WMO

# INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

UNEP

## Fourth Assessment Report

***Expert/Government Review of the Second-Order Draft***

# Chapter 7

| Chapter-Comment | Batch | From Page | From Line | To Page | To line | Comments | Considerations by the writing team |
|---|---|---|---|---|---|---|---|
| 7-1 | A | 0 | 0 | 0 | 0 | General: Observation that "electrical equipment" resp. "high voltage gas insulated substations" is dealt with in Chapter 7-Industry (e.g. 7.4.8) and Chapter 4--Energy Supply in parallel. In both cases same applications for transmission, distribution of electricity are meant. Other hand it is noted that different terms are used. Enough background on this subject is available inside current IPCC documentation: New IPCC 2006 Guidelines for National GHG Inventories-Volume 3-IPPU(Industrial Processes and Product Use)-Chapter 8--Other Product manufacture and Use together with Volume 3 Glossary for IPPU would give not only background but also all necessary terms and definitions. To secure consistency on terms inside IPCC documents and Chapters of the 4th assessment report I'd like to suggest the following: 1.Concentrate all relevant information in one of the chapters--preferably Ch.7 and make reference to that in Ch.4.--2.Introduce above IPCC 2006 guidelines source at appropiate place in the text and list it under References<br>(Friedrich Plöger, Siemens AG) | Accepted. JH to respond. |
| 7-2 | A | 0 | 0 | 0 | 0 | please see attached survey (F o r m a t i v e R e s e a r c h f o r t h e C l i m a t e F o r u m; J u l y 2 0 0 6; A S U R V E Y O F S U S T A I N A B I L I T Y E X P E R T S A N D I N - D E P T H I N T E R V I E W S W I T H C L I M A T E C H A N G E S O L U T I O N P R O V I D E R S) [available as pdf from TSU-PBO].<br>(Lorenz Koch, World Business Council for Sustainable Development (WBCSD)) | Accepted. LB will consider reference |
| 7-3 | A | 0 | 0 | 0 | 0 | General Comments<br>Overall this is an excellent chapter and reads well with good referencing. A few comments made at the Paris meeting were to include additional technologies but that will require for those who commented to supply the literature for the LAs.<br>(John Kessels, Energy Research Centre of the Netherlands) | Noted – with thanks. |
| 7-4 | A | 0 | 0 | 0 | 0 | Please see the following article on why interim crediting could hinder greenhouse gas reductions Parkinson, S; Begg, K; Bailey, P and Jackson, T (1999) JI/CDM crediting under the Kyoto Protocol: does 'interim period banking' help or hinder GHG emissions reductions? in Energy Policy 27 p.129-136<br>(Kirsten Macey, Climate Action Network Europe) | Rejected. Not applicable to Chapter 7. Interim banking is an issue for Chapter 13. |
| 7-5 | A | 0 | 0 | 0 | 0 | General comment on chapter 7 : Issues such as material flow between industries, | Accepted (partially). Material flow between |

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| | | | | | | change of supplies through transport flux, and the consumption of products are not covered in the chapter. Although this is probably also the mandate of chapter 11, this weakens the whole chapter and could be at least mentioned in introductions. (ANTOINE BONDUELLE, Université Lille II) | industries is addressed in Section 7.4.9, but not identifed as such. The meaning of "change of supplies through transport flex" is unclear. Consumption of products is not in the mandate of Chapter 7. LB and JR will consider these issues in the rewrite of the Introduction |
| .7-6 | A | 0 | 0 | 0 | 0 | In general, the technological options are given prominence in the chapter to policies to attain these potentials. One weakness of the chapter is that in most cases, public policymakers get no suggestions on how they can help or push industries toward efficient paths. (ANTOINE BONDUELLE, Université Lille II) | Rejected. IPCC cannot be policy-prescriptive and tell policymankers how to "push" industry. Chapter incldues a discussion of policies to the extent allowed by IPCC norms. |
| 7-7 | A | 0 | 0 | 0 | 0 | The consequences of the recent growth of industry in China, with rapid growth of efficiency should be highlighted because of the scale and speed and impact of changes happening there (Expert Review Meeting Paris, IPCC) | Accepted. IEA has provided additional input on China which will be considered in the rewrite of the Chapter. LP, KT, CD, and ZF will produce first draft.. |
| 7-8 | A | 0 | 0 | 0 | 0 | None of the chapters pays attention to a product oriented approach to mitigation. It was recommended to discuss this either in Ch 7 or in Ch 11.Energy consuming products is largely included in Ch 6. (Expert Review Meeting Paris, IPCC) | Rejected. Products are the mandate of Chapter 5 for transportation and Chapter 6 for consumer products. |
| 7-9 | A | 0 | 0 | 0 | 0 | more attention was asked for new technological developments that might qualify for being mentioned in the chapter: high temperature solar systems, superconductivity, bio-refineries in paper and pulp industry for production of for example transport biofuels, carbon capture and storage in pulp & paper industry. (Expert Review Meeting Paris, IPCC) | Noted. LB has asked for input from experts making these comments. Will evaluate and use as appropriate. |
| 7-10 | A | 0 | 0 | 0 | 0 | Apart from describing and estimating the potential from new technologies, the chapter should pay attention to new system solutions for industrial processes, using "conventional" technologies. (Expert Review Meeting Paris, IPCC) | Accepted. Systems approaches addressed in Section 7.3.1. LB will add to this section if additional references forthcoming from experts who made these comments. |
| 7-11 | A | 0 | 0 | 0 | 0 | Chapter 3 gives rather a lot of attention to biomass with Carbon capture and storage. Chapter 7 touches upon CCS but fails to acknowledge the potential for | Noted. LB will evaluate reference and add to CCS discussion, if appropriate. |

