9	53		53		6th row, 1st column: if I am not mistaken, the sustainable public procurement is not mentioned in the text, so it appears in this table suddenly	Accepted - to be addressed
25090	9	53				Please add the following as a reference to CASBEE that is found in Building labels and certificates; "Murakami et. al., (2004) CASBEE; COMPREHENSIVE ASSESSMENT SYSTEM FOR BUILDING ENVIRONMENTAL EFFICIENCY", Murakami S., Iwamura K., Sakamoto Y., Bogaki K., Sato M., Ikaga T. and Endo J., Journal of Technology and Design, Architechtural Institute of Japan, vol.20, p199-204 (in Japanese) FYI: English abstract can be found in http://ci.nii.ac.jp/naid/110006348482/	Accepted - to be added
33834	9	54		54		last row, 2nd column: you could mention EED as an example	Rejected. EU EED is a framework not a leadership activity. Paolo: we could partly accept it as the EED requires in Art. 5 national authorities to achieve the 3% refurbishment rate for central government buildings amd other action for the examplary role.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
33831	9	54		54		1st row; 1st column: ETS can be mentioned as an example	Rejected - no primarily a building sector policy, so out of scope for this chapter
33832	9	54		54		4th row, 2nd column: Estonia is just one of the examples; the measure is widely applied in former ECC like Poland, Slovakia, etc., where also EU Structural Funds are used.	Noted - no references provided; data available for Poland, also available in HU (not sure about SK) - we will try to dig out a reference
33833	9	54		54		6th row, 2nd column: In the Netherlands, some of the voluntary agreements have a binding character; once taking voluntarily part in the agreement, the intended objectives are binding. Also, an example is the Convenant of Mayors where the participation is voluntary, but failing to comply with the targets can result in dismission of the city from the convenant.	Noted - already included
25748	9	54				In the "Carbon markets" line of "Further information, comments" column, Tokyo CO2 Emission Reduction Program is mentioned. But this example should be deleted completely because Tokyo CO2 Emission Reduction Program is currently under the special measure for the Great East Japan Earthquake, which allows CO2 emission increase caused by home generation. This means that the program is not implemented under normal condition. Therefore, Tokyo CO2 Emission Reduction Program should not be considered as a good example of carbon markets.	Noted. We already mentioned that the Tokyo CO2 cap programme is temporary "suspended", however it is still working well and for all electric buildings it results in energy savings
27839	9	54		54		Please add the following information in the 2nd column, 4th line: "Further information, comments […] and Germany (CO2-Rehabilitation Program)".	Accepted - to be added
27840	9	54		54		Please add the following information in the 3rd column, 4th line: "Environmental effectiveness (selected best practices of annual emission reduction) GE: 6.8 Mt CO2, cumulative 204 Mt CO2 (2001 – 2012)".	Accepted - to be added if reference can be found
41372	9	55	1	55	31	It would be more meaningful to quantify success of some of these policy packages. Consider ways to shorten the section, using table, adding quantified impacts.	Noted, but it is hard to find solid data in peer review papers
33835	9	55	31	55	31	Suggestion for addition at the end of the paragraph: 'Financial and fiscal incentives of local and national governments show positive results in some cases on stimulating the increase of labour in the buildingsector and in CO2 reduction/energysavings.' source: (* Publication PBL/ECN planbureau 'Possible Climate-instruments for national and local policy- on CO2 reduction, employment, costs for governments and livingcosts'.)	Rejected. Employment effects results from the measures rather than the policy drivers and are therefore best addressed under co-benefits
33836	9	55	31	55	31	suggestion for an addition at the end of the paragraph: 'Policy-packages of national and local governments and integrated projects are needed to avoid debt-problems and fuel poverty for low-income households -on the shorter and longer term- because energy-costs will rise." source: Wisse Veenstra, 2012, fuel poverty in the Netherlands, publication of Agentschap NL, http://www.rwsleefomgeving.nl/onderwerpen/lokaal_klimaatbeleid/	Noted. Agree with the comment, but the reference provided is not peer reviewed. Paolo: I do not agree with the comment, as it refers to other policies not related to efficiency, perhaps better to discuss in the co-benefit section

