

Expert Review Comments on the IPCC WGIII AR5 First Order Draft – Chapter 9

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12576	9					Legend for blue and green bars missing (presumably these refer to the years 2006 & 2009). Also, this figure may be omitted (its objectiveness is not very clear) to meet the page limits of the chapter.	Accepted. Fix legend
2901	9					(Bretzke, 2005) is not in the References section at end of chapter	Accepted. Provide Henry/Katka with reference
2902	9					(Mapp, Nobbe, and Dunbar, 2011) is not in the References section at end of chapter	Accepted. Provide Henry/Katka with reference
3508	9					It is recommended to include various Green Mark Incentive Schemes, which are ongoing, but have been proven successful in upscaling the green building development take-up rate in Singapore so far.	Noted. If there are references, if there's space
2361	9					The page constraint is recognized. One general idea could be to reduce text and move all key content elements to the tables. Focus the text to explain and synthesize the tables. (tricky thing...)	Accepted. Attempt more tables/figures
16257	9					The chapter mentions in the executive summary the importance of assessing the entire lifecycle of buildings, and particularly the important role of material choice for indirect emissions saving (new construction), however, beyond these general statements, it lacks more specific information on the relative relevance of building materials for total emissions (ev. also lack of information thereof) and potential mitigation options (particularly relevant for developing countries that are currently urbanizing).	Accepted. Reduce text and move all key facts in tables
10198	9					EU27: Very good that which measures and measure effects are hypothetical is stated	Noted. No action
15499	9					(Whole chapter) Buildings - Very well documented and complete analysis - Having said that some parts need to be completed	Noted. Not clear what reviewer wants to be completed. However, my understanding is that; after addressing all the concerns by other reviewers then this reviewer's comments would have been addressed.
7788	9					Considering the huge potential through the introduction of energy-efficient appliances/equipments especially in developing countries, Chapter 9 should address more on such potentials through the introduction of highly efficient equipments. For example, Morishita & Ghishi (2010) examined the potential of energy saving in the residential sector of Brazil, through the introduction of energy-efficient household appliances such as refrigerator, air conditioning, and electric shower. According to this study, replacement of incandescent lamps by fluorescent ones corresponds to a 14.5% per year average energy saving. Besides, Boardman (2004) figured out that even in the U.K., introduction of energy-efficient domestic fridges and freezers resulted in a 15% improvement in the energy efficiency in 15 months. (Claudia Morishita, Enedir Ghishi, "Assessment of the impact of energy-efficient household appliances on the electricity consumption in the residential sector of Brazil" Congress paper 244, World Energy Council (2010)) (B. Boardman, "New directions for household energy efficiency: evidence from the UK", Energy Policy, 32, 1923-1933 (2004))	Accepted. A separate section on Appliances and equipment and a summary table have been added. Our decision has been to not discuss specific technologies, but rather, to refer to sources of detailed information.
2193	9					Energy intensities are given in MegaJoules/m ² year in reference (Amstalden et al., 2007). A heating energy intensity of 195 kWh/m ² year (equal to 700 MJ/m ² year) should accordingly be mentioned in Table 9.4 at the corresponding position with a reduction of energy use down to 90 kWh/m ² year (equal to 320 MJ/m ² year).	Noted.
2196	9					MINERGIE-P (instead of MINERGIE-P5) should be written for Reg CH and reference [18].	Rejected. Not applicable now - this level of detail eliminated

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2199	9					The Minergie Standard currently very favourable situation, discussed for page 17 (see comment above), should also be mentioned here (capture of 25% of the Swiss market of new constructions in 2012).	Rejected. Short space allowed
17970	9					Do you think that there are comparable metrics in other chapters that could be compared to or even included in this figure?	Noted. The other sectoral chapters do not discuss analytically the employment impacts as a co-benefit of mitigation actions (there are only simple references). In the literature there are similar metrics at least for RES technologies. However, we think that Chapter 6, where a synthesis of co-benefits will be presented, is the appropriate place for such a discussion. No action
18886	9					As this table holds very much information that will probably be lost to the policy maker, try to consider extracting the essence of this table into figures, e.g. there could be a figure with y-axis "difference to baseline [%]" and another with y-axis "difference to base year". On the x-axis you would have for both a continuous part "delta time [yr]" and one column without time (for before/after data giving no time frame).	Accepted. Consider suggestion
18889	9					Is it possible to convert numbers in this table to LCCE? If so, that would be great!	Rejected. Would lose information
18890	9					Please make a figure from the LCCEs contained in the table.	Rejected. Would lose information
18880	9					Though there was very positive feedback to this figure at the Expert Review Meeting, having this figure is problematic, as in my view it is problematic to single out one or two scenarios.	Noted. Will be considered
18893	9					Given the arguments in line 15-19 I suggest to change (or amend) the figure and have separate ones for the 5 world regions that we are using throughout the report (or for 3: developed, developing, EIT). As the figure is hard to read, please consider adding ranges at the right (like SRREN Figure SPM.9) for each of the six mitigation categories for the year 2050. In the text you could also take this figure as reason to discuss that the decarbonization of the electricity sector is not covered in your chapter, so that if this would take place and would be included the ranges would move downward. Please discuss with Ch.7 where you will centrally discuss this issue so that you can reference it from different points in your chapter as needed.	Noted. Will be considered
18895	9					Please make clearer which studies are sectoral and which IAM - this would probably be interesting to identify possible systematic differences. (I understand that currently there is only on sectoral study.)	Noted. Will be considered
7557	9					This section will be eliminated because other sections can follow.	Rejected. Required FAQs
7558	9					This section will be eliminated or shortened because almost Q&A are contained in the body.	Rejected. Required FAQs
7553	9					This section will be eliminated or shortened especially 9.5.3. (For example, Soot emissions from cooking)	Accepted. Will be shortened
7556	9					This section will be eliminated or shortened especially 9.7.3. (For example, Environmental and health effects)	Noted. Taken into account. The text has been revised considerably and is more focused on buildings sector following the comments of several reviewers.
11698	9					Section 9.1 contains only one subsection 9.1.1. If the summary of AR4 is only showing importance and GHG reduction potential of building sector, it should be unified into section 9.2. Alternatively, it should be outlined the "extensive discussion of the wide range of technical and design measures" of AR4, which is written at the line 22 to 23 of page 15.	Accepted.

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18860	9					consider adding to the first paragraph the questions the chapter tries to answer	Accepted.
18876	9					Sort by size (either blue or green), this will help get more out of the figure.	Noted. Will consider
9104	9					Several statements and expressions should be described more accurately. The energy efficiency standard must be internationally harmonized. When a country's standard or measurement method is different from others, the promotion of efficient appliances will be delayed or can not be made perfectly there. The Japanese Top-runner Program is not MEPS. As the policies for market transformation depend on the status and conditions of the target market, they must be applied very carefully. Too many labels cause the confusion in the market. For example, there are detailed descriptions in the 'Good Practices Handbook for Market Transformation (Asia Pacific Partnership on Clean Development and Climate, 2008).'	Noted. Will consider
3506	9					It is recommended to include in this section a sub-section about building gross floor area incentive scheme.	Noted. Will consider
9105	9					same as above	Noted. Will consider
18854	9					Should it not rather be "in the building sector" rather than "in buildings"?	Editorial.
8855	9					Extremely important section - There is a strong need to expand this section with statements on knowledge gaps and a summary of structured recommendations for future work; while reducing the pages other sections. Let's think about how will AR6 come back and focus in a few years compared with the completed AR5.	Rejected. Strict page allocation, unfortunately
3490	9					It is recommended to add a sub-session (called 9.2.3.3) to discuss about another major driver, which is the rise of household income in developing countries. For more discussion about the driver, please refer to [Cam C.N.W. (2012). Technologies for Climate Change Mitigation: Building Sector. Denmark: UNEP Riso Centre.]	Noted. Urbanization and economic activity
12578	9					Ideas expressed here overlap with 9.2.3.1 - may be combined	Accepted. Avoid overlap
9102	9					There are no descriptions about Japanese frontier activities such as the CO2 zero emission house by the combination of energy-efficient equipments, solar battery, fuel cell co-generation system, Lithium ion rechargeable battery and their linkage by HEMS with efficient house insulations (N.Shibaike and T.Hajima, Concept of a Lifestyle with Net Zero CO2 Emissions, Proceedings of Care Innovation 2010, CARE Electronics, 2010, 1.5.2.).	Rejected. Our decision has been to not discuss specific technologies, but rather, to refer to general sources of detailed information.
9103	9					same as above	Rejected. Same as above (comment no 9102).
2879	9					Add Ft. Polk military base 4000-home retrofit study to the table: Building type & location - 1994-1995 -- 4003 homes on Ft. Polk military base in Louisiana, USA retrofited with package of energy savings measures predominantly based on ground-source heat pumps under a 20-year energy savings performance contract (ESPC) to an energy services company (ESCO); Energy savings - 32.5% reduction in pre-retrofit electrical energy use, 40% reduction in electric peak demand, complete elimination of natural gas usage in base housing (all figures apply to total base housing); Economics - estimated annual energy and system maintenance cost savings to Ft. Polk is \$3.2 million ; References - (Hughes and Shonder, 1998; Shonder and Hughes, 1997a; Shonder and Hughes, 1997b)	Rejected. Old reference - we've generally stuck to post-AR4. Even the case studies already in the FOD have been eliminated, following other comments - now we present only generalized results (but for separate end use categories)
3492	9					If case studies are mentioned, it is more appropriate for a report at the global scale like AR5 to make an attempt to include case studies from all continents or climatic regions, rather than overtly focus on only a few countries.	Noted. If case studies are retained, we've attempted to get what we can from all regions.
12847	9					A prominent example that could be added here is that the Empire State Building is slated to cut energy use by 38% from 2013 on, saving an estimated \$4.4 million a year. Monitoring of the effectiveness of retrofit measures so far indicates that the project is on track to meet its goals. See: http://www.esbnyc.com/documents/sustainability/ESB_2011_Annual_Savings_Report.pdf	Noted.

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18878	9					Maybe it is possible to develop a figure on the findings in this section, either giving % savings compared to BAU or by showing a qualitative cascade (or ranges) of which measures bring which improvements.	Noted. Will be considered
3493	9					This section should include a few additional paragraphs, highlighting the relevant technologies that have the ability to circumvent/mitigate the issues caused by negative behavioural aspects.	Accepted. Regulation for energy saving can tackle it.
7552	9					Eco-point system for housing in Japan has to be mentioned: http://www.env.go.jp/en/wpaper/2011/pdf/22_Chapter4-3.pdf For example, insert the following sentences. The eco-point system for housing is similar to the one for home appliances. The objectives of the eco-point system for housing are to promote global warming countermeasures and revitalize the economy. Under this system, users can receive points for the construction of an "eco-house" or for doing a renovation with energy saving features, and can exchange those points for various products or for additional renovations. As a result of the introduction of this system, energy saving eco-houses are increasingly widespread. Since the system started, the total number of renovations and new construction combined increased from approximately 3,000 in March 2010 to approximately 75,000 in March 2011 (MOE Japan 2011).	Accepted. Consider suggestion by Writing Team. Add 'housing eco-point system' to "Comments" column "Grants and subsidies are economic incentive, in the form of funds transfer" row in Table 9.10.
8852	9					Shorten the section, improve the subsection 9.4.4 on costs by adding some quantified data.	Accepted. 1. Shorten entire section 2. Improve section 9.4.4 3. Include quantitative data
3494	9					This section, "Urban Form and Human Settlement", is too superficial, and indeed needs to rewrite substantially. In this category, land use planning is only one of many important affiliate plans that influence green house gas emissions. Other climate impactful affiliate plans are (1) green and blue network plan, (2) site coverage plan, (3) plot ratio plan, (4) building height plan, (5) amenities distribution plan, etc. It is highly recommended that each of the above affiliate components/plan is deserved to have one dedicated sub-section for sufficient analysis and assessment.	Accepted. To be discussed with Chapter 12 where the substantive section should be
3496	9					In this section, while "heating technologies" were received much attention by the authors, various "cooling technologies", including "district cooling" have not been adequately captured.	Accepted. 1. Provide clarity about the fact that cooling is generally provided by electricity and... 2. Discuss about "district" cooling
3497	9					It is recommended to include in the discussion the principle: plan for expansion, but do not size it. Please refer to [Graham C. I. (2009). High-Performance HVAC. In Whole Building Design Guide. Washington D.C.: National Institute of Building Sciences.]	Rejected.
4578	9					Along with climate change feedbacks in energy consumption for buildings, there is also a potentially strong feedback between renewable energy policy, energy system transformations and building energy consumption. As energy systems are transformed from fossil-fuel-dominance to renewables, there may be advantages to increasing electricity shares in building energy consumption, replacing natural gas or other fossil-based direct combustion. At present, in most areas, however, increasing electricity use in the building sector would result in an increase in CO2 emissions. If buildings are constructed with current energy system parameters in mind, then the lock-in effects make changes to dramatically lower future emissions more difficult.	Rejected. Discussed in 9.4 No need in there.

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8853	9					Very important section. However, results from limited studies cited in this section could present a bias and significant uncertainties in the predictions (e.g., 9.5.1). As a whole, we need more studies here and probably shall state knowledge gap and needs/recommendations for further studies, on global and regional levels. References and findings in section 9.5.2 (geo-engineering) seems to be US centric, shall add more validated outcomes from regional studies in developing worlds, e.g., China, India, Indonesia, etc. An example citation: Tengfang Xu, Jayant Sathaye, Hashem Akbari, Vishal Garg, Surekha Tetali. 2012. 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, February 2012, Pages 1–6. http://dx.doi.org/10.1016/j.buildenv.2011.08.011 .	Noted. Taken into account. We didn't find additional studies on global level but several others on national and regional level confirm the results presented in our text (less heating, more cooling, increased electrification). We included in the text some additional references regarding national/regional studies.
18863	9					Add legend explaining which is 2005 and which 2000. Consider using colour coding for the 5 economic world regions we are using in the report, so that a (possible) clustering can be seen. For the years 2000 could be coloured a bit greyish to distinguish the years.	Rejected. Not relevant to 9.5. It belongs to 9.4
7554	9					There are global activities such as GSEP Coolroof & Pavement WG and has to be mentioned. For example, insert the following sentences. It is estimated that increasing the earth's reflectivity by 10 percent by adopting cool roofs and surfaces in hot climates would have a cooling effect equivalent to reducing greenhouse gas emissions by 44 billion metric tons of carbon dioxide over the 20-year life of the roof (2.2 billion metric tons annually). That is the rough equivalent of either eliminating global anthropogenic emissions for more than a year or taking 1 billion cars off the road for 11 years (GSEP 2012). http://www.cleanenergyministerial.org/our_work/buildings_and_industry/cool_roofs.html	Accepted. Will see how can be addressed.
7555	9					Other related report can be found at a the following site. http://www.miracool.jp/wp-content/uploads/thesis16.pdf	Accepted. Will see how can be addressed.
18883	9					Consider converting numbers in this section into a figure or table	Accepted. Will see how can be addressed.
12582	9					General comment: this section may be shortened (thereby reducing the overall length of the chapter)	Accepted. Has been shortened and re-organized
8854	9					Extremely important section. However, there is a lack of cost per energy saving data with known uncertainties and consistent rigors among the data compiled. Also, while it may help reader understand the role of payback time in common decision-making practices by introducing such concept. I view this rather disturbing in the IPCC report because it is not a good metric/criterion to use, let alone to promote it whether or not it's intentional. For the worth of it, I'd suggest the section to be written surrounding the concept of cost of conserved energy as a way to judge cost effectiveness.... As a whole, we need more studies here and shall state knowledge gap and needs/recommendations for further studies, on global and regional levels, on different time frames. Again, references and findings in section 9.6 seems to be model based, with huge uncertainties not necessarily acknowledged. We shall add more validated outcomes from regional studies in developed and developing worlds, e.g., China, India, Indonesia, Brazil, etc.	Noted. LCCE will be computed wherever possible if not already published. We generally refer to CCE, but also mention payback time when it is short and is given in the cited literature. We agree with the point that payback time is the wrong metric when the payback time is long but the CCE is still less than the cost of energy. We have not been able to find any studies from developing countries giving the incremental cost of efficient new buildings or of retrofits.
18864	9					As the cooling/heating needs in different countries very much depend on the climate, this is besides the stage of development probably one of the main drivers. So I suggest to point this out in the text or even cluster by different climates focus on the other factors.	Rejected. Comment unclear
18885	9					This section has no text, please add to explain table.	Accepted. Editorial

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17969	9					Introductory sentences like the ones in Chapter 10 might be a good idea to prepare the reader for the following discussions: "Besides economic cost aspects, several other aspects have implications on the final deployment of mitigation technologies. Co-benefits, co-costs, risks and uncertainties associated with alternative mitigation technologies as well as public perception thereof can affect investment decisions of companies and priority setting of governments."	Accepted. Text revised.
18865	9					Consider changing this figure in the following manner: In order to see how different the development is throughout the world (and to hint at what might be coming with business-as-usual development) giving all numbers PER CAPITA might be more insightful. To preserve the info contained in the current figure, three stacked bars could be added, one for each building type, stacking the absolute number of the different world regions (colour code should then be for these bars for the world regions). This would allow better comparison between the regions and give the total world numbers, too.	Rejected. This comment is not related to the figure included in Section 9.7
12583	9					Scope of shortening with focus on building related aspects only	Accepted. Text shortened.
3503	9					It is recommended to include a sub-section on the benefits of application of urban green roofs and vertical green towards reduction of urban heat island effect, and biodiversity restoration in urban setting. For details, please refer to [Cam C.N.W. (2012). Technologies for Climate Change Mitigation: Building Sector. Denmark: UNEP Riso Centre.]	Accepted. Text added.
17974	9					This section should rather be moved to section 9.7.2 since it related to an economic effect (i.e. productivity) rather than to health.	Accepted.
17976	9					This section is solely about the rebound effect which is not a technological risk, but an economic response to relative prices changes. It should thus be discussed in the section 9.7.2. Please consider a broader discussion of risks and uncertainties along the classification of risks and uncertainties provided in Section 6.7. Please liaise with the other sector chapter LAs to discuss the process by which a more consistent approach can be reached.	Accepted. Taken into account. The rebound effect is now discussed under 9.7.2. We mention risks associated with mitigation (see 9.7.1) but in the buildings sector risks are less important to co-benefits. So the emphasis should be on co-benefits
18853	9					This section and Section 9.7.5 both have "public perception" in the title - try to clarify the titles so that it becomes clearer which aspects are discussed in which section.	Accepted.
17977	9					This section is institutional aspects that should be discussed in the policy section; but the section does not discuss public perception of mitigation actions in the building sector which seems to be a gap in the current state of the chapter.	Accepted. Taken into account. There are some overlaps between capacity building and policies, here addressed accordingly
17978	9					An recommended usage of the introductory sentence to this section to the other Chapters to refer to the agreement reached in Wellington (p. 36) which might be helpful for readers: "Barriers and opportunities are referred to as conditions that hinder or facilitate the implementation of the analyzed measures."	Accepted. Incorporated
18894	9					"compare a few selected bottom-up and top-down building sector scenarios": Please discuss this e.g. at SIE-3, as singling out few IAM scenarios will probably be problematic.	Noted. Will consider
3093	9					This is quite long and uses a lot of jargon. This should be cut to around 2 pages similar to other sector chapters (e.g. industry & agriculture). For example, the last section (from line 37 on page 6 can be cut - far too much detail on methodology that is unnecessary for an exec summary)	Accepted.