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| | | | | | | CCS applied to emissions from biomass. Biomass is rarely used today in applications of the sort of size that would be compatible with CCS and achieving a growth in such applications presents a certain challenge. Some industrial sectors, such as the pulp and paper sector and biofuel production make exceptions. Detailed techno-economic analyses concerning large-scale biomass conversion (including analysing the biomass supply) with CCS are uncommon, but results from existing studies should be reported here, especially new publications since the SRCCS deadline.<br>Recent publications that analyse biomass with CCS in the industry sector include: CCS could be applied also in the forest sector. Cost estimates are quoted in the SRCCS and further estimates are available through new publications:<br>- Möllersten K, Chladna Z, Obersteiner M (2006). Negative emission biomass technologies in an uncertain climate future. 8th Greenhouse Gas Control Technologies Conference (GHGT-8), Trondheim (Norway).<br>- Möllersten K, Gao L, Yan J. CO2 capture in pulp and paper mills: CO2 balances and preliminary cost assessment. Mitigation and Adaptations Strategies for Global Change. Published online August 2006.<br>CCS in biofuel production (sugar cane mills) has been analysed by:<br>Möllersten K, Yan J, Moreira JR, (2003). Potential market niches for biomass energy with CO2 capture and storage - Opportunities for energy supply with negative CO2 emissions. Biomass and Bioenergy 25(3):273-285.<br><br>(Kenneth Möllersten, Swedish Energy Agency) | |
| 7-12 | A | 0 | 0 | 0 | 0 | Nowadays, we can see M&A between companies all over the world. These dynamics influence the global CO2 emissions mitigation?<br>(Toshihiko Masui, National Institute for Environmental Studies) | Rejected. Comment unclear. |
| 7-13 | A | 0 | 0 | 0 | 0 | Please define industry. It seems to include part of the transformation sector. It is not possible to check many figures without knowing the system boundaries of this analysis. EG Refineries and coke ovens seem in, but what eg about CHP?<br>(Dolf Gielen, International Energy Agency) | Accepted. LB will add a definition of industry to Section 7.1, and space permitting, to the Executive Summary. |