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27841	9	55	34	56	2	Referring to data concerning the "CO2-Gebäudesanierungsprogramm", 2001-2012: Germany´s CO2-Gebäudesanierungsprogramm (CO2-Rehabilitation Program), operated by the KfW bank, offers grants and loans with low interest rates for energy efficiency in residential buildings. The program is attractive to end-users and home owners, such as private landlords and housing companies. The scheme has triggered energy efficiency measures in 2.8 mio dwellings and the construction of more than 0.5 mio energy efficient new dwellings from 2001 until 2012 in Germany. By the CO2-Rehabilitation Program 6.8 MtCO2 per year (cumulative 204 MtCO2) will be reduced over the 30 year useful life of the measures. Up to 300.000 jobs per year are secured/safeguarded. In addition energy consultancy is funded. To initiate comprehensive measures in the energy efficiency of urban quarters and infrastructure the KfW program Energetische Stadtsanierung (Energetic urban renewal) was introduced 2011.	Noted. We agree this is an important programme, but do not have the space to go into major detail. The reference provided is not peer reviewed, but we can look at adding some new peer reviewed publications (R. Gavin has analysed the KfW scheme in Germany in at leats 3 papers).
33837	9	55	44	55	46	There is a lot of EU research and implementation carried out and still going on regarding Innovative financing solutions and business models like in EU projects RE-BIZZ, Cost-effective or E-hub.	Rejected. Nothing new in the RE-BIZZ final report, we have briefly presented what is also in the cited report. E-hub
19536	9	55	1	55	31	reduce page count by 0.35 (of 18 needed) by reducing sec. 9.10.2.6 from 0.65 to 0.30 pages; the key points about "packages" can be made using less than half the current page length	Noted. We will look at editing to shorten throughout. This looks like a strong possibility
30363	9	55	12	55	12	Not convinced the evidence is strong enough to say the EU scheme was 'very' successful. Evidence is limited and needs to take into account the influence of technological change over that period (e.g. the switch to LCD TVs), and consumer demand (e.g. for portable equipment / devices). Also, section could be generally shortened and toned down, especially given the use of only two sources to cover a large subject area.	Rejected. Evidence is good for those appliances to which standards were applied and the context makes this clear
30362	9	55	6	55	6	Delete '(' after '2012'	editorial
30364	9	55		56		This section realy needs some reference to 'Soft Landings' - see http://usablebuildings.co.uk/UBTOverflow/SoftLandingsFramework.pdf - and many other refs. This has a huge amount of support by building professionals in the UK and overseas.	Rejected. We are unaware of policy support for 'soft landings' (as opposed to the idea, which we agree is important and is included at 9.3.3.2); it is not a policy but a method for building design.
19537	9	55	33	57	4	reduce page count by 0.50 (of 18 needed) by reducing sec. 9.10.3.1 from 1.4 to 0.90 pages; this can be accomplished through sticking to the key points and economizing on the phrasing	Noted. To be considered in overall revsions
41373	9	56	10	56	14	The authors need to address the problems encountered for PACE program, e.g. it's stopped because FM wouldn't back mortgages with PACE liens on them.	Accepted