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2908	9					The following references seem to not be cited anywhere in Chapter 9: ACEEE (2010); AEA (2011); Anderson and Leach (2009); APERC (2010); BETMG (2012); BPIE (2011); Cabeza et al (2013); CB (2012); CPI (2011); Dascalaki and Santamouris (2002); DECC (2011); Dili et al (2010); DPMT (2009); ECEE (2011); Enlighten (2010); EPC (2008); EU (2002); FI (2005); GMCF (2009); Gov't of Latvia (2011); Gov't of Slovakia (2011b); Gov't of Finland (2011a); Gov't of Ireland (2011); Jarvey (2008); Hayes et al (2011); Healy (2004); Holmgren (2006); IEA (2003); Kahn (2008); Kazuari (2007); Knigge and Gorlach (2005); LDA (2011); Li and Colombier (2011); Luttmer (2006); MacKellar et al (1995); MIKR (2011); Missaoui and Mourtada (2010); MLIT (2010b); Montanya et al (2009); Pavan (2008); Price et al (2011); Schneiders et al (2009); Togeby et al (2009); Uitdenbogerd et al (2009); UK DE (2011); UNEP Risoe (2012); UNHSP (2009); Urge-Vorsatz and Tirado Herrero (2012); Van Wie McGrory et al (2006); Wiel and McMahon (2005).	Accepted. Find these references
2854	9	0				In many places (example - Executive Summary, pg 1, line 1) there are comments like [high agreement, robust evidence] or similar. Why are these needed? I suggest deleting and several lines of text could be eliminated.	Rejected. Mandatory inclusion
8974	9	0				There few sections that the titles do not reflect the contents. E.g. 9.3.3.3, 9.6.3.2, and 9.7.4. Though this review shall not make any comment on the language, some sections are not easy to understand due to the structures of the sentences	Accepted. Problems fixed
12339	9	0				General comment: This chapter should also deal with the cooling agents used in air-conditioning equipment, heat-pumps and commercial refrigeration. Rationale: The use of cooling equipment in buildings is increasing and choices with regard to the the phasing out of existing agents (CFCs, HCFCs and HFCs) and the alternatives (HFCs, natural agents, natural cooling) will have significant implications on total CO ₂ -equivalent emissions from the sector. The IPCC special report "Safeguarding the Ozone Layer and the Global Climate System - Issues Related to Hydrofluorcarbons and Perfluorcarbons" (Chapter 4 and 5), as well as more recent publications, might serve as a basis for this coverage.	Accepted.
16948	9	0				I regret I have not had time to review the Sectoral chapters in depth. It may be interesting to illuminate the hypothesis that the Buildings sector is the most heavily dependent upon "First Domain" characteristic, and in particular to liaise with FOD Chapter 2 on how they relate to "System 1" decision-making systems laid out there. This is the broad suggestion laid out in the structure-setting Chapter 3 of Grubb, Hourcade and Neuhoff, Planetary Economics: the Three Domains of Sustainable Energy Development, Taylor & Francis forthcoming (Chapters 1 – 5 submitted, others in draft available on request). See also Chapters 4 and 5 on the theory and evidence respectively around energy efficiency policies. The authors also really need to liaise with Chapter 3 discussion of cost curves to try and bring some consistency to the IPCC report.	Accepted. 1. Liaise with Chapters 2 & 3; 2. Check cost curves
2186	9	0				Chapter 9 gives an excellent overview of the current GHG emission trends and mitigation options of the building sector for the upcoming decades. It outlines the potential of state-of-the-art green building technologies with a focus on the contribution and opportunities offered by building refurbishments. The chapter is written using a clear style and includes enough scientific references to convince most readers about the importance of the building sector for the mitigation of climate change. However repetitions can be observed in many sections of Chapter 9 and could simply be avoided by a further text polishing in order to reduce the pages number down to 40 pages (instead of 56 pages).	Accepted. Repetitions will be dealt with.

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15678	9	0				Chapter 9 is party difficult to read, because not all sections and subsections are at the same "level". With that, I mean that some sections with rather relevant information are put in subsections, whether less relevant information or additional examples are put in sections. In my comments, I now and then tried to rearrange some sections and subsections in such a way that it became more understandable to me. But it's of course just my opinion.	Accepted. Re-structure the chapter; albeit within the constraints of the headings provided by IPCC; which we have very little room to manoeuvre.
18769	9	0				Please consider discussing planned obsolescence in context of sustainability or reference Ch.10 where this might be centrally discussed.	Noted. Covered indirectly. Will be done directly if a reference is found
18972	9	0				General Comment: Storyline and strategies. The chapter is already in a good state, but please try to focus it more on answering: What are the different sectoral options/pathways to reduce emissions? What is their potential? What do they cost? What are the policy instruments that can facilitate this? And what are the trade-offs? Further, better carve out the barriers that hinder potentials being realized. For this consider shortening 9.1 through 9.6, particularly 9.3, (see comment on redundancies) and reorganizing 9.7 through 9.10. Try to introduce pros and cons of different options and trade-offs between them (e.g. NZEB, Passive House). Ensure that the approach you take on this is compatible with the other sectoral chapters to enable comparison and possible synthesis.	Accepted. 1. Story lines and strategies to be strengthened; 2. Re-organized 9.3 & 9.6; 3. Shorten section 9.1 and 9.2; 4. Reorganise sections 9.7-9.10
18973	9	0				General Comment: Kaya identity. The Kaya identity is already well used in structuring the chapter. There are some section, though, that would be good to also use this approach, e.g. the policy section, where for different policies it could be described to which Kaya component (and how much) they could contribute to. Also, it would be very good if now the quantitative side of the Kaya approach could be taken on – if sufficient data exists.	Accepted. Include quantitative side of Kaya identity
18974	9	0				General Comment: Trends and drivers. Try to introduce forecasts/scenarios about expected increase of floor space, change of number/types of buildings, etc. and provide (e.g. back-of-the-envelope calculation) numbers incl. consequences (e.g. contributions to Kaya components).	Accepted. Introduce forecasts/scenarios about expected increase in floor space, ...
18975	9	0				General Comment: Redundancies. There are overlaps and redundancies between Sections 9.3, 9.6 and 9.9, especially concerning mitigation options. Technologies could be presented more briefly.	Accepted. Eliminated redundancies between 9.3, 9.6 and 9.9
18976	9	0				General Comment: For all sectoral chapters there must be more clarity about what is covered in 9.6 and what in 9.9. The coming meetings should work on this.	Accepted. Streamlined
18977	9	0				General Comment: Unified metrics. Unifying metrics would allow further comparison and synthesis. Sections 9.3.3 and 9.3.4 are very detailed and should be synthesized, e.g. – if possible – by unified metrics and by giving ranges. Please also try to be transparent about and possibly standardize discount rates and economic payback time.	Accepted. Section 9.3 completely rewritten with these comments in mind
18978	9	0				General Comment: Interlinkage. Improve the (explicit) linkage to Chapter 12.	Accepted.
18979	9	0				General Comment: Key message. Have a more prominent discussion of the danger of lock-in including quantification if possible [Section 9.4.5]	Accepted.
18980	9	0				The chapter is still over its page limit. I suggest to particularly shorten Section 9.3	Accepted. Shorten section 9.3
18981	9	0				Try to include more bottom-up studies in the transformation pathways section.	Noted. Within strict page limit
18982	9	0				When evaluation policies, more attention needs to be given to multi-level governance	Noted. Where specific to building sector
3648	9	0	0			Overuse of abbreviations. Please reduce.	Accepted. Check all abbreviations
7703	9	1			86	I appreciate that much of the literature in this field is in the grey literature, including government reports. Just relying on the white literature greatly reduces the strength of the conclusions that can be reached. Personally, I have no problem reporting grey literature. But one should be very circumspect about drawing broad conclusions about how much mitigation can be achieved at what cost from that grey literature. I would suggest backing off on the conclusions so that only those that are clearly supported appear.	Noted. Will consider

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9215	9	1	1	1	1	Some contents of Executive Summary are not in the body text. So corresponding descriptions are necessary in the body text. Especially, since efficient improvement of energy consumption appliances are essential for CO2 reduction, latest information of technologies should be introduced in the body text.	Noted. It is better that Executive summary and body text have the same structure. Usually readers expect the summary summarizes the body text. Therefore, it is favorable to conform the contents of body text to the summary, especially the part of mitigation option.
4584	9	10				(Labeled as "Table 10.1") It seems that PE demand would also be an important metric, since carbon emissions will depend on that.	Noted. Will consider
9545	9	10	7	10	10	Please, replace text with the following; residential electricity consumption has been growing at an average of 3.4% globally between 1990 and 2006. It is mainly consumed in cooking, water heating, space heating, space cooling, lighting, and the use of appliances and electronic equipment. The share of electricity in each end-use category varies among countries depending on country circumstances, particularly climatic conditions and economic development level. (Energy efficiency policy and carbon pricing, 2011, IEA, p17). Energy consumption in the buildings sector is reduced by around one-third of the Baseline scenario level in 2050 (Technology roadmap Energy-efficient Building, 2011, IEA, p6). Energy savings in residential space heating account for around a quarter of the savings. (ETP 2010, IEA, P223)	Noted. Grey literature? These details have been removed in FOD for saving space. Not the place for energy savings.
3110	9	11				surely there are some more up to date figures than 2005?	Accepted. Seek for recent data; It refers to Table 9.2 and figure 9.5
2866	9	11	14	11	14	change ". . .keeping the same or having better living standards imply increasing demand. . ." to ". . .constant or improved living standards imply increased demand. . ."	Accepted. Should change statement as suggested.
6619	9	11	15			Remove the reference to energy service from this section, which deals with the scale of buildings	Accepted. Kaya identity should be used and then services can be examined accordingly.
2865	9	11	8	11	8	change ". . .metrics of scale. . ." to ". . .metrics for scale. . ."	Accepted. Should change statement as suggested.
4583	9	11				"Number of residential units" does not necessarily seem to be a good metric, since houses can also increase in size dramatically over time, e.g. In the US	Rejected. No such data available for all regions
15212	9	11	12	11	13	In this part the data are behind the times, and in order to calculate the growth rate, the data source should be unified.	Accepted. Check
4582	9	12				Cannot distinguish light blue and white in legend	Accepted. Legend should be improved
4581	9	12				Would be useful to have a longer term view, not just 2000-2005. For example, throughout the 20th century	Rejected. Data available provided
2886	9	12	13	12	13	(IEA, 2010b) is not in the References section at end of chapter	Accepted.
6621	9	12	15		17	The last sentence of the paragraph reads obvious and unessential	Accepted.
18862	9	12	4			unit for 2.9 missing	Accepted. Provide units
2867	9	12	5	12	5	change ". . .space and hours of air conditioning is an important driver. . ." to ". . .conditioned space and hours of air conditioning are important drivers. . ."	Accepted. Consider making changes as suggested by reviewers
6620	9	12	5		6	Remove the whole sentence, which deals with energy service but not with the scale of buildings	Accepted. Kaya identity should be used and then services can be examined accordingly.
2868	9	12	7	12	7	change ". . .building's. . ." to ". . .building. . ."	Accepted. Should change word as suggested.
16888	9	13				It would be very interesting to see this broken out by climate zone as well.	Noted. If data is available

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
18866	9	13	10			"new types of energy services": Please define or give examples.	Accepted. Provide examples of energy services
4988	9	13	3	13	4	Sentence: Energy intensity for residential buildingsas shown in figure 9.6. Is it for residential buildings or for all buildings as in title of figure 9.6	Accepted. Delete the word residential
13518	9	13	3	13	4	Sentence: Energy intensity for residential buildingsas shown in figure 9.6. Is it for residential buildings or for all buildings as in title of figure 9.6	Accepted. Delete the word residential
3095	9	13				No mention here of climate - it's the key reason why Iceland and Canada are right at the top (high heating requirements), whereas other countries at similar levels of development like France and the UK are lower down (lower heating requirements and also limited air con needs)	Accepted. Include a line about the climate influence, but without missing the point of the influence of the level of development.
11699	9	13	1	13	7	The description is required that the difference of energy consumption among countries come from not only the difference in economy but also the difference in climate.	Accepted. Include a line about the climate influence, but without missing the point of the influence of the level of development.
15215	9	13	6	13	7	In this figure the data of Korea is wrong, see sheet 'figure modified'	Noted. OK but couldn't find the sheet
2870	9	14	12	14	12	change "... projected to..." to "... will..."	Editorial.
18868	9	14	13			"... population": add until/by when	Editorial.
2871	9	14	14	14	15	change "... despite the fact that the rural population is still larger with as high values as..." to "... up to..."	Accepted. Should state as suggested.
18869	9	14	15			"... for the US": give reasons, e.g. higher living standards in cities	Accepted. Should state as suggested.
2872	9	14	16	14	16	change "... use until..." to "... by..."	Accepted. Should state as suggested.
2869	9	14	2	14	4	reword first sentence on page 14 as follows -- Increased size and daily usage hours leads to increased energy consumption and building emissions (Zhou et al., 2008; Zhang, Jiang, et al., 2010).	Rejected.
18870	9	14	20			"since 2007": Please give range instead to be clear when study took place.	Accepted. Include 2007-2008 as range
2887	9	14	21	14	21	(ABC, 2008) is not in the References section at end of chapter	Editorial.
6623	9	14	26		27	Without more detail, this sentence is quite uninformative. Either develop it or delete it.	Accepted. Develop sentence as suggested by Writing Team. Could be developed by adding that, by 2050, 82% of population would be middle class
2873	9	14	27	14	27	delete the phrase "than in the other income groups"	Accepted. Delete the phrase
6624	9	14	30		31	The first two sentences of section 9.2.3.2 are not clear	Accepted. Delete phrase as suggested by Writing Team. DELETE "Such totals do not show, however, huge inequalities."
6625	9	14	33		35	This sentence reads unessential	Rejected. None. It's one of our key messages
2888	9	14	37	14	43	(WBSCD, 2006) is not in the References section at end of chapter	Editorial.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7492	9	14	38	14	43	“Providing energy to the more than 1 billion people without access to electricity (Pachauri 2012), as well as to the 2.7 billion people, nearly 40% of humanity (Hailu 2012), who do not have clean cooking facilities is one of the world’s most critical development challenges. The ways these energy services are provided will significantly determine building-related emissions, since energy sources and technologies vary greatly between regions (WBCSD 2006)”. Most rural people have access to kerosene and urban people to coal, kerosene LPG/natural gas. They also have access to electricity. For rural people it is availability and cost that are the important factors and for urban people it is the cost of the various fuel type. Electricity is an expensive cooking fuel and in many cases the supply is unreliable. Simple initiatives can provide ‘clean cooking facilities’. They include: better ventilation if cooking indoors: dryer biomass fuel: in improved and more efficient stoves (with chimney for indoor cooking); and better kitchen practices etc. Using unprocessed biomass and charcoal are important household fuels as Figure 9.8 indicates. They will be around for many decades so these households should be helped. I should add, that wood etc. are important fuels in the service sector in developing countries – about 10% of household energy use. This is not shown in Figure 9.8.	Rejected. Too much detail, not enough space. Biomass in services sector is actually reflected in Fig. 9.8
2889	9	14	39	14	39	(Pachauri, 2012) is not in the References section at end of chapter	Accepted.
2874	9	14	39	14	40	delete the phrase ", nearly 40% of humanity (Hailu 2012)" -- Hailu 2012 is not in the References Section at end of the chapter	Accepted.
6626	9	14	39			I couldn't find Pachauri 2012 in the reference list	Accepted.
9427	9	14	4	14	8	<ul style="list-style-type: none"> · Addition is needed as shown below. · To avoid misunderstanding, following description is necessary. (following the passage of “By 2050, emissions from the building sector, including those associated with electricity use, will nearly double from 8.1 Gt to 15.2 Gt CO2 according IEA Energy technology Perspective reference scenario (IEA, 2010). ”) Currently, both space heating and cooling as well as hot water are estimated to account for roughly half of global energy consumption in buildings. Most of CO2 emissions from space heating and water heating are caused by combustion of fossil fuels and also the demand for cooling is rapidly increasing in developing countries (IEA Technology Roadmap, 2011 and IEA-ETSAP and IRENA Technology Policy Brief E19, 2012). · Refer to the following documents. <p>①IEA Technology Roadmap Energy-efficient Buildings: Heating and Cooling Equipment ②IEA-ETSAP and IRENA © Technology Policy Brief E19 – March 2012 - www.etsap.org - www.irena.org</p>	Rejected. Don't think this explanation is really necessary taking into account our space limit.
2890	9	14	40	14	40	(Hailu, 2012) is not in the References section at end of chapter	Accepted.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
3649	9	14	43	14	43	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 10.1007/s11027-011-9343-5.	Noted. Too much detail for an example of a single country (although a significant one) given our space restriction. I could try to get the main idea in one sentence Provide a short sentence to summarise the whole idea
18867	9	14	5			Grammar/orthography: "are expected to" instead of "willcould"	Accepted. Check and deal with grammar
18872	9	14	6			"reference scenario": I suggest to state that "reference" means "BAU" as this might not be clear otherwise to everyone - but maybe "reference" is also well enough established.	Accepted. Clarify use of "reference scenario" or BAU
2189	9	14	9	14	28	Urbanization can lead to more efficient and sustainable construction forms than rural areas, in particular in regard to transportation: this should be mentioned. See reference Dujardin S. et al, Home-to-work commuting, urban form and potential energy savings: a local scale approach to regional statistics, Transportation Research part A: Policy and Practice, 46(7), pp. 1054-1065, 2012.	Rejected. For Chapter 12.
3096	9	14				I presume an important issue here is that urbanization tends to be accompanied by higher energy service requirements (e.g. air con, appliances) as people's incomes tend to be higher in urban than in rural areas?	Accepted. Review text
8975	9	14	22	14	24	Suggest to use the same basis of growth rate for Japan (e.g. m2 per year). That would be clearer and fair for comparisons.	Rejected. Unclear
6622	9	14				This discussion does not provide an intuitive understanding of the issue of urbanization. On the one hand it seems like it increases energy consumption, but on the other hand it is stated later in the text (section 9.4.1) that compact urban forms can lower energy consumption. The two effects should be very briefly commented on	Noted. They are complementary perspectives of urbanization. 9.2 is about drivers and trends, and urbanization as a driver of energy use, while 9.4 compares urban forms and their impacts on energy. (what does "intuitive understanding" mean?)
7029	9	14 of 86	8	14 of 86	8	Add "and so, it'd be worthy to transfer them modern technologies and technologies for renewable energy sources in order to reduce those emissions".	Rejected. Don't think this is the place to such statement
7030	9	14 of 86	18	14 of 86	18	Substitute "industrialized" for "developed", after "with 1% in", around the middle of the line.	Accepted. For consistency replace "industrialised" with "developed"
2358	9	15				Good figure, examine whether a "post abatement view" of the right hand side column (energy by usage type) is possible, will give an indication how much you can reduce each usage bucket	Accepted. Include iconic graph
6627	9	15				Figure is very hard to read	Accepted. enlarge figure
2875	9	15	10	15	10	change ". . . buildings (Jennings et al., 2011). In OECD countries, the rate of new construction is low. Annual new. . ." to ". . . new buildings (Jennings et al., 2011). In OECD countries, annual new. . ."	Rejected. Not agree
18871	9	15	12			"0.6% - 16%": Please check whether that wide range is actually correct.	Accepted. Check correctness of range
2876	9	15	13	15	14	delete the sentence "Retrofit of existing buildings is an important strategy for developed stocks."	Accepted. Delete sentence s requested