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| 7-14 | A | 0 | 0 | 0 | 0 | Two other studies that ought to have been reflected in the chapter (both in the general discussion of policy instruments and in the respective sector sections) are the case studies prepared for us on the impacts of hypothetical carbon taxes levied on the steel and the cement sectors, cf. attachments. The steel case study highlights one impact of policy use that seems overlooked in the context of the "Industrial Mitigation Matrix" discussed in section 7.2: Policies can – even within relatively short time spans – stimulate a change in the mix of technologies applied. Regarding steel, a carbon tax would trigger a significant shift from basic oxygen furnaces to scrap-based electric arc furnaces – in addition to changes in the input mix within these sectors, etc. [I have now seen that reference is included to the steel sector study in Chapter 13. However, the study was issued in 2003, not 2002.]<br><br>(Nils-Axel BRAATHEN, OECD) | Noted. The matrix in Section 7.2 addresses technology only, not the impact of policy on technology choice. If these studies have value, it would be in Section 7.9. LB to evaluate. |
| 7-15 | A | 0 | 0 | 0 | 0 | The chapter seems to be dominated by a focus on what is 'technologically possible' rather than what would be 'optimal' for society as a whole. [Overall, there doesn't seem to have been many economists involved in the drafting!]<br><br>(Nils-Axel BRAATHEN, OECD) | Rejected. The charge to the chapter was to evaluate mitigation potential, not to decide what would be optimal. |
| 7-16 | A | 0 | 0 | 0 | 0 | my impression that what is written is rather 'light', with lots of description and very few attempts to analyse. I understand that the process is to be based on what others already have written, but the literature does contain quite a few examples of analyses that could have been quoted or at least referred to.<br><br>(Nils-Axel BRAATHEN, OECD) | Rejected. Comment provides no detail. |
| 7-17 | A | 0 | 0 | 0 | 0 | New system solutions, using totally or partly traditional equipment, in process industry has probably a considerably higher potential than stated in the chapter. The assessment there (5-10 % for process integration) seems reasonable based on experience and history. General conditions, however, have changed or will most probably change in the near future. Examples are higher electricity, oil and gas prices as well as policy instruments resulting in benefits for CO2 mitigation/cost for | Taken into Account. The references supporting the claims of higher potential for process integration are not identified. The reference on use of CCS in the paper and pulp industry appears to be the same as identified in Comment 7-11. LB to evaluate. |

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| | | | | | | $CO_2$ emissions.<br>References showing higher potentials (20-40%):<br>CSS is discussed in the chapter as an interesting measure in some types of process industry, but not in the pulp and paper one. Publications in international journals have shown, however, that this option could be of importance for this industry.<br>(Thore Berntsson, Chalmers) | |
| 7-18 | A | 0 | 0 | 0 | 0 | The chapter fails to present a consistent and systematic overview of options and potentials for GHG mitigation in the industry sector. The level of detail of the analysis varies considerably between different regions, countries, sectors and technologies while it is generally not justified why some regions, countries, technologies or options get more detailed coverage than others. Under the individual sectors the focus is primarily on single technologies and information concerning potentials of system measures/process integration is scarce.<br>(Government of Sweden) | Noted. The level of detail was dictated by the available literature. |
| 7-19 | A | 0 | 0 | 0 | 0 | The summary tables should be more transparent. A consistency check between the numbers provided in the tables and the accompanying text should be performed. U.S. Government<br>(Government of U.S. Department of State) | Accepted. LB/JR responsible for assuring consistency. |
| 7-20 | A | 0 | 0 | 0 | 0 | The relationship between water, waste reduction and energy consumption needs to be addressed. Regulations and policies affecting these areas can have a large impact on greenhouse gas emissions. U.S. Government<br>(Government of U.S. Department of State) | Accepted. The impact of waste regulations is discussed in detail in Section 7.9.8. More information will be added on the impact of energy policy in light of IEA's World Energy Outlook 2006. No information has been found on the impact of water policy on industrial GHG emissions and this comment does not supply references on that topic. LB/RM responsible. |
| 7-21 | A | 0 | 0 | 0 | 0 | The largest concern is the lack of attention to some crosscutting technology platforms that have broad applications across industries and processes. In particular, expansion on advanced steam and process heating technology | Noted. EW and LB will seek appropriate references. |