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
26398	9	56	42		44	Tax exemptions read like subsidies. If this is the case, then according to the papers mentioned above, it is a less effective mechanism than a tax, not more. This is because compared to energy taxes, energy efficiency subsidies generate a rebound effect.	Noted. The comment appears to be a misunderstanding. The analysis is that tax exemptions for energy saving equipment are more effective than energy taxes. We will clarify this. Paolo: I do not agree with the comment. Energy taxes needs to be very high tohve a real effect. Subsidies tends to be more effective. tax examption could be for end-users (France, Italy) or manufacturers of efficient products
34517	9	57	1	57	2	The tax polices are suggested in the paper, not in use yet. So, suggest changing "tax policies are used to" to "tax policies were suggested to be used to"	Noted
33838	9	57	24	57	31	This paragraph could be shortened and certain details left out.	Accepted. To be edited.
24134	9	57	24	57	31	Keep this para as it is very important to introduce success scheme to the world.	Rejected. Space constraints require edtiing
20626	9	57	31	57	31	Please also take into consideration that concentional CDM projects in the buildigh sector suffer from the disadvantage that the GHG emission reduction per building is relatively small. Hence, Programmatic CDM projects bundling a large number of buildings provide for a larger potential.	Rejected. This does not refer to CDM Paolo: I propose to integrate this comment at page 57 line 42, see also next comment
23123	9	57	39	58	7	Replace text "The CDM is... SHS type projects" by "However, it until recently has bypassed the sector entirely. Some of the methodological obstacles to energy efficiency projects are discussed by Michaelowa et al. (2009). However, a "whole building" baseline and monitoring methodology approved in 2011 may pave the way for more building projects (Michaelowa and Hayashi 2011). Since 2009, the share of CDM project in the buildings sector has increased, particularly with regard to efficient lighting schemes (UNEP Riso Centre (2013). The voluntary market has complemented the CDM as a finacing mechanism, for example for solar home systems projects (Chaurey and Kandpal 2009)". References: Michaelowa, A.; Hayashi, D.; Marr, M. (2009): Challenges for energy efficiency improvement under the CDM—the case of energy-efficient lighting, in: Energy Efficiency, 2, 4, p. 353-367; Michaelowa, A.; Hayashi, D. (2011): Waking up the sleeping giant: How the new benchmark methodology can boost CDM in the building sector, in: Trading Carbon Magazine, 5, p. 32-34. (Data should be updated at the time of finalization of AR5.)	Accepted. Will integrate this comment in a shorter version.
19538	9	57	32	59	8	reduce page count by 0.50 (of 18 needed) by reducing sec. 9.10.3.3 from 1.6 to 1.10 pages; this can be accomplished through sticking to the key points and economizing on the phrasing	noted. As above (see comment no 26398)
22096	9	58	42	58	46	States "there is evidence" but does not cite. Please include a reference.	Accepted
30365	9	58	45	58	47	This is post-occupancy evaluation in all but name - if implemented correctly and legally enforced.	Rejected. This refers to post=completion, not post-occupancy
25337	9	59		59		In this section, elaborate discussion should be on the data set quantity, quality and updatation. Buildings as such in state of dynism, the uncertainties about the data may be very high.	Rejected, due to space constraints
41377	9	59	21	59	21	Please remove "not" before "seldom."	Accepted, rephrased

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30366	9	59		59		Disagree with the general theme here, at least for the developed world. Compared to other sectors we have a large amount of knowledge and tools to bring to bear on reducing emissions from the built environment. Much of it may not be perfect, but still good enough for decision-making purposes. In the UK there is a surprising amount of academic and professional concensus on what we know and what works, and the problem is largely now a political one. For example, despite a wealth of academic evidence to the contrary, the UK Government continues to support and use the Standard Assessment Procedure (SAP, and it's sub-model rdSAP) for assessing the energy performance of domestic buildings. However it has discontinued use of and support for the alternative National Home Energy Rating Service assessments, which numerous studies and experts agree was a better model, for example because of its sensitivity to local climate, occupancy, and other factors not related to the building envelope and services. Some refs in our report at: www.scotland.gov.uk/Resource/0038/00389071.pdf . We have the knowledge, the tools, a general agreement about what needs doing to reduce emissions from the UK 's building stock, and that it would be good for the economy - the problem here really is just a lack of political will and resistance from the construction sector.	Noted
24720	9	59	10			Suggest there should be short paragraph conclusion for this section.	Accepted
19539	9	59	9	59	22	increase length by 0.7 pages; in my opinion development of Chapter 9 has uncovered more "gaps in knowledge and data" than are currently mentioned here, and about 1 page will be required rather than the current 0.3	Rejected, due to space constraints
41374	9	59	9	59	22	We recommend that the authors add proactive statements that would promote building science educations worldwide.	Noted. Considered
41375	9	59	9	59	22	Gaps in knowledge and data section is terse and needs to be expanded.	Rejected. Short space
41376	9	59	9	59	22	Suggested additions to the Gaps in knowledge and data section: 1) Develop bottom-up information on cost of conserved energy (and cost of carbon abatements) for end-use efficiency measures for various types of buildings (residential, commercial) with consistency and compatible methods applicable to different climates/regions across the world. 2) Promote database develpment and sharing of building performance (baseline, retrofits, etc.) regionally and globally that can be used to advance understanding of energy savings potentials. 3) Development of building standards/codes on the regional levels taking climates, economics of measures into account to guide implementation. 4) Document applications of new technologies, practices, standards/codes, policy instrument and quantify their impacts. 5) Quantify energy impacts from behavioral changes in building life cycles.	Noted. Important but this section is severely constrained in space
25392	9	6	16			Regarding the "low evidence" finding. Note the 3-fold difference in energy use for identical homes cited in Parker et at 2012 (Parker, D., E. Mills, L. Rainer, N.J. Bourassa, and G. Homan. 2012. "Accuracy of the Home Energy Saver Energy Calculation Methodology," Proceedings of the 2012 ACEEE Summer Study on Energy Efficiency in Buildings, American Council for an Energy-Efficient Economy: Washington, D.C.) This is just one of many items in the literature that show a huge role for behavior.	Noted. Still low evidence at global scale