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2877	9	15	15	15	16	change "...the 1990s. In China, for example, more than 90% of buildings have been built since 1996." to "...the 1990s - more than 90% in China."	Accepted. Change as suggested
12577	9	15	17		19	difference between 'buildings' and 'accommodation' is not clear	Accepted. Change as suggested
4580	9	15	17	15	19	Comment seems to be misplaced here - out of context	Accepted. Change as suggested
2891	9	15	5	15	5	(IEA ETP 2012 data) is not in the References section at end of chapter	Accepted.
11711	9	15	20	24	3	Compared to corresponding part of chapter 8 and 10, it is strange that there is no description on technology inventories. At least, it should be included in the table of technologies. "Regional specificities" in building sector means not only economic development but also difference in climate. There are different kind of applicable technologies between cold region that require insulation and energy cascading and hot region that require cooling and shading. This point should be emphasized.	Noted. Our decision has been to not discuss specific technologies, but rather, to refer to sources of detailed information
6628	9	15			16	This section is too long. First, it is redundant (at least in its intention) with section 9.1.1. Second, even though the subsequent section states that there has not been any major technological developments since the AR4, the key points of the AR4 don't need to be described again with so much detail.	Rejected. The summary of AR4 is short compared to the material it summarizes, and all the points made here need to be made.
3491	9	15 of 86	15		16	Please provide reference or source for the claim of "more than 90% of buildings have been built since 1996".	Accepted.
7031	9	15 of 86	7	15 of 86	7	Substitute "industrialized" for "developed" before "and developing", at the last part of the line.	Accepted. Substitute "industrialized" with "developed"
12579	9	16			17	Another subsection under 9.3 may be introduced to address the building embodied energy (EEn) issue (reference material will be e-mailed). Since urban India will undergo huge additional residential floor space in the coming years and EEn of these multistoried apartments are in the range of 10-12 GJ/Sq m, the cumulative EEn can no longer be ignored.	Rejected. We already have a subsection on LCA, which involves embodied energy.
2892	9	16	13	16	13	(Lewis, 2004) is not in the References section at end of chapter	Accepted. To be done
2190	9	16	21	16	22	Item (ii) should also include "appropriate window shadings"	Rejected. Our decision has been to not discuss specific technologies, but rather, to refer to sources of detailed information. No action
7723	9	16	34	16	48	Rigid polyurethane foam is one of the most efficient insulation materials for buildings. HFC(Hydro FluoroCarbon) is essential as the blowing agents for rigid polyurethane foam. The existing HFC is zero ODP, but rather higher GWP. Recently several fluorocarbon producers announced zero ODP and very low GWP HFO(Hydro Fluoro Olefin) as the blowing agents for rigid polyurethane foam. In a few years, HFO blown rigid polyurethane foam is expected to be used for the excellent building insulation materials in the world. (TEAP Report-Decision XXIII/9 Task Force, 2012, page 57-67 ; TEAP Rigid and Flexible Foam Report. 2011 May. page 43-44)	Noted. We've added a section on F-gases, which includes a reference to foam insulation.
15681	9	16	35	16	35	This section is called "Significant technological developments ..." and starts with the sentence "There have been no major technological developments ...". Maybe renaming the section in "Currently planned developments" or something like that? Maybe also rephrasing the first sentence, because it is interesting to know what happened in the last few years and not what has not happened. Other suggestion: put subsections 9.3.2 and 9.3.3 together, because 9.3.2 is something like an introduction to the examples discussed in 9.3.3.	Accepted. Re-written
11700	9	16	35			Is it really true that "There have been no major technological developments since AR4"? ICT technology (written in 9.3.6), progress in inverter technology, LED, distributed generation and efficiency improvements in appliances might have huge impact on global warming mitigation in this sector.	Accepted. Re-written

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7698	9	16	5	16	5	Harvey is grey literature -- conference proceedings. Shouldn't be used for what appears to be a very substantive conclusion.	Rejected. The cited reference is in a book published by the American Institute of Physics. This is a point demonstrated later by the case studies - so will refer to these or the synthesis that will replace them
6629	9	16				I would remove the word 'significant' from the title of the section	Accepted. Re-written
6630	9	16				The first sentence of this section comes at odds with the statement made on page 4, lines 13-15. A discussion about how the 2 ideas articulate would be welcome	Accepted. Re-written
4730	9	16	35	16	35	After AR4, residential fuel cell have been on the market and getting diffuse. Some technologies using ICT such as demand response using smart meter are new developments. Since 9.3.6 Energy Management System and Control and 9.4.3.1 introduces demand-response, the expression "There have been no major technological development..." seems to be inadequate.	Accepted. Re-written
3097	9	17				please clarify in each case whether these are residential or non-residential buildings. Most of these examples/sources are now quite a few years old - can't you find some more up-to-date examples? E.g. in the UK this office building (http://www.passivhaus.org.uk/page.jsp?id=96) has an energy demand of 103 kWh/m2 and CO2 reductions of 80%	Accepted. References to specific case studies have been deleted.
11701	9	17				These examples (Germany, US, UK) are only in relatively cold climate. Examples in temperate or tropical region should be added in this table and description in 9.3.3.1.	Accepted. Section re-written, with a better cold:hot balance.
2191	9	17	13	17	25	The list of Building Standards given here should absolutely include the Swiss "Minergie" Standard created in 1996, which comprises more than 20'000 buildings and has captured 25% of the Swiss market of new constructions in 2012. This standard is described in details at http://www.minergie.ch . It is probably the first worldwide "Green Building" label, already created in the 90's, promoting heating intensities lower than 38 kWh/m2 year. The "Minergie" Standard has been regularly updated over the years (as Minergie-P, Minergie-ECO and recently Minergie-A), the last update corresponding to a Net-Zero Energy Building Standard with a heating intensity of 0 kWh/m2 year.	Rejected. We mention only one standard, Passive House, because it is the most strict. NZEBs are discussed separately.
18874	9	17	14			"new residential buildings" - suggest to change to "new standard [or: average] residential buildings"	Noted. No longer applicable due to re-write/
6631	9	17	3			I couldn't find a working paper version of Harvey 2013 on the internet	Noted. We did not say that it was on the internet. What is now Harvey (2013) will be published in ARER
18873	9	17	7	17	8	"recently completed": Are these BAU references?	Noted. No longer applicable due to re-write.
6632	9	17		18		It seems like sections 9.3.3.1, 9.3.3.2 and 9.3.3.3 deal with the same object but differ by the methodology reviewed. Rather, these subsections could be combined in one, and a foreword could be introduced at the beginning of section 9.3.3 to say that there are different methodologies available. Note that the discussion in current section 9.3.3.3 can be removed, since it is inconclusive	Noted. Section 9.3 has been completely re-written.
15679	9	17	1			It's unclear to me how this section is build up. It's called "Exemplary New Buildings", but only gives examples of new buildings in subsections 9.3.3.1 and 9.3.3.4 (Passivhaus and NZEBs, resp.). For me, it would be better understandable to give the subsections the names of the new buildings and put subsections 9.3.3.2 and 9.3.3.3 together as measures to evaluate new buildings at the end of this section.	Noted. No longer applicable due to re-write.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9428	9	17				<ul style="list-style-type: none"> · Addition is needed for the description of Japanese cases. · This is because little reference has been made to Japanese cases in the sections cited above. · Refer to the following documents. <p>A district heating and cooling system (DHC) is expected to be a promising energy-saving measure for high-density business areas in Japan. However, it has not been verified what advantages of the DHC are important for energy conservation. The clarification of this issue is supposed to contribute to improving the energy efficiency of the DHC.</p> <p>This paper focuses on the electric-driven heat-pump-type DHC, which uses only electricity as its energy source. An existing DHC plant has been selected for the case study, and its energy efficiency is examined by a simulation model that uses parameters derived from the measurement data. The simulation results for the plant reveal that the DHC exhibits an energy-saving effect of 29% for cooling when compared with the individual heat source system mainly due to the following two advantages: "economy of scale in chillers/heat pumps" and "thermal storage effect". Further, the energy-saving ratio for heating is only 5% since heat recovery chiller cannot be operated sufficiently due to the lack of cooling demand during winter.</p> <p>Verification of the energy-saving effect of the district heating and cooling system—Simulation of an electric-driven heat pump system</p> <p>Energy and Buildings, Volume 40, Issue 5, 2008, Pages 732-741 Tomoji Nagota, Yoshiyuki Shimoda, Minoru Mizuno</p>	Rejected. Our decision has been to not discuss specific technologies, but more might be said about district cooling systems in 9.4. No action
6633	9	18	15			can be easily achieved' is vague. One wonders: 'at what cost?'	Rejected. Cost is not given in this case.
2192	9	18	23	19	14	Countries dominated by heating loads admit also another definition of Net-Zero Energy Buildings and Energy-Plus Buildings. In these cases, the heat generated on an annual basis by the solar thermal collectors installed on the building roof is equal (or resp. larger) than the building heat demand for space heating and domestic hot water; sensible heat storage are used to retrieve the solar heat produced during summertime in the winter season. Several realizations of this kind are described each year by the Solar Energy Agency at http://www.solaragentur.ch/	Noted. This is not inconsistent with our definition. No space for elaboration
6635	9	18	34		38	One issue mentioned in the executive summary is the absence of evidence about how a large-scale implementation of low-energy buildings can occur (page 4, line 28). How does this general idea articulate with the more precise points made here?	Rejected. The discussion here is about NZEB's, not LE buildings, and the very next sentence raises the Q of feasibility.
6636	9	18	41			the 'effective', or 'realized' reduction	Rejected. Unclear
3099	9	18	42			not sure it's true to say that net zero energy is easiest in buildings with a large roof area. Biomass CHP linked to district/communal heating is an easy and probably cheaper option - very common in Austria.	Rejected. These are not NZEBs as we have defined them.
3102	9	18				rather than making this a subsection, this could be integrated into 9.3.6 (which is about control)	Noted. Will consider
8976	9	18	18	18	22	The title does not reflect the contents. Furthermore, 'post-occupancy evaluation' should include objective and subjective based assessments, which based on calculation and also surveys.	Rejected. Yes it does.
6634	9	18		19		This section is too long	Noted. Section 9.3 has been completely re-written.
12637	9	18		18		In Japan, a demonstration house "Life Cycle Carbon Minus House" was built within Building Research Institute on the initiative of MLIT. (http://www.kenken.go.jp/japanese/contents/lccm/kengaku.html)	Rejected. We have avoided specific case study examples here

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11702	9	18	23			Is there significant potential at wind turbine in building sector? In contrast, solar water heater should be emphasized.	Noted. Probably not cost-effectively. We can refer to a couple of recent papers (not sure if they cover costs)
8977	9	18	38	18	41	This statement is unclear to me. Moreover, renewable energy could be part of the 'energy saving measures', unless the author is referring to 'energy efficiency measures'?	Accepted. Clarify
3100	9	19				again, these sources examples are mostly more than 5 years old. Surely, there are more up to date examples?	Rejected. Not found such examples
11704	9	19				As same as table 9.3, there is only the case in the cold region.	Rejected. Not found such examples
6637	9	19	19		21	Do these expectations take into account post-retrofit behavioral adjustment?	Noted. Will check
2878	9	19	3	19	3	change ". . .heat pumps, than. . ." to ". . .heat pumps, then. . ."	Editorial. No longer applicable due to re-write
9622	9	19	3	19	7	Please, mention heat pumps are useful for space heating as well as cooling. In addition, air source heat pumps reach 6.7 of COP with the average cooling and heating efficiency of household air conditioners, and reach 7.0 of COP with centrifugal chillers for commercial and industrial uses. 1)Masanobu Sasaki(2011), Policy Trend of Heat Pump In Japan 2)ETSAP TECHDS Energy Technology Briefs http://iea-etsap.org/web/Highlights%20PDF/E19_HL_HeatPump_HN_March2012_Final_GSOK.pdf	Rejected. We do not have a general discussion of heat pumps, but only mention them in one specific context. Anything more would not fit in.
9429	9	19	3	19	8	· Addition is needed as shown below. · For better explanation, add the description following the phrase '...the heat pump electricity use.' According to IEA, CO2 emissions reductions in space heating/cooling and water heating by 2050 will be projected at 2 Gt. Of this amount, reductions by electrical heat pumps are assumed to be 1.25 Gt (63% of the total in space heating/cooling and water heating). As for reductions in other technologies, solar thermal systems will account for 0.58 Gt (29% of the total) and cogeneration for 0.16 Gt (8% of the total) (IEA Technology Roadmap, 2011). Figure7 is good example. · Refer to the following documents . ①IEA Technology Roadmap Energy-efficient Buildings: Heating and Cooling Equipment ②IEA-ETSAP and IRENA © Technology Policy Brief E19 – March 2012 - www.etsap.org - www.irena.org	Rejected. Does not fit into the context here
18875	9	19	3			Grammar: "then" instead of "than"	Accepted. Fixed
11703	9	19	5	19	6	Concrete numerical value ("COP of up to 5") is not significant since COP is affected by climate and the category of heat pump.	Noted. It is an example of what can be done in a relatively cold country, however.
8978	9	19	3	19	7	Not sure if the author means reducing the peak heating load,s hence smaller size of heat pumps and so smaller kW of PV is needed? If it is then 1) there is no connection or discussion on how ZEB reduce the peak heating loads; 2) the size of PV array could be misunderstood as the physical size. Suggest: reduce the power needed from PV system; 3) besides pumps, in fact the efficiency of all the auxiliary items bring effect on the total electricity/ energy use.	Rejected. Both physical size and required power output are reduced. We need to keep the text short.
8979	9	19	8	19	10	Should be the energy efficiency measures reduce the demand but not the PV	Rejected. The sentence refers to NET demand
12635	9	19				Reduction effect by retrofitting building insulation is diverse by region. In general, reduction potential depends on the Degree-Day or so on. Cases in other regions should be described.	Rejected. The table shows what has been done in regions

Expert Review Comments on the IPCC WGIII AR5 First Order Draft – Chapter 9

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7699	9	19	16	20	11	30 year payback is hardly economic. These conclusions should be tempered and only white lit cited.	Rejected. We don't call them such, but in fact if payback time < measure lifespan, it is economic in the sense of being negative cost. 3 out of 6 sources are from journals, but the rest I still consider to be reliable.
8980	9	19	20	19	21	What is the definition of 'primary energy use' here? Usually it refers to energy before any conversion, whereby electricity is not part of it but after the primary energy converted into electricity.	Rejected. Standard definition applied
12580	9	20				List may be augmented through more reference material (reviewer may mail some case studies of tourist buildings of India)	Noted. Not applicable now, as case studies have been cut.
6639	9	20		21		too much detail here	Accepted. Consider suggestion by Writing Team
9430	9	20				<ul style="list-style-type: none"> · Addition is needed for the description of a case where absorption chiller was replaced with heat pump chiller or centrifugal chiller. · As Fig. 9.8 in the text shows, one half of the CO2 generated in buildings comes from space heating/cooling and from water heating; it is therefore important to take measures to deal with the space heating/cooling and water heating. Specifically, in addition to the enhanced thermal insulation of buildings (load reduction) proposed in the text, introduction of high-efficiency space heating/cooling and water heating using heat pumps are important as measures taken on the demand side. Use of solar heat and CHP has less effect in reducing CO2. · Refer to the following documents . <ul style="list-style-type: none"> · Kanto Bureau of Economy, Trade and Industry of the Ministry of Economy, Trade and Industry cites a case of energy-saving attempt in hospitals where oil-burning absorption water cooler/heaters of air conditioners were replaced with electric heat pump chillers, and oil-burning boilers of water heaters were replaced with EcoCute devices, thereby reducing the energy consumption by 18%, from 550 kl/year to 452 kl/year [1]. The Bureau also reports a case of a factory where space heating/cooling, water heating and lighting account for a large part of the energy consumption, which achieved 22% reduction in yearly energy consumption by replacing oil-burning absorption refrigerator with heat pump. <p style="text-align: right;">1] Kanto Bureau of Economy, Trade and Industry's Compendium of Energy Saving Actions by Small- and Medium-sized Enterprises (Regional survey for the promotion of voluntary measures, conducted in fiscal 2009) http://www.kanto.meti.go.jp/tokei/hokoku/data/20100709shouene_torikumi.pdf p p age42-43 page18-19</p>	Rejected. too much detail
3101	9	21	14			needs to explain what a 'curtain wall' is - not a term in common use	Noted. But the sentence has been deleted.
6640	9	21	16			there seems to be no major technical problem': this is not a very rigorous statement	Noted. But the sentence has been deleted.
7700	9	21	27	21	35	cites are to grey literature	Rejected. I consider ECOFYS to be a credible source of information
18877	9	21	33	21	34	"30 year period" and "payback times": If possible please state assumptions about discount rate.	Noted. But the section has been deleted
10196	9	21	8	21	12	Speculative, preferably only report projects that have shown to be effective	Noted. But case studies have been deleted