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| | | | | | | opportunities should be incorporated in section 7.3. There is also very little discussion on the role that sensors and control systems, as well as advanced materials, can play in reducing energy intensity both in existing process technologies as well as technologies under development."   . U.S. Government (Government of U.S. Department of State) | |
| 7-22 | A | 0 | 0 | 0 | 0 | The chapter would benefit from summarizing broad-based greenhouse gas mitigation strategies (e.g. energy management, benchmarking), key mitigation actions (e.g. recycled plastics, process heating, etc.) and associated costs, and key policy options for deployment in each sector in various regions of the world.  This would enable policymakers to preliminarily evaluate and prioritize the best mitigation opportunities for their industries.  U.S. Government (Government of U.S. Department of State) | Rejected. This would take a major restructuring of the chapter, and it is not clear that the information needed is available. |
| 7-23 | A | 0 | 0 | 0 | 0 | The chapter would benefit from a short conclusions section which would summarize broad-based greenhouse gas mitigation strategies (e.g. energy management, benchmarking), key mitigation actions (e.g. recycled plastics, process heating, etc.) and associated costs, and key policy options for deployment in each sector in various regions of the world.  The outcome of this conclusion should enable policymakers to preliminarily evaluate and prioritize the best mitigation opportunities for their industries.  U.S. Government (Government of U.S. Department of State) | Rejected. This would take a major restructuring of the chapter, and it is not clear that the information needed is available. |
| 7-24 | A | 0 | 0 | 0 | 0 | The chapter addresses crosscutting industrial mitigation opportunities in a broad sense.  The chapter, however, could benefit from additional discussion of technical issues associated with sector–specific applications of crosscutting industrial mitigation opportunities.  U.S. Government (Government of U.S. Department of State) | Rejected. Comment is vague and it is unclear what technologies and applications the reviewer is referring to. |
| 7-25 | A | 0 | 0 | 0 | 0 | Include a discussion of the mitigation of fugitive emissions from the chemicals and refining industries.  U.S. Government (Government of U.S. Department of State) | Accepted. LB responsible. |
| 7-26 | A | 0 | 0 | 0 | 0 | Discussion of what is occurring in the developing versus developed world needs | Accepted. Space limitation preclude |

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| | | | | | | more elaboration. There needs to be an identification of the sector-based opportunities that will produce savings in developed versus developing countries, for example, new plant construction versus substantial retrofit. U.S. Government (Government of U.S. Department of State) | addressing this topic in any detail, but it will be mentioned in the rewrite of the introduction. LB responsible. |
| 7-27 | A | 0 | 0 | 0 | 0 | Chapter 7 addresses CCS in a broad sense. The chapter could benefit from additional discussion of technical issues associated with sector–specific applications of CCS. U.S. Government (Government of U.S. Department of State) | Accepted. Space limitation preclude discussing any technology in much detail. LB will consider. |
| 7-28 | A | 0 | 0 | 0 | 0 | Based on industry feedback and analysis, the industrial sector will be increasingly challenged by the uncertain availability and price volatility of their energy needs for operation. A number of technical and market barriers have impeded a wider adoption of fuels flexibility technologies to replace conventional fuels in the industrial sector. There should be some discussion of fuel and feedstock flexibility through applied R&D for industrial process integration with various synthetic fuels and material production, as well as integration and synergy across industries and processes." U.S. Government (Government of U.S. Department of State) | Rejected. Does not consider GHG mitigation. |
| 7-29 | A | 0 | 0 | 0 | 0 | Although costs are presented throughout the chapter in terms of US dollars, the year or years of the dollars is/are not clear. This detracts from the clarity and perhaps also internal consistency of the document (e.g., the costs cited from different studies may not be comparable). U.S. Government (Government of U.S. Department of State) | Accepted. Will clarify, wherever possible. All responsible. |
| 7-374 | A | 0 | 0 | 0 | 0 | In row Chemicals and add under Fuel switching: "more utilisation of residual chemical gas" (or more flaring instead of venting) (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Noted. This comment appears to refer to Table 7.4. The table is not meant to be comprehensive. LB will add additional information to the extent that space is available. |
| 7-30 | A | 2 | 23 | 2 | 25 | Sentence should be qualified rather than just blaming industry as a "major emitter". Would suggest that an addition at the end of the sentence is made as follows: "in producing products and services to satisfy societal demand." | Accepted. Term "major emitter" will be removed and appropriate data presented to indicate role of industry in GHG emissions. |