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35273	9	6	17	6	21	This part neglects the reality of developing countries and only mentions that the behavior informed by awareness can reduce energy consumption by 20-50%. However, it fails to address the fundamental reason why energy consumption in developing countries is lower than that in developed countries is because of poverty, different lifestyles and unfulfilled service demand. It is suggested to add the following at the end of this sentence. "Energy consumption per capita of developing countries in the building sector is only 1/5-1/3 of that in developed countries [Figure 9.2], which is mainly due to different lifestyles and unfulfilled service demand. (THUBERC,2012) Developing and developed countries shall take different energy-saving pathways. For developing countries, the key is to improve energy efficiency, while for developed countries, the key is to change their high energy consumption lifestyle to reduce total energy consumption."(Tsinghua University Building Energy Research Centre (THUBERC) (2012). 2012 Annual Report on China Building Energy Efficiency. Beijing: China Building industry Publishing Company. (In Chinese))	Rejected. Such fundamental reasons are addressed in the chapter. These pathways make sense but the section can not be policy prescriptive in order to define what is "key"
41274	9	6	20	6	20	"which will lead to building energy use doubling." Do the authors mean global or just in developing? Please clarify.	Accepted
30936	9	6	21			Suggest spelling out "ICT". It is not spelled out in the preceding text.	Accepted
26573	9	6	29		38	rephrase: Beyond direct energy cost savings, many mitigation options in this sector have significant and diverse co-benefits such as energy security, air pollution and health benefits; productivity, competitiveness and net employment gains; increased social welfare, alleviated energy and fuel poverty, decreased need for energy subsidies and less exposure to energy price volatility risks; increased value for building infrastructure, improved comfort and services [high agreement,36 medium evidence]. But these are rarely internalised by policies [medium agreement, medium evidence].	Noted. The Executive Summary is being redrafted with significant changes
24705	9	6	3	6	7	This is very valuable material. Suggest that it is important to keep when shortening the chapter.	Noted. Text has been changed, trying to keep content
26574	9	6	38		40	TAKE OUT	Rejected. No reason explaining
41275	9	6	47	6	47	Please revise "codes" to "building codes" if that is what is meant here.	Accepted
26572	9	6	7		10	take out	Rejected. No reason explaining
41273	9	6	7	6	9	This is vague. Please rewrite the sentence to improve clarity.	Accepted
40712	9	6	7		10	This statement is not self-explanatory. The timing of lock-in (80% of 2005 final building energy use) and the scope of final energy use should be clarified.	Accepted
30338	9	6	41	6	43	Personal experience supports this statement. Was involved in the 'sustainability' work on the Edinburgh Harbour development here in Scotland. Behind closed doors any sustainability measures unacceptable to Forth Propeties Ltd (which was most of them) where scoped out from the start. Of course the 'consultation' exercise was designed around this.	Noted
30339	9	6	44	6	45	Furthermore (in the EU at least), much of that data is already collected - e.g. through DEC and EPC registers, consumption data shared between suppliers and government, etc. I'd argue that in a growing number of countries the question is more one of how based to manage and use it to leverage emissions reductions.	Noted
30337	9	6	8	6	8	In case not seen. In the UK we often quote a figure of 70% of the building stock being in use in 2050. Source appears to be work by the Suatainble Development Commission and a report by the Centre for Low Carbon Futures (link http://www.superhomes.org.uk/wp-content/uploads/2012/01/Retrofit_Challenge_2011.pdf)	Noted. "May" in the sentence
30935	9	6	8	6	9	Appears a word is missing in the second half of this sentence, should it read "shifting their energy services [to] electricity…"?	Noted. Text has been changed
22912	9	6	7	6	9	If 80% has been locked in, there is no way to reduce more than 20 %.	Noted. Text has been changed