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6638	9	21	9			I could not find the reference listed as Anonymous 2009 on the internet	Noted. Its from ASHRAE Journal - which is widely available. N, but case studies have been deleted.
6641	9	21				This section is informative, but not essential	Rejected. We keep this section
15680	9	21	36			Section 9.3.5 is, compared to the other sections within section 9.3, far less technical. Sections 9.3.6 and 9.3.7, however, are technical again (EMCS and materials lifecycle, resp.). For me, it would be more logic to put subsections 9.3.5 and 9.3.8 together (or at least at the end of section 9.3) to go beyond the technical part and include the human side of this section.	Accepted. This, and a new section on biomass, have been put near the end of 9.3
2194	9	22	12	22	48	Further possible references on predictive and adaptive control (with corresponding market products in 2012) are Morel N. et al., NEUROBAT: a predictive and adaptive heating control system using artificial neural networks, Solar Energy, 21 (2-3), pp. 161-202, 2001 and Guillemin A. and Morel N., Innovative lighting controller integrated in a self-adaptive building control system, Energy and Building, 33(5), pp. 477-497, 2001.	Noted. The section has been deleted, repalced with a summary statement in 9.3.2
4577	9	22				Although likely important, optimization of building energy consumption can also be achieved by looking at much coarser data, for example, monthly data from utilities as is commonly available in the US. See e.g. Brecha et al. Energy Policy (39) 2011 pp. 2982-2992; Hallinan et al, ASHRAE Transaction Vol. 117, Part 2, Paper ML-11-003 (2011) (for commercial buildings); Hallinan et al, ASHRAE Transaction Vol. 117, Part 2, Paper ML-11-009 (2011) (for residential buildings)	Noted. Will look at the suggested reference. Useful, but I think that we already have too much material
6642	9	22				This section is too long	Rejected. We should actually expand the section to address the next two comments.
11660	9	22	12	22	48	The potential emission reduction or energy-saving from the energy management system should be described.	Accepted. Agree. We can mention the potential.
11705	9	22	12	22	48	Information and communication technology have strong impact on GHG mitigation in building sector. There are so much examples other than shown here such as high performance sensing technology, behavior change due to visualization of energy consumption using smart meter, detailed building commissioning using BEMS data and so on.	Accepted. Agree. We can mention the potential.
2195	9	23	3	23	4	Low-energy buidlings do not systematically show larger embodied energy and/or environmental impacts (through construction materials) than conventional buildings, as shown by reference Altherr R. and Gay J.-B., A low environmental impact anidolic façade, Building and Environment, 37(12), pp. 1409-1419, 2002.	Editorial. Inserted "generally" before "greater"
2893	9	23	37	23	37	(WBSCD, 2006) is not in the References section at end of chapter	Accepted. The reference was deleted in re-writing
6645	9	23	42		43	More comments on figure 9.11 are needed	Noted. The figure has been deleted.
4579	9	23				What are the total lifecycle impacts from low- to zero-energy buildings? If operating energy use is reduced 90% or more, but the embodied energy in construction is significantly higher, is there a possibility of reaching overall goals of, e.g. 90% lower emissions?	Noted. Probably not - the cited examples show much less savings on a lifecycle basis.
6643	9	23				This section is informative, but the sake of clarity, the case studies should rather be summarized in a table.	Accepted. Actually, case studies have been deleted and replaced with general conclusions form a detailed review paper
6644	9	23				Without naming it, this section implicitly deals with the rebound effect. I could be worthwhile to name it more explicitly, or at least it is consistent with what is said in Section 9.7.4	Noted. Will check

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12638	9	23		23		There are studies which show that change of life style contribute more to reduction of energy consumption than improvement of insulation in residential building. (Kenichi HASEGAWA et al., 2006) (http://ci.nii.ac.jp/els/110004809857.pdf?id=ART0007535868&type=pdf&lang=jp&host=cinii&order_no=&ppv_type=0&lang_sw=&no=1347573540&cp=)	Noted. Since there is expression that "life style has a major effect on energy use...", no action is necessary. This depends on how much the insulation was improved
4576	9	23	33	23	43	The personal behavior aspect should be emphasized far more, especially with regard to existing homes in developed countries. See for example Dietz et al. PNAS November 3, 2009 vol. 106 no. 44 pp. 18452–18456; Brecha et al. Energy Policy (39) 2011 pp. 2982-2992 etc.	Accepted. Consider suggestion by Writing Team. Since there is expression that "life style has a major effect on energy use...", no action is necessary
15213	9	23	33	23	43	In this part we should point out that in developing countries we should not change our lifestyle into life style of developed country like US and Europe. This will result great energy use in buidling sector and the earth can not afford this much energy.	Accepted. Consider suggestion by Writing Team. Add text shown below to 9.3.8.. Building sector of developing countries has a risk to become huge emission source because of their large population. Though it is unavoidable to change their life style with modernization, the change should be guided to the life style which does not increase CO2 emission
7032	9	23 of 86	43	23 of 86	43	Substitute "industrialized" for "developed" before the word "nations", at the last part of the line.	Editorial.
4731	9	24				Figure 9.11 doesn't seem to be the best graph showing "Emerging economies like China have different consumption level benchmarks from developed nations." Figure 9.11 could be deleted.	Accepted. Improve Fig. 9.11.
11779	9	24	21	24	24	Delete all. In Japan recent GTCC technology achieved more than 58% efficiency, thus this sentense is not nesesarily matched.	Noted. This will be revised to clarify that the total efficiency of cogeneration plant is higher where heat can be effectively utilised
9561	9	24	21	24	22	This seems to be wrong as combination of high efficiency heat pumps and centralized power plants becomes more efficiently use of energy.(renewableenergy in idustrial applications, p37, UNEDO)	Noted. This will be revised to clarify that the total efficiency of cogeneration plant is higher where heat can be effectively utilised
10665	9	24	21	24	24	Delete all.Japan's most recent CCGT technology achieved more than 58% efficiency, thus this sentense is not nesesarily matched.	Noted. This will be revised to clarify that the total efficiency of cogeneration plant is higher where heat can be effectively utilised
4732	9	24	21	24	22	Reference should be added. IEA (2010) Energy Technology Perspectives 2010, International Energy Agency (IEA), Paris, France.	Accepted. Consider suggestion by Writing Team
10010	9	24	21	24	22	This part should be deleted or revised to explain that total energy efficiency of cogeneration is higher than centralized power plant only if waste heat could be utilized perfectly. The detail energy efficiency is described in (IEA, 2011, page15, Table4). This literature is listed in the No51 line of this table.	Noted. This will be revised to clarify that the total efficiency of cogeneration plant is higher where heat can be effectively utilised

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9431	9	24	21	24	24	<ul style="list-style-type: none"> · Deletion of the entire sentence is needed. · Distributed energy systems are not necessarily higher in efficiency than centralized power plant. · Cogeneration improves energy efficiency when the heat is utilized, although there are only a few applications where usages of heat and electricity can be balanced. When compared in terms of efficiency of only the power generation function, centralized power plant has higher efficiency. (e.g. Efficiency of gas burning engine CGS is about 40 to 45%, while the most advanced thermal power plant in Japan has efficiency of about 58% <MACC1, 500□C>). · Refer to the following documents . <ul style="list-style-type: none"> 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 exergy 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. · Evaluation of Total Energy Efficiency of CGS on the Basis of Exergy Concept」 (2008) Journal of the Japan Institute of Energy 87, 285-290(2008) ①Masanobu Sasaki(2011), Policy Trend of Heat Pump In Japan(Chapter4 4.2) 	Noted. Will check. Space prevents a full analysis of the thermodynamics
18879	9	24	22			should read "thAn centralized power plantS"	Accepted. Consider suggestion by Writing Team
9432	9	24	30	24	38	<ul style="list-style-type: none"> · Addition to the case study is needed for the description of the district heating and cooling system in Tokyo Skytree area. · The above-mentioned DHC is a good example, in that Japan’s highest comprehensive yearly energy efficiency (coefficient of performance) of 1.35 is planned (c.f. average DHC efficiency in Japan is 0.749), and that high-efficiency heat pump, large-capacity heat reservoir and ground source heat pump are employed. 	Rejected. The case has just started operation. It's too early to evaluate the performance. We do not believe it is appropriate to mention specific projects. No action
10011	9	24	32	25	1	This part should include "heat pumps" that use underground water. Heat pump system using underground water is effective where underground water is abundant.	Accepted. Agree. Should add 'groundwater' to the list of potential heat pump sources. We will add 'groundwater' to the list of potential heat pump sources.
11287	9	24	5	24	10	We suggest to add to this paragraph the following sentence: Urban planning that take into consideration local climatic patterns such as: the sun path, the direction of prevailing winds, and the topography of the area, will facilitate the construction of buildings that are properly oriented and that make use of passive building elements such as natural shading, cooling and lighting, and resulting in less GHG emission.	Accepted. To be discussed with Chapter 12 where the substantive section should be.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
11706	9	24	9			From the viewpoint of natural ventilation potential, compact urban form is not effective for passive cooling.	Accepted. will check with ch12 and see who covers this issue. This needs input from someone in the team with better expertise on passive cooling, but may be deleted if the substance is moved to Chapter 12.
9073	9	24	4	27	12	9.4 Infrastructure and systemic perspectives can be deleted due to limitations on the nos of pages	Rejected. Disagree. This section is a requirement. Also important to understand the potential of the buildings sector to use low carbon fuels. Infrastructure and system play a very important role for effective energy consumption. Therefore 9.4 is necessary. No action
15682	9	24	4			Does subsection 9.4.1 really belong here? It seems very much decoupled from the rest. Subsection 9.4.2 says "This section therefore focuses ...", but then stops, so it seems to be more an introductory passage, which doesn't need a subsection number at all.	Accepted. Chapter 12 is a better home for the substance on the wider built environment infrastructure. Just needs cross-referencing here.
6646	9	24				With so few elements, this section is not very informative and could be removed	Accepted. Chapter 12 is a better home for the substance on the wider built environment infrastructure. Just needs cross-referencing here.
11712	9	24	5	24	11	This description is also shown in Chapter 12 (Section 12.3-4 especially in 12.3.2.6). In general, sections 12.3 and 12.4 have strong relationship with 9.4. Coordination between two chapters is needed.	Accepted. Chapter 12 is a better home for the substance on the wider built environment infrastructure. Just needs cross-referencing here.
12581	9	24	8			In the warm humid climate region of India, more surface-to-volume- ratio is preferred to induce natural ventilation and passive cooling - this may also be mentioned	Accepted. Will modify the text to recognise the urban heat island effect is exacerbated by density
6647	9	24		25		This section is too long	Accepted. Agreed, can be edited.
7033	9	24 of 86	16	24 of 86	16	Add "zero and" before the phrase "lower carbon fuels".	Rejected. Disagree. For the foreseeable future, all external fuels to buildings in the form of electricity, gas and heat/coolth supplied through infrastructure systems will have some carbon implications. No action

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7034	9	24 of 86	19	24 of 86	19	The same as 32nd Comment.	Rejected. Disagree. For the foreseeable future, all external fuels to buildings in the form of electricity, gas and heat/coolth supplied through infrastructure systems will have some carbon implications. No action
17389	9	25				It is very interesting and useful to talk over the utilization of ground source heat pump(GSHP), I think it needs to be further discussed and explored, from the point of COP and associated costs in some typical regions, both industrialized and developing countries. Some challenges related to the deployment and scale-up potentials should be adequately assessed, since this option is quite promising and should be well analyzed for giving the audience a good view.	Accepted. This is a valid point. The section on electricity infrastructure does not see the best place for a detailed discussion of heating technologies. But there is no detail in Chapter 7 or Chapter 9.3 either. Needs wider discussion.
4733	9	25	10			The title "Electricity infrastructure" doesn't seem to fit the contents which includes heat pump. Text is too long.	Accepted. There should be a discussion of the implications for infrastructure here only.
9546	9	25	17			Please, add following; heat pumps use renewable energy from their surroundings (ambient air, water or ground). They achieve point-of-use efficiencies greater than 100%, i.e. they provide more useful cold or heat (in energy terms) than the electricity input. (Technology roadmap Energy-efficient Building,2011, IEA, p16, p18)	Noted. This is a valid point. However, the section on electricity infrastructure does not see the best place for a detailed discussion of heating technologies. But there is no detail in Chapter 7 or Chapter 9.3 either. Needs wider discussion.
9433	9	25	17	25		<ul style="list-style-type: none"> · Addition needed for the description of HP used at minus 25°C. · Since the most advanced air source heat pump can be used under ambient condition of minus 25C, this case can be added as a good example. · Refer to the following documents. <ul style="list-style-type: none"> ①Masanobu Sasaki(2011), Policy Trend of Heat Pump In Japan(chapter2 2.2) ②ETSAP TECHDS Energy Technology Briefs http://iea-etsap.org/web/Highlights%20PDF/E19_HL_HeatPump_HN_March2012_Final_GSOK.pdf 	Rejected. This section is about decarbonisation strategy, not the temperature range within which heat pumps are viable. No action
9624	9	25	19	25	20	<p>Please, replace 'and therefore ...process.' with a technology has steady progressed because air source heat pumps can be used in outdoor with minus 25 degree Celsius.</p> <p>1)Masanobu Sasaki(2011), Policy Trend of Heat Pump In Japan 2)ETSAP TECHDS Energy Technology Briefs http://iea-etsap.org/web/Highlights%20PDF/E19_HL_HeatPump_HN_March2012_Final_GSOK.pdf</p>	Rejected. This section is about decarbonisation strategy, not the temperature range within which heat pumps are viable. No action
4734	9	25	22	25	24	The market of heat pump is matured in Japan. So the text could be modified as follows. In some countries heat pump is prevailing technology and the market is matured especially in Japan. There is a growing market for low-cost air source heat pumps in mid-latitude countries, notably Italy and France (Singh, Muetze, et al., 2010), New Zealand(Howden-Chapman et al., 2009), some regions of China (Cai et al., 2009) are growing.	Accepted. Consider suggestion by Writing Team
11780	9	25	27	25	30	Agree.	Noted. Nothing to be done
9547	9	25	27	25	30	Good comment	Noted. Nothing to be done

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
10666	9	25	27	25	30	Good example.	Noted. Nothing to be done
9548	9	25	30	25	31	Please, replace here with the following due to unclear; the electricity sector is decarbonised and this enables the buildings sectors to reduce CO2 emissions by additional electrification. As a result, the share of electricity in final consumption rises to 27% in 2050 as low-carbon electricity increasingly substitutes for fossil fuels. (ETP2010, IEA, p81)	Accepted. Happy to clarify the point in the SOD. Quoting the precise estimate from IEAETP does not seem appropriate here.
9549	9	25	31	25	33	Please, check and accommodate analysis of sectoral energy use, 6.8.2.1, in Chpter 6 as the trend of final energy use in buildings sector looks downwards.	Noted. This will be addressed through liaison with Chapter 6
9550	9	25	36	25	38	Please, describe here in a positive manner due to unclear; e.g. a high cost heating system needs a supportive scheme to shift the neregry source.	Rejected. Disagree. It is not the role of an IPCC assessment to promote a specific fuel. No action
10012	9	25	36	25	38	This part should be deleted because there is no evidence that the electrified heating system is more costly than other heating systems.	Rejected. Disagree. Well established that a heat pump is more expensive than a fossil fuel boiler.
9623	9	25	4			Please, insert a good following example after (kuzuki et al., 2010); 'Tokyo Skytree district heating' is a good example as the highest annual energy efficiency of 1.35 is planned, compared with domestic DHC with 0.749, and high spec heat pumps and huge thermal storage tank and geothermal heat pumps are introduced. 1)Masanobu Sasaki(2011), Policy Trend of Heat Pump In Japan 2)ETSAP TECHDS Energy Technology Briefs http://iea-etsap.org/web/Highlights%20PDF/E19_HL_HeatPump_HN_March2012_Final_GSOK.pdf	Rejected. The case has just started operation. It's too early to evaluate the performance. We do not believe it is appropriate to mention specific projects. No action
9551	9	25	40	25	42	Please, replace intermittent with low or zero emissions.	Rejected. Disagree. The SRREN reference is about intermittent renewables not low carbon electricity in general. No action
9552	9	25	43			Please, add hydro pumps as means of energy storage; e.g. not only hydro pumps but also thermal energy strage...	Rejected. Disagree. This section is about infrastructure for buildings. No action
11707	9	25	43	25	49	In combination with electricity infrastructure using intermittent renewable energy, electricity load curve leveling such as demand response is important. However, it seems strange that this subsection include thermal energy storage in building envelope, which is originally intend to stabilize the operation of building HVAC equipment. Since this phase is duplicate page 23, line 26-28, it should be unified.	Accepted. Thermal storage in buildings is included here because it will affect electricity infrastructure needs and therefore the viability of electricification of heating. Agree that repetiton of 9.3.7 needs to be addressed.
6648	9	25		26		This section is too long	Accepted. Agreed. Should be edited for key messages
3495	9	25 of 86	16		16	To add: "in the temperate region" after the first word of this line, i.e. "countries".	Rejected. Disagree. The same principles apply to electrification of water heating in all climate zones. No action
7035	9	25 of 86	5	25 of 86	5	Add "zero and" after the phrase "alone deliver", at the beginning of the line.	Accepted. Precise phrasing will be revised for consistency with Section 9.3