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| | | | | | | (Nick Campbell, ARKEMA SA) | LB responsible. |
| 7-31 | A | 2 | 23 | 2 | 25 | No proper recognition that he industrial sector is about the only sector to be reducing its GHG emissions. First sentence of Executive Summary should be reordered to recognise progress: "The industrial sector is a major emitter of GHGs, however it has been reducing its emissions intensity through more energy efficient technologies and investment in gas scrubbing technology."<br>(Robert Chase, International Aluminium Institute) | Accepted. Chapter does indicate that industry's share of global emissions is declining. Energy intensity is difficult to use because figures are not presented for all sectors. LB will consider in rewrite. |
| 7-32 | A | 2 | 23 | 7 | 0 | Page 2 and page 7 Looking at the table page 7, it seems that final energy excludes refineries, but energy-related carbon dioxide seems to include feedstock (which does not result in emissions). If refineries are excluded and the IEA method for emissions accounting from CHP is applied, 8.5 Gt energy-related CO2 in 2002 seems too high for the sectoral emissions. World total manufacturing industry from fuel combustion according to IEA statistics 4.3 Gt in 2002 (excl. electricity use related upstream emissions in the power sector, excl. process emissions, excluding coke ovens and excl. refineries). So may be process emissions are included in table 7.1? IEA (2006, p. 391) gives a total of 5.3 Gt in 2003 (excl. electricity, excl. refineries, incl. process emissions). Please, clarify.<br>Manufacturing industry CO2 emissions from IEA statistics (excl. coke ovens, refineries, process emissions, indirect emissions) [Mt CO2/yr]<br>1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003<br>4397.81 4309.25 4359.61 4481.37 4586.68 4490.13 4375.55 4190.87 4317.67 4268.85 4324.81 4509.24<br>(Dolf Gielen, International Energy Agency) | Accepted. LP will provide clarifying text. |
| 7-33 | A | 2 | 33 | 0 | 0 | I don't think that non-ferrous metals is an energy intensive industry (see IEA energy balances for OECD and non-OECD countries). Instead the food processing industry uses more fuel. When using "forest products" I think of wood, where in fact pulp and paper production is meant. To avoid confusion I recommend to use the familiar name "pulp and paper production".<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Comment on non-ferrous metals rejected. They are always included in lists of energy-intensive industries. Comment pulp and paper accepted. |
| 7-34 | A | 2 | 35 | 2 | 37 | Sentence is a bit unclear – goes from world energy use by sector to developing | Accepted. LB will include in editing. |

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| | | | | | | world's ownership of production from these sectors – suggest adding after "accounted for" "a large percentage of worldwide production in many of these sectors with ..." U.S. Government (Government of U.S. Department of State) | |
| 7-35 | A | 2 | 38 | 2 | 41 | Logic isn't clear. It says developing countries have new technology which uses less energy, and developed countries have old, inefficient facilities and tech transfer is needed for developing countries. As worded this is not the logical conclusion. Later in Ch 7, it makes the point that a lot of old, inefficient technology remains in developing countries and that this is the reason for industrialized countries to share technology. See page 6, lines 10 through 19 for clearer discussion. U.S. Government (Government of U.S. Department of State) | Accepted. LB will clarify in editing. |
| 7-36 | A | 2 | 38 | 2 | 41 | "The discussion of developing countries having the latest technology and lowest specific energy use seems somewhat contradictory with stating that there is a huge demand for technology transfer to these countries. This discussion is repeated in other places in the chapter (e.g., page 57, lines 33-39). Maybe changing the word "Many" to something that would imply a smaller portion of facilities in these countries that have the latest technology would address this concern. Perhaps replace with: "The newest industrial facilities in developing nations include the latest technology with lowest specific energy use." U.S. Government (Government of U.S. Department of State) | Accepted. LB will clarify in editing, but since there are several suggestions for modifying this text, compromise wording will be used. |
| 7-37 | A | 2 | 40 | 2 | 40 | after "...still remain", add this sentence "But due to the need to upgrade existing facilities is still strong in developing countries" before "This creates…" (Government of China Meteorological Administration) | Accepted. LB will clarify in editing, but since there are several suggestions for modifying this text, compromise wording will be used. |
| 7-38 | A | 2 | 43 | 2 | 43 | The only industrial process described in the chapter is that of HCFC-22 manufacture which produces HFC-23. Would suggest a change replacing "HFCs from chemical processes" with "HFC-23 from the manufacture of HCFC-22". (Nick Campbell, ARKEMA SA) | Accepted. LB will change in editing. |
| 7-39 | A | 2 | 44 | 2 | 45 | modify after processing, SF6 from use flat panel screens ( liquid crystal display) and semi-conductors, magnesium die casting, many military applications, electrical | Rejected. More detail than appropriate for the Executive Summary. However, JH will ensure |