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22790	9	6	7	6	9	The sentence is hard to understand. More explanation is necessary. If 80% has been locked in, there is no way to reduce more than 20 %.	Noted. Text has been changed
25741	9	7				In the "Carbon efficiency" column of "Key policies", cap & trade is mentioned. But 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. Cap and trade is still a key policy, not deemed to be ineffective in all cases
24706	9	7	11			A few acronyms make this table difficult to understand - RES, CB, CR. Suggest that these are spelt out in full in their first instance in each chapter, as each is likely to be read independently of the whole document.	Accepted
41277	9	7	11			The authors need to enhance contents and clarity as well as to acknowledge the limitations. The current contents don't seem very useful. The text is hard to read because of acronyms and abbreviations. The row labels don't make much sense and information populated doesn't inform the reader. We understand that it's a summary of the chapter, so it has to be comprehensive with sufficient notes to be self-explanatory.	Noted
41278	9	7	11			Row 1 &column 5: Please consider re-wording of "service demand reduction" to "service sufficiency." Row 7&column5: add "cultural impacts" as one of the important barriers (as well as stimuli).	Rejected. These are different concepts
41276	9	7	2	7	2	We suggest to promote the idea and emphasize the need for promulgating and reforming curricula in higher education worldwide.	Rejected. Too specific, maybe policy prescriptive
34804	9	7	3			Detail: add "WG III" before "AR5"	Noted. Text has been changed
33795	9	8	10	8	11	"Nearly zero energy new construction has become the law in 27 MS of the EU"…which law do you mean? Maybe you mean that the EU MS countries sharpen gradually their national laws in order to meet the EPBD requirement that all new construction will have to be NZEB from 2020 (and from 2018 as for public buildings)?	accepted; it is correct to say that "EU MS countries have to meet the EPBD requirement that all new constructions will have to be Near Zero Energy Buildings from 2020 (and from 2018 for public buildings)"
30937	9	8	11	8	12	It is not clear if this sentence refers specifically to the EU, and following from the previous sentence, more broadly or to another specific region. There could be more robust consideration of the two-part question such that the answer more specifically answers recent advances and know-how important from a mitigation perspective.	Rejected. It states region as examples.
33796	9	8	12	8	15	The incremental costs have been …..for new residential buildings…; please check with the 5-16% on the page 20; line 10. The latter might include the incremental costs for renovations.	Accepted
41279	9	8	12	8	15	Please rephrase for clarity.	Noted. Changes made
24707	9	8	16	8	21	Consistency - suggest amend numbers so they are consistent with the numbers in section 9.2.1	Accepted
23480	9	8	18	8	18	125 EJ. Could be typo error of the unit?	Rejected. It is correct: Exajoules.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
41280	9	8	28	9	19	Please rephrase the paragraph for clarity and conclusion(s). The words chosen such as "identity logics, decompositions, identities, components, drivers" should be better defined up front, or more common words such as "metric" should used. Also, giving the equations in the text tends to obfuscate the discussion - maybe put them in a box with side explanation, or can take them out if need room (if they're not original). The four can maybe just be better defined in sentence form in the text (co2 intensity, energy intensity, etc).	Noted. But this discussion and terminology are consistent with Chapter 6, so cannot be changes here only
34808	9	8	29			Detail: add "WG III" before "AR5"	Accepted
26575	9	8	36	9	1	TAKE OUT	Rejected. No reason explaining
41281	9	8	38	9	6	Each term in the equations needs to be clearly explained and defined in a more rigorous and consistent way.	Noted, but there are page constraints
34809	9	8	38			Detail: Please check whether redundant with formula on next page (p.9, l.5)	Noted
29202	9	8	43	8	43	Term FE has not been defined - all the terms in the equation need to be clearly written in.	Accepted
30570	9	8	9			"nearly zero energy new construction has become the 11 law in the 27 member states of the European Union" It is just under preparation, only few of the countries have already ratificated the law. After 2018/2020 it will be obligatory.	Accepted (partially). It is correct to say that it is correct to say that "EU member states are in the process of transposing the EPBD provision of mandatory Near Zero Energy Buildings from 2020 (and from 2018 for public buildings)into national law
22083	9	8	29	9	19	Focus on describing the development of the conceptual framework used to organise the literature and inform the chapter structure. Much of this is irrelevant and could be summarised or cut. Continued use of decomposition equations throughout section 9.2 is not helpful to the reader.	Noted
31605	9	8	43	8	45	No definition of 'FE' explained in the text.	Accepted
31606	9	80	25	80	30	Nguyen et al. 2011a and 2011b are shown the same. Error generated from Reference Manager or Endnote?	Accepted: Reference library update
25336	9	9		16		Building classification in terms of commercial and residential need to be reloooked, as in developing countries especially india, the intermix between commercial-residential may be the actual situation. The cooking energy consideration to be included in building energy may be given a reconsideration.	Rejected. The classification "residential/commercial" is a well accepted methodology. Although in some countries, residential buildings may have a business in the basement, this is not representative of a commercial building. Cooking energy consumption data is very scarce and a trends representation for world countries was not possible
41282	9	9	14	9	23	These equations are important relevant to Figs 9.5 and 9.6, need to clarify why you're breaking down the equations components for later plots.	Noted, but there are page constraints
34810	9	9	14			Detail: delete "these"	Accepted
26576	9	9	16		19	we focus on the four main identities;;;. Take out: to end phrase of l.19	Accepted, rephrased
41283	9	9	22	9	30	The reference given for the citation "(IEA 2012)" (i.e., on page 72 line 16 "IEA (2012). Policies and Measures Database. International Energy Agency, Paris, France.") is not specific enough to easily locate this key reference On the IEA website there are some 159 references that result from a search on "Polices and Measures Database" for 2012. Please be more specific.	Rejected. The website does not have such specific links