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7036	9	25 of 86	8	25 of 86	8	Add "zero and" before the phrase "very low energy", at the last part of the line.	Rejected. Disagree. For the foreseeable future, all heat supplied through infrastructure systems will have some carbon implications. No action
7037	9	25 of 86	10	25 of 86	10	I haven't seen here issues like decentralized and distributed renewables electricity generation, smart grids, local grids, WADE, etc. I think they deserve an important place concerning "Electricity infrastructure", which is the name of the Section.	Accepted. Needs wider discussion where this fits in Chapters 7, 9 and 12. Those new technologies should be described.
7038	9	25 of 86	11	25 of 86	11	Substitute "industrialized" for "developed", before "world, around the middle of the line.	Accepted.
7039	9	25 of 86	41	25 of 86	41	Add "zero and" before "lower carbon off peak electricity", around the middle of the line.	Rejected. Disagree. For the foreseeable future, all electricity supplied through infrastructure systems will have some carbon implications. No action
6649	9	26	20			the concept of commissioning is not clear to me. How does it compare to maintenance?	Rejected. This is a surprising comment. They are different concepts both in everyday use and amongst building professionals. No action proposed.
6650	9	26	23			the economic barriers identified above': throughout the chapter, the barriers are not clearly identified (see for instance the vacuum in section 9.8)	Rejected. No action needed here as barriers addressed in Section 9.8 and there is a huge extant literature on them covered in AR4.
18881	9	26	47			"size of the lock-in risk": define the metric used	Noted. I think Figure 9.12 is fairly clear. The potential reduction from 'sub-optimal' to 'state of the art' is 80% of the 2005 total. May be this could be clearer in the text.
15683	9	26	48	26	48	Since the word "cost-effective" is also mentioned here and subsection 9.4 deals with the "systemic perspectives" promised in its title, subsection 9.4.4 could be integrated in subsection 9.4.5. For me, it would make section 9.4 a bit more fluently; going from a general view about the energy infrastructure at the start via a more deeper view on the electricity and gas infrastructure in the middle to the political and financial barriers and challenges at the end.	Accepted. Very good point to be addressed in revision of 9.4.4 and 9.4.5
4735	9	26	9			Gas infrastructure is still important for high efficiency distributed energy systems described in 9.4.3.	Noted. This is a difficult sub-section. The developing literature is divided on the role of gas in the built environment.
6651	9	26		27		Useful reference on this topic: Vogt-Schilb and Hallegatte, 2011, "When starting with the most expensive option makes sense", Policy Research Working Paper 5803, World Bank, http://www-wds.worldbank.org/servert/WDSContentServer/WDSP/IB/2011/09/21/000158349_20110921094422/Rendered/PDF/WPS5803.pdf	Accepted. Thank you for the helpful comment. Will consider in revision.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7040	9	26 of 86	8	26 of 86	8	Add "zero and" before the phrase "lower carbon supplies", at the last part of the line.	Rejected. Disagree. For the foreseeable future, all electricity supplied through infrastructure systems will have some carbon implications. No action
7041	9	26 of 86	23	26 of 86	23	Add "zero and" before the phrase "low carbon vectors", around the middle of the line.	Accepted. Proposed to omit this sub-section to save space.
7042	9	26 of 86	23	26 of 86	23	Add "zero and" before the phrase "low energy buildings", at the last part of the line.	Accepted. Proposed to omit this sub-section to save space.
7043	9	26 of 86	42	26 of 86	42	Add "zero and" before the phrase "very-low energy", at the last part of the line.	Rejected. Limited literature on district heating in zero energy buildings
6652	9	27	14	28	14	The introduction to section 9.5 is too long	Accepted.
15703	9	27	17	27	17	Besides the reference "Pyke et al., 2012", the following reference gives a good overview of the current status about the various interactions between the climate sciences and the construction industry: Gerdes, A., Ch. Kottmeier, and A. Wagner (eds.) (2012). Proceedings of Conference on Climate and Constructions, 24 and 25 October 2011, Karlsruhe, Germany, KIT Scientific Publishing, ISBN: 978-3-86644-876-6, 384pp. Available at: http://digbib.ubka.uni-karlsruhe.de/volltexte/1000028785	Accepted. Reference added
9074	9	27	13	29	42	9.5 Climate change feedback and interaction with adaptation can be deleted due to limitations on the nos of pages	Rejected. No action
4736	9	27	13	28	14	The opening text for 9.5 is too long. It should be divided to some sub-sections.	Rejected. No space left
7044	9	27 of 86	17	27 of 86	17	Add "zero and" before the phrase "low-carbon buildings", at the middle of the line.	Accepted. Section 9.4
7045	9	27 of 86	18	27 of 86	18	Substitute "industrialized" for "developed", before the beginning of the hyphen around the middle of the line.	Accepted. Section 9.4
7046	9	27 of 86	27	27 of 86	27	Add "zero and" before the phrase "Low energy consuming buildings", at the second half of the line.	Accepted. Section 9.4
7047	9	27 of 86	30	27 of 86	30	Add "zero and" before the phrase "Low energy consuming buildings", at the first half of the line.	Accepted. Section 9.4
7048	9	27 of 86	31	27 of 86	31	Add "zero and" before the phrase "lower-energy consuming", at the last part of the line.	Accepted. Section 9.4
6653	9	28	15			I would remove 'and CC mitigation' from the section title	Accepted.
9434	9	28	32	28	36	<ul style="list-style-type: none"> · Deletion of the entire sentence is needed. · The description implying that the 0.3Gt increase in CO2 emission from the residential sector is caused by electrification is inappropriate. · It is illogical to blame electrification for this increase in CO2 emission. · The increase of 0.3 Gt occurred mainly through meeting residential demands. The problem lies in whether to meet the demands with electricity or with other energy sources. Electricity is preferable because it provides for higher amenity and enables CO2 reduction. · Refer to the following documents. <p style="text-align: right; margin-right: 20px;">Sugiyama [1]</p> <p>found that the electrification rate increases more or less in final electricity demand by 2050; however, the final energy demand doesn't necessarily show an increase in all the studies. He suggested that climate policies can lead to reduced final energy demand. In conclusion, policy measures which decarbonize power generation and accelerate future growth of electrification are "promising" options. [1] Masahiro Sugiyama(2012), "Climate change mitigation and electrification (Energy Policy44)" Volume 44, May 2012, Pages 464-468</p>	Noted. Taken into account. It is not electrification that leads to these results but the assumptions of the scenario considered, which assumes that the emission factor of electricity is higher compared to those of fuels. The text was rewritten to clarify this. The suggested reference shows that the implementation of mitigation actions enhance electrification and so decarbonization of power sector is of particular importance. However, in this paragraph the focus is on the possible implications of cc on energy demand and the associated emissions and so the suggested reference is not very relevant.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
18882	9	28	48			"\$2B": Please spell out billion/bio.	Editorial. Consider reviewer's comment
2894	9	28	5	28	5	(Graham, 2005) is not in the References section at end of chapter	Accepted. We contact Graham to provide the required reference.
6925	9	28	40			Suggest to refer to WGI AR5, Ch7 for the assessment of physical science basis of RM (SRM). Please make sure not to reassess what is the task of WGI Ch7, e.g., in the discussion of changes in radiative forcing, and ensure consistency.	Accepted. Will include the reference.
8524	9	28	40			The title and text of Section 9.5.2 concern the Section 6.9.2 (ground-based SRM). The first part of Section 9.5.2 (from page 28 line 41 to page 29 line 5) could be omitted at all because this part of the text deals with microclimate of buildings.	Noted. We will not delete, but cross reference 6.9.2.
7049	9	28 of 86	36	28 of 86	36	After the phrase "above that of fuels", add the sentence "if electricity continues to be generated with the current energy mix; in case it would be generated with renewables, the result could be very different at all."	Accepted. Will (a) make a reference to the proposed study, (b) make the discussion neutral.
6654	9	29	1		25	Too much detail. Should be summarized in a table	Rejected. A table only repeats the numbers
2895	9	29	12	29	13	(Hansen et al., 1997a,b; Hansen et al., 2005; and Myhre et al., 1998) are not in the References section at end of chapter	Accepted.
18884	9	29	15			"100 kg CO2 per m2": This is probably annual, right? If so, please add it.	Accepted. No. It is one time. Added "one-time" to the text.
2896	9	29	21	29	21	(Menon et al, 2010) is not in the References section at end of chapter	Accepted. We added.
6655	9	29	29		33	Problem with the sentences	Accepted. Improved the sentence.
7493	9	29	29	29	35	"Black Carbon (BC) or soot is highly absorptive of solar radiation and can be transported by clouds over long-distances (Ramanathan and Carmichael, 2008) leading to an increase in the radiative force (RF) of the Earth. BC is a pollutant emission resulting from incomplete combustion of coal, oil products and, particularly to the buildings sector, of bio fuels -fuelwood and other types of traditional biomass utilized (e.g., cooking on wood burning fire in developing countries)". If households have chimneys, then some soot will accumulate in them. With indoor cooking and no chimney, most soot etc. will accumulate within the kitchen. Also soot added to the soil increases its fertility. Chimneys can be swept and the soot put on the market garden as can the ash from the wood – a fertilizer high in potassium. (K).	Accepted. Deleted a part of the section.
2897	9	29	35	29	35	(Edenhofer et al, 2011) is repeated twice; delete one	Accepted.
9607	9	29	37	29	41	Please, move to technical risks, page 60, in chapter 7.	Rejected. This is status quo not mitigation. It belongs to here.
2898	9	29	42	29	42	(Edenhofer et al, 2011) is repeated twice; delete one	Accepted. Agree. Did it.
13061	9	29	43	37	12	On the Costs & Potentials issues it is difficult for the reader to access the bigger picture of the cost & potential information. Each sector has its own approach to costs and potentials, which is appropriate as each sector has its own unique qualities and considerations. Nonetheless, the information that will be most relevant to take-away for policy-makers is overarching cost information that brings these different pieces together. To help policy-makers access this information, it should be important to highlighting market realization, but also the policy aspects of cost (by policy it is meant institutional frameworks and/or market frameworks and/or capacity building arrangements, etc...). In both developing and developed countries policy can have a strong impact on cost. Simply looking across the costs & potentials sections of the sector chapters, the reader could miss this message, although the information on policies and measures is there in the chapter. Therefore it could be important to make sure that these informations are put in perspective appropriately.	Accepted. The section has been redrafted, with a focus on measures to reduce costs where high, and on the fact that in many cases costs are already low

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12634	9	29				This paragraph may refer to Global Alliance for Clean Cookstoves at the Clinton Global Initiative(http://www.state.gov/secretary/rm/2010/09/147500.htm) and SLCF report by UNEP(http://www.unep.org/publications/ebooks/slcfl/).	Accepted. Deleted a part of the section.
4737	9	29	26			This story may be less important for Buildings chapter. Text should be shortened.	Accepted. Deleted a part of the section.
15685	9	29	26			The thematic in this subsection is really interesting, but does it really belong in a chapter called "Buildings"?	Accepted. Deleted a part of the section.
8400	9	29	27			Delete "by clouds", this is not correct. Correct grammer in this sentence.	Accepted. Deleted a part of the section.
6926	9	29	27	29	33	Please be more specific when talking about RF, also refer to WGI AR5 Ch07.	Accepted. Deleted a part of the section.
4738	9	29	44			Only the table 9.5 consists 9.6.1 and there is no text. It looks unusual.	Accepted. Table has been moved to later in 9.6, and text about it written
2359	9	30				Split table into "by technology" and "by policy" - those two things should rather not be mixed	Noted.
9553	9	30		31		Please, simplify two-page table.	Noted.
12639	9	30		31		The criteria for selecting of literature is unclear. There are many literatures in other regiions, thus these other literatures should be described.	Noted.
3498	9	30 of 86				Under "CARBON EFFICIENCY" category, please include two more mitigation measures. The two are: (1) Carbon sequestration building materials and products, and (2) building integrated greenery systems. For details, please refer to [Cam C.N.W. (2012). Technologies for Climate Change Mitigation: Building Sector. Denmark: UNEP Riso Centre.]	Noted.
3499	9	31 of 86				Under "DEMAND EFFICIENCY" category, please consider to include "behaviour change catalyst" mitigation measures. They include home area network (HAN) and Pre-paid meters. For details, please refer to [Cam C.N.W. (2012). Technologies for Climate Change Mitigation: Building Sector. Denmark: UNEP Riso Centre.]	Noted.
7701	9	32	10	32	49	Virtually all of the cites here are to the grey literature -- reports. Also, on line 33 it is not clear what \$0.10/kWh means as an "equivalent cost."	Noted. Much of what is available is on the grey literature. Case studies have been deleted anyway.
18887	9	32	18			Please define what you mean with "premiums" here.	Accepted. Consider suggestion by Writing Team
15687	9	32	2	32	2	Sentences like "Earlier sections have shown ..." and "The previous section has demonstrated ..." (subsection 9.6.3.1 - first sentence) are not always relevant and make the text longer and since the chapter has to become shorter...	Accepted.
6656	9	32		33		Section is too long	Accepted. Has been shortened
9554	9	33		36		Please, simplify two-page table.	Accepted. Table has been deleted in fact
6657	9	33	1			particularly well documented': some references should be effectively cited	Accepted. This section has been completely re-written
6660	9	33	10		11	The first sentence of the section reads redundant and way too general	Accepted. This section has been completely re-written
2899	9	33	19	33	19	Mata et al., (2010) is not in the References section at end of chapter	Accepted. This section has been completely re-written
6661	9	33	19			I couldn't find Mata et al 2010 in the reference list	Accepted. This section has been completely re-written
6658	9	33	2		5	conventional standards' versus 'specific circumstances': this remains quite vague and it could aptly be removed. Moreover the status of two references is inappropriate for citation in IPCC report	Accepted. This section has been completely re-written

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
18888	9	33	20			are the numbers in this line global - if so, please add this information	Accepted. This section has been completely re-written
2900	9	33	22	33	22	Polly et al., (2011) is not in the References section at end of chapter	Accepted. This section has been completely re-written
6662	9	33	22			I couldn't find Polly et al 2011 in the reference list	Accepted. This section has been completely re-written
6663	9	33	23		25	3% discount rate and 3% price escalation seems like a set of assumptions that would be very favorable to investments in energy conservation. What is the sensitivity to these assumptions?	Noted. This section has been completely re-written
15690	9	33	30			It's hard to compare the costs if they are in euros, pounds, and dollars (also counts for the tables 9.7 and 9.8). Is it possible to use one of them and then put the currency exchange rates as footnote?	Noted. The table has in fact been deleted.
6659	9	33	8		9	policies such as...discount rates and anticipated holding times': these two elements are not 'policies'	Accepted. This section has been completely re-written
12640	9	33		34		It might be better to follow the format of Table 9.8.	Noted. The table has in fact been deleted.
15688	9	34	2			I couldn't find a reference of the table in the text.	Noted. The table has in fact been deleted.
12641	9	34		35		Same as above	Noted. The table has in fact been deleted.
3500	9	34 of 86				It is highly recommended to include NZEBs from other regions, at least different climatic regions, for a more comprehensive assessment. Examples of these buildings in the tropic include BCA Academy ZEB in Singapore, Zero Energy Office in Malaysia, etc.	Noted. The table dealt with costs, but in any case has been deleted.
6665	9	35	11			cost-optimality (rather than cost-effectiveness) is indeed not a very intuitive concept. A short definition would be necessary	Noted. Will consider
15689	9	35	3			I couldn't find a reference of the table in the text.	Noted. The table has in fact been deleted.
6664	9	35	7			as section 9.6.1 already pointed out': there was no text in section 9.6.1	Accepted. Text added
15686	9	35	7	35	7	In my version, section 9.6.1 is empty...	Accepted. Text added
6666	9	35				Too many details	Noted. Not sure what is being referred to, but the table has been deleted and the text re-written
6667	9	36	25		32	Repetition with the methodology discussion of pages 17-18	Accepted. Re-written to avoid redundancy
15691	9	36	37	36	38	What is "industrial ecology literature"?	Noted. Now deleted
15693	9	36	43	36	47	If I understand right, Lovins (2010) describes a concept that technical development will increase so fast in future that it will reduce the expected costs of today. If that's right, it's hard to believe. It would mean that I can plan as expensive as I want. I just have to "believe" that time will be on my side. It seems also not consistent with subsection 9.4.5 (lines 28 to 31: This means that buildings ...).	Noted. This material has been deleted.
18892	9	36	43			"...through costs": add reference to Figure 9.13.	Noted. This material has been deleted.
18891	9	36	5			"... years, decades": consider adding "no time give (before/after)" here	Noted. This material has been deleted.
3103	9	36				I would cut this section - it's quite vague and doesn't really discuss what the heading suggests (or certainly not community approaches)	Accepted. Deleted
6668	9	36		37		The concept of 'tunneling through costs', without giving more concrete examples, remains abstract. Overall, the evidence of it seems not compelling enough (and not peer-reviewed) for it to be cited in this report.	Accepted. Deleted

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7702	9	36	34	37	12	again, most references here are from the grey literature. Also, what is the source of Fig 9.14? Finally, on lines 36-7, you cant simultaneously minimize energy demand and maximize efficiency--one or the other.	Accepted. Deleted
15692	9	36	34			Because this section deals with economic benefits, doesn't it fit better in section 9.6.3. This would make section 9.6.3 a bit more substantial, since it deals for a large part with what already has been written and what will be discussed in the next sections.	Noted. This section has been deleted.
12122	9	36	36	36	38	The statement "It requires understanding and leveraging whole-system design to minimize energy demand and maximize efficiency" is unreferenced Please add a reference to the only book on Whole System Design in the world - Stasinopoulos, P., Smith, M., Hargroves, K. and Desha, C. (2008) Whole System Design: An Integrated Approach to Sustainable Engineering, Earthscan, London, UNESCO and WFEO. And please also consider adding from 2007 IPCC AR4 WGIII Building Chapter - "Energy efficiency strategies focused on individual energy-using devices or design features are often limited to incremental improvements. Examining the building as an entire system can lead to entirely different design solutions. This can result in new buildings that use much less energy but are no more expensive than conventional buildings. The systems approach in turn requires an integrated design process, in which the building performance is optimized through an iterative process that involves all members of the design team from the beginning."	Rejected. These points are covered earlier in our discussion of the integrated design process. The book is only 208 pages and only one chapter in 10 deals with buildings. No room for more.
12123	9	36	36	36	38	The economic benefits of integrated and community-based approaches - the real economic benefit from integrated design approaches arises because it is in the front end design phase that most of the design decisions are made which will lock in the overall building energy usage long term. As Paul Hawken et al wrote in the book Natural Capitalism, "By the time the design for most human artefacts is completed but before they have actually been built, about 80-90 percent of their life-cycle economic and ecological costs have already been made inevitable. In a typical building, efficiency expert Joseph Romm explains, 'although up-front building and design costs may represent only a fraction of the building's life-cycle costs, when just 1 percent of a project's up-front costs are spent, up to 70 percent of its life-cycle costs may already be committed. When 7 percent of project costs are spent, up to 85 percent of life-cycle costs have been committed'. That first one percent is critical because, as the design adage has it, 'all the really important mistakes are made on the first day'."	Noted. We already discuss integrated design and cost reduction, moreso in the revised draft
6669	9	37				This figure brings some value added but there are no details about the sources, etc.	Accepted. Figure deleted
6670	9	37				Again, the existence of co-costs (loss in amenities due to efficient lighting, mercury pollution due to efficient lighting, inconvenience due to housing works), even if they don't prevail in the cost-benefit balance, should be mentioned (and ideally some estimates of their value should be provided)	Noted. Taken into account. The issue of risks associated with mitigations actions is now mentioned in Sub-section 9.7.1. However, we consider that these risks are limited compared to co-benefits and mainly concern the rebound effect and the lock-in effect.
15694	9	37				I don't understand the figure. The colors are countries, right? From the text, I understand that you want to show that there is hardly any relationship between energy savings and CCE (Page 5, line 5 and 6). Why then do you need the classification by countries? Does it make sense anyway to show a figure where you see so less? Wouldn't a sentence like "A meta-analysis of data reported by the literature showed that cost-effectiveness of retrofits does not necessarily depend on the depth of a retrofit." tells the reader the same as the figure does?	Accepted. Figure has been deleted to save space