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22792	9	9	22	9	26	The sentences appear many times.	Rejected. The authors feel that this information is essential to this subsection development.
30127	9	9	30			I think the reference here should be ETP 2012 not IEA 2012.	Accepted
34513	9	9	25	8	25	change "suppy" to "supply"	Editorial
22084	9	9				There is an overemphasis on assessment of energy demand related to end uses without translating this into carbon (CO2 or CO2e). There needs to be a quantification of GHG emissions associated with energy end uses and construction. The link between energy and GHG emissions is not made.	Accepted. Relation between GHG emissions and energy is added. Moreover, emission figures have been added
19513	9	9	20	16	13	reduce page count by 0.5 (of 18 needed) via text revision (this plus previous comment saves a full 2 pages)	Noted. The chapter has to be reduced.
34509	9	9	21	15	4	Should consider the differences of building operation mode between developing and developed countries. Reference: Jiang Yi(2007). Building energy-saving and life mode. Proceedings of the Seventh Annual Meeting of the Building.(In Chinese)	Noted. Reference in Chinese
34508	9	9	22	9	22	The data "32%" in the first sentence of 9.2.1 is different with the data "34%" in Figure 9.1.	Accepted.
31607	9	9	33	11	2	What are other uses (32%) in Commercial sector?	Accepted
30562	9	9 of 92	6			Must say: "zero" instead low.	Rejected. As stated in the text "Low-carbon" is related to "low-carbon" but also to "zero-carbon" ("renewable sources").

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32527	9	921				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	Accepted small editorial comment. Rejected request to add many additional reference

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32528	9	933		935		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	Accepted small editorial comment. Rejected request to add many additional reference

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32529	9	937				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	Accepted small editorial comment. Rejected request to add many additional reference

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32530	9	939				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	Accepted small editorial comment. Rejected request to add many additional reference

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32531	9	942				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	Accepted small editorial comment. Rejected request to add many additional reference

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32532	9	966		967		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	Accepted small editorial comment. Rejected request to add many additional reference

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32533	9	979				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	Accepted small editorial comment. Rejected request to add many additional reference

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32534	9	985				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	Accepted small editorial comment. Rejected request to add many additional reference

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32535	9	997		998		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	Accepted small editorial comment. Rejected request to add many additional reference
26568	9	ALL				General comment: are all formulas presented in the text useful? Necessary? They often take space without adding anything to the explanation given. LIMIT COMMENTS TO RESULTS throughout the text, it will reduce significantly page numbers….	Rejected. Formulas were condensed in size. They explain the identities
26569	9	ALL				TOO MANY SOURCES in the text: in case of multiple references, take out ALL references previous to, but keeping, 2010.	Rejected. Unclear

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23773	9	general				missing at the outset and throughout the chapter is the causal link between the evolution of global fossil fuel use and building technology, materials, construction and design evolution (Droege, P. 2006. Renewable City. Wiley). there should also be a much clearer statement on the need to understand that fossile fuel combustion and land/water cover changes are primary causes, while building energy aspects are proximate forces. the building as renewable power station' is entirely missed here. see Droege, P. Urban Energy Transition. Elsevier. and Droege. P. 100% Renewable. Routlegde, also: http://www.worldfuturecouncil.org/fileadmin/user_upload/PDF/100__renewable_energy_for_citys-for_web.pdf	Reject. Our mandate does not include active renewable energy features (as that is a supply issue)