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12848	9	38	11	38	13	The criticism of some of the studies about green jobs potentials deserves a little more prominence and a reference to an actual study that criticizes green job claims (Carley at al. only includes a reference to such studies). In addition to questioning the efficacy of using public funds for energy projects instead of other investments, the criticism has been made that several green jobs studies neglect the possible inefficiencies of investing in labour-intensive activities. An example of a study criticizing green jobs claims is: Gülen, Gürcan (2011), Defining, Measuring, and Predicting Green Jobs. Copenhagen Consensus Center: http://www.copenhagenconsensus.com/Default.aspx?ID=1542	Noted. Taken into account. Much of the criticism about green jobs potential mainly concerns investments on RES technologies, while this section focuses on energy efficiency initiatives. The suggested study will be included in the text. Also, we can refer Alvarez et al. 2009. The additional point on possible inefficiencies of investing in labour-intensive activities will be noted also into the text..
12849	9	38	24	38	28	It is worth clarifying if lines 24-26 refer to gross or net jobs generated. A problem with stating job numbers generated by a specific amount of money is that wages differ greatly between countries. Obviously, where wages are higher, the same amount of money will generate fewer jobs, and vice versa. It has to be pointed out whether these numbers apply only to developed countries, and even if this is specified, there is still a wide range of wages.	Accepted. Accepted text - revised appropriately.
12642	9	38		40		As mentioned in 9.10.3.2, it was revealed that the higher environmental performance, the higher rent and occupancy rate was. Thus, the enhancement of asset value may be considered as one of co-benefits derived from improving environmental efficiency of building.	Accepted. Accepted It is included in the table in Section 9.7.1. No space for a more extended analysis.
9555	9	39	33	39	35	Please, reflect here by using the following information; 1) Residential appliances and equipment represent one of the fastest-growing energy loads. The IEA estimates that at least 3.7 EJ per year could be saved costeffectively by 2030. 2) Lighting represents almost 20% of global electricity consumption. This consumption is similar to the amount of electricity generated by nuclear power. The latest IEA estimates show the total savings potential in residential and services lighting at more than 2.4 EJ per year by 2030. 3) Buildings hold great potential for cost-effective energy savings. The IEA estimates that the energy savings potential in this sector in 2009 will be in the range of 20 exajoules (EJ) per year by 2030, which is the same as the current annual electricity consumption of the United States and Japan combined. (25 energy efficiency recommendation, IEA)	Noted. Taken into account. The text that the comment concerns deleted.
17971	9	39	3	39	3	To avoid confusion, it might be a good idea to change 'all the studies' into 'All the studies for the USA' to avoid the impression that this applies to all studies considered.	Accepted.
17972	9	39	14	39	21	Reduction of demand is included in both (i) and (iv) making this effect redundant.	Accepted. Text revised.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
17290	9	4		7		Comment to Executive Summary. In this section, the energy policy of Appliances should be described clearer. Reducing our use of energy for buildings and appliances decreases the demand for primary energy and is a key means to deliver better economic performance, increase energy security and reduce greenhouse gas. About the energy policy of Appliances, Market Transformation should be highlighted as the concept. Market transformation is a holistic, market-based approach designed to promote the manufacturer, purchase, and use of energy-efficient products, services, and/or practice. As its core, it is an integrated and dynamic strategy that coordinates separate "technology push" and "market pull" policies and programs to trigger a permanent shift in the target market. - Technology oriented approaches are closely related to the international standards for IEC, ITU-T test procedures, etc. and the present performance of target products. policies and programs must precisely reflect the level of available technologies and be mindful of the incubation of emerging technologies with future progress and protection of their intellectual property in mind. - Market oriented approaches target improved communications between players in the target market such as governments, manufacturers, retailers and consumers. They must be analyzed with the section of tools and objects in each segment in order to evaluate the cost effectiveness of implemented policies and programs. The global of market transformation is to create structural and behavioral changes in the marketplace that are self-sustaining over time and ultimately deliver: (i) An increased market share for high energy efficient appliances, services, and practices; (ii) Accelerated deployment of the most efficient technologies; (iii) an array of measures - such as "S & L scheme", "Monitoring & Verification scheme", "Tarining and Education", "Utility DSM programs", "Design competitions", "Financial incentives" and bulk purchasing are employed - targeted at appropriate market participants. (iv) Existing market or competitive forces are tapped or leveraged to achieve energy efficiency gains. For example, there are detailed descriptions in the Good Practices Handbook for Market Transformation (Asia Pacific Partnership on Clean Development and Climate, 2008).	Noted. Will consider
7853	9	4	1	56		It is suggested to include a list of abbreviations in each chapter to increase the user-friendliness.	Accepted. in case the page limit allows.
8851	9	4	1	86		General comments on a whole chapter: The chapters are too long, improvement shall be made to enhance the coherence and focus within and among chapters. e.g., for both chapters 9 and 10 it's important to compile/analyze/present data on the costs of conserved energy for efficiency measures in consistent manner, in comparisons with traditional energy sources and emerging renewable energy addressed in other chapters (e.g. chapter 7). Also, industrial buildings are very energy intensive (e.g., cleanrooms, laboratories) and GHG-intensive. Opportunities to improve efficiency and save energy from this subsector are abundant, and needs to be included/addressed. This may benefit from research outcomes (cleanrooms) published in archival journals for North America and Asia.	Noted.
3094	9	4	11	9	12	page 4 talks of potential savings of 29% by 2030 but doesn't say compared to which year, whereas page 9 talks about 40% but doesn't specify by when. Are these figures consistent? They need to clearly state by year y, compared to year x.	Accepted.
2356	9	4	11	4	11	Avoid qualifying wording without quantification. "cost effective" - how do you define?	Rejected. Following literature
2187	9	4	11	4	29	The Executive Summary gives a sound and synthetic view of the content of Chapter 9. The second alinea should however also mention Positive Energy Buildings as recent developments in green building technology (even for building retrofits); its should not be only restricted to Lean and Net Zero-Energy Buildings, giving the impression that the latter are the ultimate possible targets for green buildings	Noted. Will consider
2857	9	4	17	4	17	change "... GHG storage ..." to "... Greenhouse gas (GHG) storage ..."	Editorial.
2858	9	4	18	4	18	delete the word "fundamentally"	Editorial.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9168	9	4	18	4	20	NZEB and ZEB are economical GIVEN a lot of subsidies for PVs and others - as such the costs to the owner may be negative, but the costs to the society is very high.	Rejected. Impossible to figure out all subsidies in the Energy sector
14408	9	4	2			Clarify whether emissions associated with production of electricity for heating and cooling buildings are attributed to "buildings" or to "energy sector" emissions. In other words, how is double-counting avoided?	Noted. Wherever possible. In Japan, only energy loss of generation is counted for energy sector, which means no double count.
9172	9	4	2	7	27	I got the impression from this exec summary that you put too much emphasis on building hardwares and computer softwares. The source of large energy efficiency gap is lack of proper human energy management systems in place. Proper human capital development and policy intervention to facilitate the coordination among key actores are essential.	Accepted.
9175	9	4	2	7	27	Also I got the impression that this exec summary you put too less attention to appliance efficiency improvement. The share of heating use at building sector is much less In developing countries and appliance efficiency of non-heat use are important there.	Accepted.
18855	9	4	2			Probably you want to add "usage" after "final energy"	Editorial.
2859	9	4	22	4	22	change "... energy active ..." to "... traditional ..."	Editorial.
2860	9	4	25	4	25	The term "ICT" is used for the first in the chapter here. Please define it -- what is ICT?	Editorial.
4575	9	4	25			ICT introduced without definition	Editorial.
6609	9	4	25			Abbreviation 'ICT' has not been defined before	Editorial.
3647	9	4	25	4	25	Please explain the abbreviation "ICT" in the text.	Editorial.
9625	9	4	30			Please, replace strong with particular.	Editorial.
2861	9	4	31	4	31	change "... strong policies ..." to "... strong incentive policies ..."	Editorial.
16882	9	4	32			You note that market forces won't cause needed transformation "fast enough" -- but this is imprecise. Mkt forces under a cap and trade or price based regime? Or simply current situations in most countries where emissions have no price? Simply because emissions do not decline as rapidly as we want, is not necessarily a signal that they are behind schedule -- even under a CO2 price, not all sectors should decline at the same pace.	Noted. Will consider
4789	9	4	33	4	33	Could you please explain what are "plus new business and financial models"?	Editorial.
9169	9	4	41	4	41	Is this decrease due to policy, or economic downturn, or population decrease?	Noted. Will consider
18856	9	4	42			"many new buildings will be added": quantification by giving a range would be good	Noted. Will consider
2856	9	4	5	4	5	change "... , 25-33% of black. ..." to "... , and 25-33% of black. ..."	Editorial.
2855	9	4	8	4	8	change "... energy carriers start using electricity. ..." to "... energy carriers will start using. ..."	Editorial.
11147	9	4	4	4	4	Halocarbon emissions are a significant part of building emissions. I am surprised that there is little mention of legislation etc. within this chapter.	Accepted. Consider suggestion by Writing Team
15211	9	4	2	6	36	In this part we should point out that in developing countries like China, the energy use in different climate zones and in urban and rural area is quite different. And when we are talking about the potential of different technologies, we should recognise that different lifestyles and service demands need different technologies to adapt.	Accepted.
7020	9	4 of 86	40	4 of 86	40	Substitute "industrialized" for "developed", around the middle of the line.	Editorial. Substitute "industrialized" with "developed"
7021	9	4 of 86	45	4 of 86	45	The same as 19th Comment.	Rejected. Unclear
6672	9	40				This section mostly deals with health problems, so it is hard to separate it from the subsequent one. What makes the two sections different should be made more clear; alternatively, the two sections could be combined	Accepted. Text revised.
17912	9	40				On housing please refer to the housing burden of disease and the recent publication of the WHO, 2011. Just an abstract of the executive summary: http://www.who.int/hia/brochure_housing.pdf	Accepted.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6671	9	40	10			I would remove 'equity, distributional impacts, gender' from the section title, as these issues are not addressed	Accepted.
11708	9	40	7	40	9	Rolling blackout after Great East Japan Earthquake on March 11, 2011 and implementation of nation-wide large-scale electricity saving activities give good example of this sentence. (Ex. Nishio and Ofuji, J. Environmental Engineering, Trans. AIJ, No.679, pp.753-759, Yagita et. al., Journal of Japan Society of Energy and Resources, Vol. 33, No. 4 pp.7-16)	Rejected. From the abstracts of these 2 papers (the main text is in Japanese) I understood that they focus on the estimation of the energy conservation effort undertaken in Japan after the big earthquake. However, the text in the Chapter is referred to studies that estimate the damages from large-scale power supply interruptions.
8981	9	40	11	40	41	The title not exactly reflects the content. Only fuel poverty has been discussed.	Accepted.
3104	9	40	11			first para is about housing issues in general but not necessarily directly linked to fuel poverty (cut be cut). Don't really understand the terms 'upliftment and up gradation'	Accepted.
15695	9	40	43			I understand why improved indoor conditions improve the health of people, but why have energy efficiency interventions have implications on the indoor conditions? Does a more energy efficient house have automatically better indoor conditions? Isn't it one aspect of building an energy efficient house to keep indoor conditions at an acceptable level (besides reducing GHG emissions, keeping the costs acceptable, etc.)?	Noted. Taken into account. Energy efficiency interventions results in fuel poverty alleviation in both developing and developed countries as less energy is need for achieving acceptable thermal conditions. Also, substituting traditional biomass for cooking in several developing countries with cleaner fuels and more efficient stoves results in significant public health benefits. These issues are now better reflected in the text.
3501	9	40 of 86				This section has not addressed gender issue, as partially suggested in the section's title.	Accepted. The title changed.
6674	9	41				This is an issue general to energy consumption, not very specific to buildings. It is not useful here	Noted. Taken into account. We have revised the text providing quantitative information for this type of co-benefits derived by studies focusing on energy efficiency in buildings.
6673	9	41	18		22	this part is informative about LIME, but not about the results this tool delivers. It should be removed	Accepted. Text revised
17973	9	41	2			There is a lot more literature on cookstoves also assessed in the SRREN, the GEA and the WEO.	Accepted. Additional material has been added.
8982	9	41	24	41	30	Suggest to be discussed in terms of thermal comfort. Air-conditioning can be applied for hot climates only. The discussion is more appropriate to cover in general or different types of climates.	Noted. Taken into account. In this subsection, workspace productivity is discussed, not the thermal comfort. The subsection has been substantially revised. A meta-analysis is also included.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
17975	9	41	40	41	45	What is the range of these monetisation of outdoor air pollution? With so many references, this could be a second candidate for a meta-analysis beyond the one provided for employment effects.	Accepted. The revised text gives some quantitative information about the magnitude of these co-benefits. However, a meta-analysis was not possible
15696	9	41	46			The first part of this subsection fits better in subsection 9.7.3.3. The part about water saving is a completely new topic, never mentioned before. Either add it to another section as an additional example or skip it (probably the topic will already be discussed thoroughly in other parts of AR5).	Accepted.
6675	9	42	10			The current title of the section is inadequate; when not simply call it 'the rebound effect'?	Accepted.
3281	9	42	13	42	14	For a more up to date review of rebound effects, see Maxwell et al (2011). Maxwell, D., P. Owen and L. McAndrew (2011). Addressing the Rebound Effect - Final Report, European Commission DG ENV.	Accepted.
3282	9	42	15	42	17	The phrase “..... caused by the additional spending.....” is inaccurate. The indirect rebound effect is caused by re-use of the money saved, which is different from simply “additional spending”. Re-use of the money saved will generally include investment (eg saving the money in a bank) as well as additional spending. The balance of how the money is re-used (saved or re-spent) is important for estimating the rebound effect, depending on the savings ratio. See Druckman et al 2011. Druckman, A., M. Chitnis, S. Sorrell and T. Jackson (2011). "Missing carbon reductions? Exploring rebound and backfire effects in UK households " Energy Policy 39: 3572–3581.	Accepted.
3283	9	42	29	42	31	Chitnis et al (2012) estimate the direct and indirect rebound effect to be 5-15% for a selection of typical energy efficiency measures applied to the UK domestic building stock. Chitnis, M., S. Sorrell, A. Druckman, S. K. Firth and T. Jackson. (2012). "Estimating direct and indirect rebound effects for UK households. Sustainable Lifestyles Research Group: Working Paper 01-12." available from http://www.sustainablelifestyles.ac.uk/sites/default/files/publicationsdocs/slr_working_paper_01-12.pdf .	Accepted.
6676	9	42	39			effective energy efficiency policies can reduce the rebound': Giraudet and Quirion (2008) show that this is true for the tax, but not for other instruments (Giraudet, L.-G., P. Quirion, 2008, "Efficiency and distributional impacts of tradable white certificates compared to taxes, subsidies and regulations", Revue d'économie politique, 118(6):885-914, http://www.cairn.info/resume.php?ID_ARTICLE=REDP_186_0885)	Accepted.
6677	9	42	44			I don't see what 'public perception' means here	Rejected. No space to explain, cannot place in a glossary either
6678	9	42	44		45	this section is little informative	Accepted. Restructured within short space allocated
15500	9	42	45	43	3	Quote examples not only link with USA.	Accepted.
8983	9	42	7	42	9	How do the green schools reduce the water usage by 32%? Is it because of reuse the rain water or due to energy efficiency measures? If it is due to the former reason, is this part of mitigation strategies? If it is because of the latter reason, it is better to mention the technologies/ measures that applied in this case. 32% is impressive.	Accepted. Explanation added.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
3105	9	42				Heading is misleading - the rebound effect is neither a technological risk nor public perception	Noted. Location of the analysis of rebound needs discussion. It's no even obvious it should be in Chapter 9 at all. There are different discussions in Chapters 7, 8, 10 and 15 (but nothing in Chapter 3). I think ours is the most best (e.g. Ch 15 only considers very old literature) Noted that this is rather misleading. However, it is a risk/co-cost/spillover issue according to our definitions. It will read better if other issues are added.
15697	9	42	10			New title suggestion: Rebound Effect	Noted. Location of the analysis of rebound needs discussion. It's no even obvious it should be in Chapter 9 at all. There are different discussions in Chapters 7, 8, 10 and 15 (but nothing in Chapter 3). I think ours is the most best (e.g. Ch 15 only considers very old literature). But it is proposed to retain the title for consistency with other sector chapters.
15698	9	42	44			New title suggestion: Integrating co-benefits into decision-making frameworks	Accepted. In 9.7.5 now
3106	9	42				Not sure why this section is called 'public perception' - it seems a mishmash of different things. First sentence mentions several US voluntary programmes but so what - what are you trying to say here? This whole section isn't very clear in what it's trying to say.	Accepted. Section rewritten
3502	9	42 of 86	10			The title of the sub-section 9.7.4 does not reflect well its content. Since this section highlights the rebound effect, please consider to include a discussion on mitigation technologies that address this issue i.e. pre-paid meter and HAN.	Accepted. But it is proposed to retain the title for consistency with other sector chapters.
12584	9	43				Institutional/cultural/legal Barriers also include slow reaction of relevant govt. departments (like municipal affairs or urban development etc.) and inadequate provision of green design elements in construction guidelines that directs the commissioning of public sector buildings in some countries.	Accepted. Included, considering short space
2360	9	43				This table is in principle very helpful. Currently the formulations are very high level. Try to be much more specific for space reasons, possibly create links to other parts instead of recreating tables	Accepted. Specific references given
6680	9	43				Bullet points would make the reading easier	Rejected. Short space available
6679	9	43				It is very surprising to have only a table to summarize the issue of barriers, which is very important and very well documented issue. See for instance the comprehensive and laready very much cited review by Gillingham, Newell and Palmer, 2009 (Energy Efficiency Economics and Policy, in the Annual Review of Resource Economics	Rejected. Short space available and no case studies post-2007 mentioned

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9913	9	43	14			<p>An analysis of 104 empirical studies of innovation to change showed the following barriers, that could refine the discussion of barriers:</p> <p>Issues of resourcing (76%), for instance, “not enough resources” (Post and Altman 1994), “lack of adequate resources such as time and staff” (Adams and McNicholas 2007), limited or no budgeting (e.g. Harris 2000 and Anumba et al. 2006), access to capital and lack of time (Rohdin and Thollander 2006).</p> <p>Issues of capabilities (75%), for instance, “low technology literacy” (Stewart, Mohamed and Marosszeczy 2004), “ill-equipped in terms of training and expertise” (Whitaker 1987), “employees are not trained” (Tamimi and Sebastianelli 1998), “lack of understanding” (Waldron 2005), “lack of technical skills” (Rohdin and Thollander 2006), “lack of skill, knowledge and expertise” (Kirkland and Thompson 1999), etc.</p> <p>Issues of communication (64%), for instance, “communication barriers” (Heide, Grønhaug and Johannessen 2002), “communication overload and distortion” (Allen 2002), “lack of communication within the team” (Attaran and Nguyen 1999), “lack of communication among those sharing responsibility for different aspects” (Kunda and Brooks 2000), “poor communication practices that damaged employee commitment to projects” (Jacobs et al. 2006), “tension among departments arising from the incompatibility of actual or desired responses” (Aggarwal 2003), etc.</p> <p>Issues of organizational structure (62%), for instance, bureaucracy (e.g. Molinsky 1999; Borins 2000; Abdul-Hadi, Al-Sudairi and Alqahtani 2005), “salary structure” (Al-Qirim 2007), “complexity, centralization, and formalization” (e.g. Allen 2002), “rigid organizational boundaries” (Butler 2006), “departmental fortresses” (Cicmil 1999), and organizational structure (e.g. Scarbrough and Lannon 1988; McGaughey and Snyder 1994; Yauch and Steudel 2002).</p> <p>Abdul-Hadi, N., Al-Sudairi, A. und Alqahtani, S. (2005): Prioritizing barriers to successful business process re-engineering (BPR) efforts in Saudi Arabian construction industry, In: Construction Management & Economics, Vol. 23, Nr. 3, S. 305-315.</p> <p>Adams, C.A. und McNicholas, P. (2007): Making a difference: Sustainability reporting, accountability and organisational change, In: Accounting, Auditing and Accountability Journal, Vol. 20, Nr. 3, S. 382-402.</p> <p>Aggarwal, N. (2003): Organizational Barriers to Market Orientation, In: Journal of Management Research, Vol. 3, Nr. 2, S. 87-97.</p> <p>Allen, R.Y.W. (2002): Assessing the impediments to organizational change: A view of community policing, In: Journal of Criminal Justice, Vol. 30, Nr. 6, S. 511-517.</p> <p>Al-Qirim, N. (2007): The adoption and diffusion of E-commerce in developing countries: The case of an NGO in Jordan, In: Information Technology for Development, Vol. 13, Nr. 2, S. 107-131.</p> <p>Anumba, C.E.H., et al. (2006): Understanding structural and cultural impediments to ICT system integration: A GIS-based case study, In: Engineering Construction & Architectural Management, Vol. 13, Nr. 6, S. 616-633.</p> <p>Attaran, M. und Nguyen, T.T. (1999): Design and implementation of self-directed process teams, In: Management Decision, Vol. 37, Nr. 7, S. 553-561.</p> <p>Borins, S. (2000): What Border? Public Management Innovation in the United States and Canada, In: Journal of Policy Analysis and Management, Vol. 19, Nr. 1, S. 46-74.</p> <p>Butler, J.C. (2006): Ten Lessons Learned: Data Warehouse Development Project, California Department of Fish and Game. In: CrossTalk: The Journal of Defense Software Engineering, Vol. 19, Nr. 10, S. 16-20.</p>	Rejected. Old references, prior to 2007
4264	9	43	41			<p>Markandya et al showed that in India when the health co-benefits of reduced particulate air pollution were taken into account using EU methodology to monetise the benefits they covered the costs of mitigation. This was less so in the case of China and the EU because of lower baseline levels of air pollution but the benefits were still substantial. Markandya A, Armstrong BG, Hales S, Chiabai A, Criqui P, Mima S, Tonne C, Wilkinson P. The Lancet - 12 December 2009; 374, 9706: 2006-2015</p>	Accepted. The revised text gives some quantitative information about the magnitude of these co-benefits. We included a more detailed paper of the same research team concerning this aspect.
3107	9	43				<p>should mention here that barriers into energy efficiency have been widely studied. This (short) section seems to be in the wrong place - should be with 9.10 as this is about policies to overcome the barriers.</p>	Accepted. Section structure readapted

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12636	9	43				"Principal-agent problem(Tenant-owner problem)"should be featured as a significant barrier in building sector. Following document may have implications. Owner-Tenant Engagement in Responsible Property Investing http://www.unepfi.org/fileadmin/documents/TenantEngagementReport.pdf	Accepted. Consider suggestion by Writing Team. Add "Principal-agent problem(Tenant-owner problem)" to Barriers column and "Institutional, cultural and legal" row in Table 9.9.
12643	9	43		43		The complexity of interaction and visious spiral of shifting responsibilities among many stakeholders are building value chain is referred to as a major barriers to energy efficient buildings. (WBCSD, "Energy Efficiency in Buildings Facts & Trends", 2007) (RICS, "Breaking Vicious Circle of Blame- Making the Business Case for Sustainable Buildings", 2008)	Accepted. This comment is true, but it is difficult to respond with simple expression. Consider suggestion by Writing Team. Add "too many stakeholders interact along a building value chain" to Barriers column and "Institutional, cultural and legal" row in Table 9.9
15700	9	43	14			The table gives a good summary of the barriers and opportunities that exit. However, wouldn't it be better to put this table (it's hardly a section) more at the end of chapter 9 and call the section something containing the word "summary"?	Accepted. Section structure readapted
15214	9	43	19	43	23	How the lifestyle is changes in developing countries is also of importance.	Accepted. Consider suggestion by Writing Team. Add "Lifestyle change in developing countries" to "Opportunities" column and "Institutional, cultural and legal" row in Table 9.9
3504	9	43 of 86				Under "Opportunities" column of "Institutional, cultural and legal" row, it is recommended to add (1) the opportunities presented to education sector, including R&D at tertiary level, (2) Inter-governmental agencies action plans, (3) cross-sectoral relationship, (4) public private partnership, etc. Overall concept can be found in [Cam C.N.W. (2012). Technologies for Climate Change Mitigation: Building Sector. Denmark: UNEP Riso Centre.]	Rejected. Overall points were already included, found no practical case to be cited. Barriers structure was the same from AR4.
2362	9	44				Taking a critical view, this chart can be interpreted that we have no clue what is needed in buildings to achieve certain pathways. Rethink if this chart is needed at all.	Rejected. Chart conveys the right messages
6681	9	44			45	the EMF25 report (http://emf.stanford.edu/files/pubs/22530/summary25.pdf) and the 2011 Special Issue of the Energy Journal on Energy Efficiency of the Energy Journal provide such modelling comparisons	Noted. Will check
15699	9	44				What do the diagonal lines mean? The figure is rather complicated, due to so many lines.	Noted. Clarify
15501	9	44	15			Delete additional brackets after Krey et al., 2012	Editorial. CSAs please check
9556	9	44	4	44	6	Please, take into consideration following; the buildings sector has an important role to play in CO2 emissions reduction. Energy efficiency options are available in the buildings sector that can reduce energy consumption and CO2 emissions from lighting, appliances and heating and cooling rapidly and at low cost. But achieving deep cuts in energy consumption and CO2 emissions in the buildings sector is a challenge. The implementation of these technologies will require much more ambitious policies, particularly in relation to building shells in the existing stock of buildings in OECD countries, as well as decarbonising the energy sources used. (ETP 2010, IEA, p218)	Noted. Already conveyed such message
4263	9	44	40			It is the combination of insulation with improved ventilation control for example through mechanical ventilation with heat recovery, that results in the health benefits by reducing exposure to indoor air pollution and to the ingress of outdoor pollutants if filters are fitted and maintained. In the Wilkinson study referred to it was assumed that the 20% of dwellings that were most tightly sealed and insulated were fitted with MVEHR	Noted. Checked.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
3167	9	44	3			Section 9.9.1 is a good model of what's needed in other sectoral chapters—a link back to chapter 6 so that readers can see how a common set of transformation pathways affects each sector.	Noted. Thanks. No action
2363	9	45				Split into "total" and "hvc" energy use	Noted.
2197	9	45	3	45	22	The evolution of the final energy demand for buildings in Switzerland, held constant over the period 1974 to present (see http://www.bfe.admin.ch), can be used to strongly back-up the argument that "despite all assumed increases in GDP, floorspace and service levels global building energy use can be held at least constant or decrease as a result of measures".	Noted. Will check
8984	9	46				What are the elements that included in 'resident others'? Heating and cooling usually play the major consumptions. Other than that are the appliances, refrigerators, TVs, etc, which is quite surprised to be the major and a lot higher than heating and cooling demands.	Noted. Clarify please
15502	9	46				Add a sub chapter on initiative to reflect building performance (Common Carbon Metric from UNEP-SBCI or others) – Link somewhere this information with baseline needs - Can be in Chapter 9.10	Rejected. No space
6682	9	46	12			the previous sections demonstrated that many strong barriers...': again, the nature of the barriers is not formally discussed, nor 'demonstrated'	Accepted. Change wording
9557	9	46	12			Please, replace strong with particular.	Editorial.
15701	9	46	12	46	12	"The previous sections demonstrated ..." Such sentences take a lot of space and are, in my point of view, not really necessary and sometimes confusing. My sentence would be "Strong barriers prevent the full uptake of energy saving measures and market forces alone will not achieve ..." Maybe it's just a matter of opinion ...	Accepted. Change wording
9558	9	46	14			Please, add the following; significant evidence shows that appliance MEPS and labelling programmes have generally been successful in terms of their effectiveness in saving energy and cost efficiency. (Technology roadmap Energy-efficient Building, 2011, IEA, p22)	Noted. Will consider
9559	9	46	19			Please, add the following; McKinsey's global marginal abatement cost curve (MACC) places efficient lighting systems and air conditioning as measures that achieve GHG emission reductions at zero or negative cost (between -60 EUR/tCO ₂ and -80 EUR/tCO ₂), i.e. at no net cost to the economy. In MACC analysis developed by McKinsey for Germany, the UK, Australia and the United States, residential appliance, equipment and lighting efficiency improvements are negative cost measures across the four countries, though the specific cost varies (AP Envecon, 2009). Most of the studies emphasize the importance of policies concerning end-user efficiency (residential and industrial energy demand) and some studies describe measures in this field as crucial factors in the short run (2010 to 2030) to reach the emission targets set for the long run (e.g. ETP BlueLine). The proposed measures comprise the thermal integrity of buildings and heat pumps (Energy Roadmap 2050, Impact assessment, European commission, p104) http://ec.europa.eu/energy/energy2020/roadmap/doc/sec_2011_1565_part2.pdf	Noted. There is a lot of controversy about McKinsey's curves
3108	9	46	22			which 5 years are these?	Accepted. Clarify
18896	9	46	6			"Figure 9.10": Probably this should read "Table 9.10"	Accepted. CSAs please check
11709	9	46	10	56	11	In the developing countries in which increase in floor area is expected, is there any other policy tool than financing shown in this subsection?	Rejected. All the policies presented (e.g. S&L, building codes, etc.) in this section apply to developing countries. No action
6684	9	47	14			Again, I could not find the reference cited as 'Anonymous 2009' on the internet	Accepted. Provide this reference
2903	9	47	2	47	2	(Lewis, 2010) is not in the References section at end of chapter	Accepted. Provide this reference
3109	9	47	2			should say 'these buildings' will still be standing	Editorial. CSAs please check

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6683	9	47	2			I could not find the Lewis 2010 reference	Accepted. Provide this reference
11781	9	47	20	47	21	In the paragraph "Energy efficiency 'white' certificates" at page 56, concern in the future is described. Thus in order for readers to understand it's not the best way to take, [only in the short-term] should be added after this sentence.	Rejected. Not Accepted WhC have proven to be cost-effective, this bullet point as it is in the FOD should be modified. No action
9562	9	47	20	47	21	Please, provide the reason of very cost effective with text as overhead costs incurred in SMEs shoulder ut's burden and most of savings are delivered by ESCOs.	Noted. Consider suggestion by Writing Team. Partly accepted, we can include a reference to ESCOs but the rest of the comment not very clear
6685	9	47	33		36	this sentence is redundant and very general. It can be removed	Rejected. Cannot accept this comment, it is very important to have this statement on co-benefits of EE policies
18897	9	47	5			Orthography: should read "countries for example"	Editorial. Correct the spelling mistake
12633	9	47	41	47	4	"Tax credit" for energy efficient building seems also emerging .	Accepted. OK accepted it will be mentioned in the paragraph on taxation. Consider reviewer's suggestion
3505	9	47 of 86	33		40	It is recommended to start this paragraph by highlighting the importance of deploying policies that promote the implementation of the building sector's mitigation technologies to be in line with the national sustainable development goals. Detailed analysis can be found in [Cam C.N.W. (2012). Technologies for Climate Change Mitigation: Building Sector. Denmark: UNEP Riso Centre.]	Accepted. Consider reviewer's suggestion
2880	9	48	16	48	16	(Bertoldi, 2010) should be (Bertoldi et al, 2010)	Accepted. Consider correction
6687	9	48	23		24	The reference to Brussels' building code seems a bit anecdotal. It can be removed	Rejected. NOT Accepted this is very good example, which I would like to keep in the text. No action
6686	9	48	5			Another pioneering publication on sufficiency is: Alcott, 2008, 'The sufficiency strategy: would the rich-world frugality lower environmental impact', Ecological Economics	Accepted.
3111	9	48	9			personal carbon allowance - this is only a potential policy instrument, it hasn't been introduced anywhere and would be politically very difficult to do. Not sure about the link between property taxation and energy sufficiency. Property taxation is usually done for other reasons, need to explain their use in this instance.	Accepted. Distinction between policies that have been implemented and those that have not. OK to explain that propose tax proposal is set as function of total energy consumption of the household has done in some countries for cars.
9514	9	48	9	48	12	delete these 2 sentences - It is not acceptable to mention personal carbon allowance in IPCC report	Rejected. No action. It's a form of carbon trading, so the comment is unjustifiable.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9435	9	48	9	48	12	<ul style="list-style-type: none"> · Deletion of the entire sentence is needed. · A policy that sets out carbon emission allowance per person or yearly kWh consumption per person does not have universal relevance. An IPCC document that includes this stipulation will lose relevance as a world-wide agreement applicable beyond particular countries or regions. Such a policy would also infringe on individual freedom and will not gain consensus. □ 	Accepted. Partly accepted, will be challenging to have it accepted by population, but has some additional benefits such as social equity. IPCC does not prescribe any policy nor recommend any policy, just indicates which are the possible policy and in order to induce sufficiency personal carbon allowances is one of the few policy available.
6688	9	49	10			there is agreement among experts and it is widely reported in the literature: further evidence should be provided on that point. All the more that I could not find Harmelink et al 2008 in the reference list	Accepted. (1) Provide more peer-reviewed literature (2) Include reference in the reference list
2904	9	49	45	49	45	(Harmelink et al, 2008) is not in the References section at end of chapter	Accepted. OK it will be added
3112	9	49				why is this a subsection? It's one sentence and doesn't really say anything.	Accepted. OK we can delete this subsection for individual policy instruments
15702	9	49	5			This subsection holds just one sentence, which can be added around the first time table 9.10 is mentioned (page 47, line 12). As a result, the title of 9.10.2.3 can be skipped as well (the title only, not the content). If you want to keep the title, then keep it and put an extra subsection before the instruments in section 9.10.2, which can be called "Policy instruments" or something like that.	Accepted. OK we will accept this comment, see also previous comment
3113	9	49				this could be merged with 'a holistic approach' on page 48	Rejected. NO we need a section specific to policies packages. No action
17291	9	49				Comment to Policy packages. In this section, the energy policy of Appliances should be described clearer. In many cases, policy measures of Appliances are used in combination to increase their impact. There are numerous examples, such as "MEPS and performance labels", "Endorsement labels and procurement policies" and "Labels, retailer programmes and customer incentives. However, with effectiveness of energy policy of Appliances, there is no one single model to employ; rather, each program varies in terms of structure, funding, and implementation. The specific policies, regulations, programs, and incentives needed are highly dependent on the nature of the target product or the technological area and conditions (e.g. market structure, resources, institutional capacity) of the target market area (e.g. national, state, regional grouping), and the background of each country such as its history, culture, custom, economical development, national awareness, etc. For examples, The Japanese Top-runner Program is not MEPS. As the policies for market transformation depend on the status and conditions of the target market. There are detailed descriptions in the Gadgets and Gigawatts - Policies for Energy Efficient Electronics (IEA, 2009).	Accepted. Include comment in the Text
3507	9	49 of 86				It is recommended to include the successful case example from Singapore government's green building policy packages, termed as Green Building Master Plan.	Accepted. OK good suggestion, it will be included
4790	9	5	1	5	3	I am not sure that this sentence is correct and true. It depends on several parameters (devil in details), and pricing could be more effective than regulation/programs. Have you got evidence to prove this sentence?	Noted. Will consider

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
16883	9	5	1		7	No evidence that prices influence building EE? Can you not examine energy efficiency in high price electricity markets like Germany and compare to low price markets like parts of U.S. to test? Is it really true? Generally, if there is no response or it is a smaller response than expected, it means the price has not increased enough, or else the models looking at the costs needed to become more efficient are not factoring in other costs that also influence peoples' decisions (opportunity costs, time, etc).	Noted. Will consider
9170	9	5	1	5	7	It is very important message to policy maker hence should be put in the exec summary.	Accepted. Will consider
9171	9	5	1	5	7	But energy price (not necessarily "mitigation policy instruments") does affect the energy consumption behaviour. It should be noted. I imagine Japan and EU are spending less than AUS and US and it is (at least partly) due to the difference in energy price.	Noted. Will consider
18857	9	5	12	5	15	This sentence is unclear. Why is "most ambitious policies" worse than "best practice standards"	Noted. Will consider
7697	9	5	20	5	24	This statement is unsupported by the literature (white lit anyway). I couldn't find support in the chapter but I may have missed it.	Noted. Will consider
6610	9	5	22		23	There is no comment throughout the report about the persistence of these potential energy savings	Noted. Will consider
6611	9	5	24			The word 'risk' seems inappropriate here. Alternative suggestion: 'likelihood'	Noted. Will consider
16884	9	5	34		45	Similar to the previous comment, I would encourage caution in claiming that price does not impact building efficiency value or investment -- I would also be very cautious in depending on engineering models that determine the value of energy savings. These will be very different from actual market potentials. The engineering or economic models frequently fail to account for other costs that dissuade people for making the investments that look like obvious energy saving winners.	Noted. Will consider
6612	9	5	42			The existence of co-costs should be mentioned, even though they might be largely offset by co-benefits	Noted. Will consider
16256	9	5	49	5	50	Unclear: Why should uniformization be needed in order to address the problem of fragmented actions? Uniform solutions might be less flexible to take the specific context into account.	Rejected.
3487	9	5 of 86	37		40	It is recommended to add: "decreased the needs to invest in additional/expansion of communal energy supply/distribution infrastructure." There are cases where more energy efficient buildings in a community are the very reason for local governments to revoke the plan of expanding/building new power plant.	Noted. Will consider
7023	9	5 of 86	18	5 of 86	18	Add "zero and" after the word "adequate".	Editorial.
7024	9	5 of 86	22	5 of 86	22	Substitute "industrialized" for "developed", after the word "In", at the beginning of the line.	Accepted. Substitute "industrialized" with "developed"
7025	9	5 of 86	25	5 of 86	25	Substitute "industrialized" for "developed", as the first word of the line.	Accepted. Substitute "industrialized" with "developed"
7022	9	5 of 86	6	5 of 86	6	Modify the sentence after the word "both", for the following one: "promotion of energy efficiency and reduced energy demand".	Editorial.
9560	9	50		51		Please, wrap up and simplify policies described by categories of labeling, MEPS, procurement, fiscal measures, and tradable energy and GHG saving scheme.	Accepted. Categorise as agreed in Vigo. OK (partly accepted) we have already in each row a different policy, but we could categorise them as agreed in Vigo on four main categories

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4739	9	50		52		<p>The element of Table 9.10 in the 13th row and 2nd column could be modified as follows Incentives (e.g.grants and subsidies) and financing (e.g.low interest loans,) for investments in energy efficiency, an in the UK Green Deal pay as you save scheme, or Japanese housing eco-point system, provides shopping point when the consumer invest energy efficiency of housing.</p> <p>The element of Table 9.10 in the 16th row and 2nd column could be modified as follows Information campaign to stimulate both behavioral changes (e.g. to turn down the thermostat by 1 C during the eating season and Japanese Cool-Biz Campaign) as well as investments in energy efficiency technologies: new developments in the area of smart metering will also impact on consumer behavior</p>	Accepted . OK accepted (we need paper reference with the evaluation of this policy)
9173	9	50				good table. But it needs much more explanation in the main text to get the message across.	Accepted . Introduce a message in the table
9174	9	50				I will refer to this table and some numbers within in our ch15 SOD.	Accepted .
9176	9	50				kazuari 2007 should be Kainou 2007.	Accepted . To be done
6689	9	51				Giraudet et al 2012 in the second row, fifth column refers here to: Giraudet, L.-G., L. Bodineau, D. Finon, 2012, "The costs and benefits of white certificates schemes", Energy Efficiency, 5(2):179-199. This should be added in the reference list	Accepted . To be done
10013	9	51				In the third columns from top, Tokyo cap & trade program is mentioned. But this example should be deleted completely. Tokyo cap & trade program is currently under the special measure for the Great East Japan Earthquake, which allows CO2 emission increase caused by home generation, which means the program is not implemented under normal condition. Therefore, Tokyo cap & trade program is not considered as a good example of cap & trade policy.	Accepted. Should delete example. OK we can take it out, though I personally think it was a good policy, just suspended because of the earthquake
2881	9	53	13	53		define ESCOs - energy services company?	Accepted . Provide definition. Definition is available in the prior draft
2905	9	53	33	53	33	(Milin and Bullier, 2011) is not in the References section at end of chapter	Accepted.
3114	9	53	7			The UK government is not planning to subsidise the interest rate. However, some measures installed under the Green Deal (notably solid wall insulation) will be subsidised under the separate energy company obligations (where energy companies have obligations to meet carbon targets)	Accepted. Rewrite the section
2906	9	54	3	54	3	(RSA, 2009) is not in the References section at end of chapter	Accepted.
15504	9	54	38			Present more in detail MRV reality and NMM opportunities link with the build environment. A dedicated sub chapter on NAMAs will make sense (see Johnson Controls or others reports) - Can be also in sub-chapter 9.10	Rejected. NMM and NAMA new concepts still being negotiated in COP/MOP climate meetings
15503	9	54	38	55	9	Suggestion to add a more comprehensive chapter on this issue. This sub-chapter is a crucial one as it is link also with methodologies to report buildings performance in a climate perspective. At least explain methodologies to secure data and carbon reduction. Explain difficulties link with CDM design (see UNEP-SBCI, Risoe)	Rejected. 1. No CDM to be discussed 2: 2 sentences to explain difficulties link with CDM. No space to discuss CDM methodologies in this chapter. 1-2 sentences highlighting these difficulties would be more than enough and provide reference.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
13698	9	54	40	55	9	Replace "The CDM is regarded ... SHS type of projects" by: Replace 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 building sector has increased, particularly with regard to efficient lighting schemes UNEP Riso Centre (2012)". 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. Consider reviewer's comment as suggested but do not replace; agree to include, but not replace any sentence.
2198	9	54	5	54	31	Real estate values of Minergie certified buildings in Switzerland are generally higher than those of state-of-the-art buildings in 2012 for reason of better aging perspectives for the future, backing-up the assertion made for Leed certified buildings in the US.	Noted. References not provided though
2907	9	54	7	54	7	(Lewis, 2010) is not in the References section at end of chapter	Accepted.
6690	9	54	7			Lewis 2010 is missing in the reference list	Accepted.
2882	9	54	9	54	9	should not (UNEP FI PWG) be changed to (UNEP FI 2009)?	Rejected. It is abbreviation of text provided in the section. No action
12644	9	54	15	54	19	The effects of environmental performance on the rent and occupancy rate have been studied intensively in recent years (Norm Miller et al., "Does Green Pay Off?", 2008)(Piet Eichholtz et al., "Doing Well by Doing Good", 2008) (Norm Miller et al., "Does Green Still Pay Off?", 2010)	Accepted. Reference the proposed literatures
3509	9	54 of 86	39		48	It is essential to elaborate the potential of CDM (Programmactic CDM) that are more "friendly" to the building sector. For more details, please refer to [Cam C.N.W. (2010). On Formalising Building Sector in the Renewal of International Climate Change Treaty. International Journal of Sustainable Development. InderScience Publishers	Rejected. No space to discuss pCDM here it would require a lot of discussions. No action
11288	9	55	35	55	35	To be included: "Green mortgage programme in Mexico is designed to promote sustainable building by offering a very attractive interest rate for such building."	Noted. Will check
3650	9	55	9	55	9	Please also take into consideration that conctional 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. No space to discuss pCDM here it would require a lot of discussions. No action
11710	9	57	12	57	22	Line feed is missing	Accepted.
11289	9	57	3	57	3	It is worth mentioning that more developing countries are looking at green building design as a solution for their energy crises. Some of them have initiated the process of reviewing their building code to include resources efficiency measures.	Accepted.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9436	9	57	30	57	32	<ul style="list-style-type: none"> · Deletion of the phrase ‘on-site renewable energy generation and cogeneration’ is needed. · This is because it does not reflect the reality. · Power generation efficiency of cogeneration is lower than that of the most advanced centralized power plant, if the usages of heat and electricity are not balanced, and therefore does not reduce dependence on imported fuel. While cogeneration has limitations on the kind of fuel (gas, oil) that can be used, centralized power plant is capable of using various types of fuel (gas, oil, coal, uranium, etc.) Take coal, for example, having the advantage of energy security in terms of both geopolitics and the amount of reserves. · Refer to the following documents. <p style="text-align: right;">Pepermans et al.[1] discussed the issue of energy security of distributed generation. They say in some discussion, energy security is 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-dispatchable 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.</p> <p>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</p> <p>[2]CIRED (1999) Disperse Generation Preliminary Report of CIRED Working Group No.4 http://www.cired.be/WG04-Report%20.pdf [1]page 794 right column lines 17-42 [2]page 5 left column lines 10-14</p>	Noted. Will check. Sources provided are old
2863	9	6	10	6	10	change "... Building ..." to "... building ..."	Editorial.
6614	9	6	26		30	In terms of co-costs: what about loss in amenities due to efficient lighting, mercury pollution due to efficient lighting, inconvenience due to retrofit works?	Noted. Will consider
16886	9	6	26		30	Seems redundant with previous paragraph.	Noted. Will consider
6613	9	6	27			It seems like CB and CR haven't been defined	Accepted. CSAs please check
9426	9	6	32	6	33	<ul style="list-style-type: none"> · Addition is needed for the description of “top runner”. · “Top runner” should be introduced as an example of Japanese high energy efficiency technologies, also in the executive summary. 	Noted. Top runner approach is already included in Table 9.10.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6615	9	6	37	7	13	Since the equation that is eventually used is the one on page 7, line 13, the discussion on other equations should be shortened or even removed from this summary	Noted. Will consider
16887	9	6	37	7	27	This is interesting but I wonder how useful it is to policymakers or those trying simply to see what can be done in this sector to lower emissions. Could you instead provide a sort of cost curve for the most cost effective means to lower energy use by building type, age, climate zone --- perhaps relate this to different levels of retail cost of electricity.	Rejected. Would be too simplified
2862	9	6	46	6	46	define the terms (Cffse) and (Crepe)	Accepted. CSAs please check
16885	9	6	8		15	I would argue that the goal for buildings should not be net zero energy use, rather low emissions associated with energy use at the lowest total cost. It is cheaper to do zero energy in building retrofits? Or would it be less costly to decarbonize the energy system?	Noted.
7852	9	6	8	6	15	Only in reading this paragraph this approach becomes apparent. It is suggested that the other chapters (e.g. energy, transport, agriculture) make it also as visible as this chapter. Although this approach might look somehow different in the various chapters the terminology used should be the same throughout the whole volume!!	Noted. Liaise with other chapters
7026	9	6 of 86	6	6 of 86	6	Add "zero and" after the word "Delivering", around the middle of the line.	Accepted. CSAs please check
2883	9	68	37			insert new reference - Hughes, P. J. and J. A. Shonder (1998). The Evaluation of a 4000-home Geothermal Heat Pump Retrofit at Fort Polk, Louisiana: Final Report. Report No. ORNL/CON-460. Oak Ridge National Laboratory, Oak Ridge, TN.	Rejected. The reviewer has not indicated where this should be included in the text. Consequently not useful to include in the list of references
8352	9	7	1	7	27	Kaya identity is shown in detail in chapter 5. I suggest this page be moved to p.26 in chapter 5.	Noted. Will consider
4728	9	7	1			Executive Summary looks good. But it doesn't summarize body text. · There is no explanation about identity in body text. · There is no text about lifestyle (page5, Line20-23).	Noted. Will consider
2188	9	7	1	7	27	The conceptual equations mentioned in this alinea are not obvious (without a proper introduction and explanation of the different literal symbols used in the equations). As they do not appear later on in the text of Chapter 9, their presence in the Executive Summary is somehow questionable.	Noted. Will consider
11697	9	7	1	8		It is very easy to understand to classify all mitigation options such as BiRES and HPE into four major mitigation strategies; Carbon efficiency, Technological efficiency, Systemic/infrastructural efficiency and Demand Reduction. However, the description in sections 9.3, 9.4 are not correspond to these classifications. It is strongly recommended that rearrange sections 9.3, 9.4 depending on the four major mitigation strategies.	Accepted. Consider suggestion by Writing Team
18858	9	7	13			Consider to introduce an indice running over different energy devices for the last three factors	Noted. Will consider
6616	9	7	14		27	This paragraph is too long	Editorial. CSAs please check
18859	9	7	15			Consider adding "for non on-site-generated energy see Ch.7"	Accepted. CSAs please check
7027	9	7 of 86	14	7 of 86	14	Add "zero and" after the words "fuel switch to", around the middle of the line.	Accepted. CSAs please check
2884	9	79	26			insert new reference - Shonder, J. A., and P. J. Hughes. (1997a). Electrical Energy and Demand Savings from a Geothermal Heat Pump Energy Savings Performance Contract at Fort Polk, Louisiana. ASHRAE Transactions, Vol 103, Part 2, pp 767-781.	Rejected. The reviewer has not indicated where this should be included in the text. Consequently not useful to include in the list of references
2885	9	79	26			insert new reference - Shonder, J. A., and P. J. Hughes. (1997b). Estimated Maintenance Cost Savings From a Geothermal Heat Pump Energy Savings Performance Contract at Fort Polk, Louisiana.. ASHRAE Transactions, Vol 103, Part 2, pp 757-766.	Rejected. The reviewer has not indicated where this should be included in the text. Consequently not useful to include in the list of references

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12574	9	8				Last row- last column: Building certificates & ratings seem to fit better under last row fourth column	Noted. CSAs please check
2357	9	8				This is the key table people will look at. 1) Drive to fill all fields with best information (blank spaces look odd). 2) Add accompanying text that numbers include duplications (and must not be added), 3) work more on synthesis for potentials - do show synthesis ranges instead of examples 4) if you show cost, use common metric (eg. \$/tCO ₂ e)	Noted. Will consider
10009	9	8				"Policies" should include "voluntary target scheme" because there are successful examples of "voluntary target scheme" in the world. Each industry in Japan has voluntary target and the voluntary target scheme has played a big role, as described in (Yamaguchi, 2012, page35 and 154), (Manuel, 2010, page 6 and 13), and (Yamaguchi, 2010, abstract). In addition, there is also a successful example of "voluntary target scheme" in Netherlands, as shown in (Martijn, 2002, page162). These reference sources are same as for No63. On the other hand, 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). These literatures are listed in the No62 line of this table. In addition, CO ₂ leakage caused by the implementation of the ETS happened actually through international transfer of industry, as shown in (Rosendahl, 2011, abstract), (Aichele, 2012, page336), and (Peters, 2011, page1). These literatures are listed in the No50 line of this table.	Noted. I think the best place for describing "voluntary target scheme" is Table 9.10.
4729	9	8	1			Table9.1 shows Mitigation options such as Highperformance building envelope, Efficient appliances, Efficient lighting and Efficient HVAC systems. Those items should be described in the body text.	Accepted. Will consider, given space allocated
7028	9	8 of 86		8 of 86		Substitute "industrialized" for "developed" in the first line of the fourth cell, in the fifth column.	Accepted. Substitute "industrialized" with "developed"
2864	9	9	13	9	13	define "IT" - it is the first time used in the chapter	Accepted.
3098	9	9	16			passive house standard in Upper Austria - the 2006 figure is very out of date. I've seen figures of 25% for Austria (http://www.igpassivhaus.at/%C3%96sterreich/Wir%C3%BCberuns/tabid/63/language/de-DE/Default.aspx)	Accepted. But this material has been deleted
6617	9	9	16		17	The sentence 'building design...mitigation strategies' reads unessential	Accepted. But this material has been deleted
12575	9	9	17		21	May be briefly touched upon as the same is almost repeated under section 9.2.1	Accepted. Redundancies removed
18861	9	9	17			Grammar/orthography: "the key" instead of "be key"	Accepted. But this material has been deleted
6618	9	9	25		27	The last sentence of the paragraph reads unessential	Accepted. But this material has been deleted
9543	9	9	34			Please, provide following information with text; buildings narrowly defined hold great potential for cost-effective energy savings. The IEA estimates that the energy savings potential in this sector in 2009 will be in the range of 20 exajoules (EJ) per year by 2030, which is the same as the current annual electricity consumption of the United States and Japan combined. (25 energy efficiency recommendation, IEA)	Noted. Integrated potentials are discussed in Section 9.9

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
15684	9	9	28			The name "New developments in emission trends and drivers" is a bit misleading, since the section hardly deals with emissions (except for subsection 9.2.3). The section 9.2 is good as an introduction how buildings and energy use have developed. Following this section, I would put the current section 9.5, because it deals with the interaction between buildings and the climate. After making clear there is a strong interaction, section 9.3 and 9.4 follow naturally, since they deal with the results from this interaction. The costs and potentials are then discussed in section 9.6.	Noted. The links between energy drivers and trends and emissions drivers and trends can be more clearly stated. But the order and titles of the subsections are approved by the plenary and cannot be changed
9544	9	9				Please, provide following information with text; residential appliances and equipment represent one of the fastest-growing energy loads; the IEA estimates that at least 3.7 EJ per year could be saved cost effectively by 2030. Lighting represents almost 20% of global electricity consumption. This consumption is similar to the amount of electricity generated by nuclear power. The latest IEA estimates show the total savings potential in residential and services lighting at more than 2.4 EJ per year by 2030. (25 energy efficiency recommendation, IEA)	Accepted. Include the text as suggested. This would not be the place to talk about energy efficiency and mitigation potentials. Regarding appliances, point 9.2.2.1 describes the trend on how having better living standards imply increasing demand for energy services in buildings. But this text can be integrated as well: "residential appliances and equipment represent one of the fastest-growing energy loads"
3489	9	9 of 86	8			While AR4 mentions about mitigation technology options, AR5 with more profound knowledge of the systems integration approach should not use the word "options". This should also be highlighted in the suggested sub-session 9.1.2 "What's New". Please refer to {UNDP & GEF (2010). Promoting Energy efficiency in buildings: Lessons Learned from International Experience. New York: UNDP}, "great gains can also be achieved from a broader, more holistic approach to buildings. [...] Large savings can be achieved by optimising the entire building system rather than improving elements individually. This can only be done at the beginning of the building's life or during major renovations. The rest of the energy consumption is linked to the building use, through the performance of equipment used in the building (e.g., boilers, HVAC system, lighting, electrical appliances, etc.) and the behaviours of the people who use them (choice of temperature, turning off unused lights and appliances, etc.)"	Noted. The points about system approach are already covered in the discussion of the IDP. However, we cannot change the title of 9.3
3488	9	9 of 86				Although the sub-session 9.1.1 provides a good summary of AR4, details about what's new in AR5 are not clearly described. It is suggested to add a sub-session (called 9.1.2), which highlights what's new in AR5. One of the items in "what's new" should be the emphasis on systems integration. This is because the concept has become more mature, and has been taken up widely in the practice. Therefore, it is worthwhile to make an assessment to its contribution to climate change mitigation from the building sector.	Accepted.
11998	9	all				I suggest to mention the design change principle cradle to cradle (McDonough and Braungart) which is to shift from "doing less of the bad" to "doing things right already on the drawing board" i.e. About sustainable design, inexistence of the concept of waste in nature etc.	Rejected. We already highlight key issues pertaining to LCA and cite key literature.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
3486	9	overall				<p>The Authors have done a great job for this first draft. The whole chapter provides comprehensive outline of the assessment to the building sector. It is recommended that the Authors should pay more attention to the following aspects:</p> <p>(1) Imbalance in addressing the building sector in all climatic regions: Although the overall assessment shows the efforts to be at the global scale, many detailed analyses and discussions seem to focus much more on the building sector in temperate regions.</p> <p>(2) The problem of using the term "options" for mitigation technologies and practices in the building sector: As the building-related professions recognised and are progressing deep into the integrated approach of building systems, many mitigation technologies and practices cannot be viewed as options nor optional. Many of them are part and parcel of larger systems that affect the energy and/or energy efficiency performance. The term "mitigation technology options", often appeared in Chapter 9 FOD, is therefore obsolete. The term can be seen as being associated with the "checklist-approach", which are outdated and known as barriers to deliver highly energy efficient buildings. Furthermore, many technologies, highlighted in Chapter 9 FOD, are not optional in the practices found in many places in the world.</p>	<p>Noted. We try very hard to focus also on other climates; literature is bounding this effort. 2. noted. The problem with the word is acknowledged; but no better word is found. "option" stands to replace "technology", recognising that our mitigation options are not only technological, but systemic, practice-wise, behavioural/cultural, etc. Team will look for more literature buildings in warmer climate zones</p>