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| | | | | | | equipment, aluminium melting, nuclear fuel cycles, medical applications and many others, and CH4....Justification: This enumeration relects the order of importance as emission sources. For an overview of currently known SF6 applications pls.refer to the new IPCC 2006 Guidelines for National GHG Inventories-Volume 3-IPPU(Industrial Processes and Product Use)-Chapter 8--Other Product manufacture and Use -partictularly Chapters 8.3 and 81. and 8.2. (Friedrich Plöger, Siemens AG) | that all applications are mentioned in the body of the Chapter. |
| 7-40 | A | 2 | 49 | 2 | 53 | In view of the controls that are already in place, it is incorrect to describe the calculated increase in emissions as a "projection" and misleading to ascribe a value to them. The text of the chapter describes emissions that are substantially lower than this "projection" and so the use of this word and the assignment of a value gives a biased view that is inconsistent with the chapter contents. (Archie McCulloch, Marbury Technical Consulting) | Rejected. The sentence is quite clear about the basis on which the projection is made and also that actions can be expected to lower the emissions level. |
| 7-41 | A | 2 | 49 | 2 | 53 | In view of the controls that are already in place, it is incorrect to describe the calculated increase in emissions as a "projection" and misleading to ascribe a value to them. The text of the chapter describes emissions that are substantially lower than this "projection" and so the use of this word and the assignment of a value gives a biased view that is inconsistent with the chapter contents. (Nick Campbell, ARKEMA SA) | Rejected. The sentence is quite clear about the basis on which the projection is made and also that actions can be expected to lower the emissions level. |
| 7-42 | A | 3 | 5 | 3 | 15 | A couple of key areas for potential reduction should perhaps be mentioned in the list. One is the useof CCS (I believe it will play a fairly important role in the future, especially for Canada) as a "process-specific" option or as an "operating procedures" option. As second one that should be mentioned here is the reduction of fugitive emissions from industrial processes, again an important option for Canada (or any nation dealing with natrual gas extraction. I realize these lists are not ment to be comprehensive but I do think that they are both somewhat unique from those already mentioned. (John Nyboer, Simon Fraser University) | Rejected. CCS and control of fugitive emissions from natural gas distribution are important options for the energy sector (Chapter 4), but they are less important for the industrial sector and not worthy of mention in Chapter 7’s Executive Summary. |
| 7-43 | A | 3 | 8 | 3 | 15 | Add - Lifecycle based design of products to reduce emissions during usage from eg energy use or disposal of decomissioned equipment. | Rejected. End-use emission from products is covered in Chapter 5 (transportation) and |

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| | | | | | | (Norbert Nziramasanga, Southern centre for Energy and Environment) | Chapter 6 (buildings). Emissions from decommissioned equipment should be covered in Chapter 10. |
| 7-44 | A | 3 | 8 | 3 | 9 | "In Sector-wide options, incorporate "high efficiency boilers and process heating systems" to add robustness. U.S. Government (Government of U.S. Department of State) | Noted. LB will add, space permitting. |
| 7-45 | A | 3 | 10 | 3 | 12 | "In Process-specific options, incorporate "cokeless ironmaking" and "high efficiency metal melting furnaces" to add robustness. U.S. Government (Government of U.S. Department of State) | Rejected. The list already includes one steel-making process. Adding more would be inappropriate. |
| 7-46 | A | 3 | 15 | 3 | 25 | Carbon capture and storage, hydrogen for ores are new technology, but not low cost, at least at moment (Yanjia Wang, Tsinghua University) | Accepted. LB will clarify the difference between new technology and low cost technology. |
| 7-47 | A | 3 | 16 | 3 | 21 | Add "and cement" to list of industries where CCS will be applicable U.S. Government (Government of U.S. Department of State) | Noted. The application of CCS to the cement industry will be further evaluated and considered for mention in Executive Summary. It will be discussed in section 7.3.7. |
| 7-48 | A | 3 | 17 | 0 | 0 | F. Al-Ansari: While existing technologies can significantly reduce industrial GHG emissions, New and lower cost technologies will be needed .... ( We are of the opinion that the existing technologies are unable to reduce GHG emissions significantly). (Ben Muirheid , International Fertilizer Industry Association (IFA)) | Rejected. Reviewer's opinion is not a basis for changing the conclusion. The chapter presents many examples of existing technology that could reduce GHG emissions. |
| 7-49 | A | 3 | 27 | 3 | 29 | This remark is based on the analysis of a limited number of sectors. Does "most of the mitigation potential" refer to the total emission reduction potential (in MtCO2)? (Government of European Community / European Commission) | Accepted. LB will change wording to tie results to Table 7.8. |
| 7-50 | A | 3 | 32 | 3 | 45 | The statement by DuPont Chairman and CEO, Chad Holliday, as presented at the Clinton Global Initiative Panel on Climate Change in New York City on September 17, 2005 and to be found under http://www2.dupont.com/Media_Center/en_US/speeches/holliday_09_17_05.html demonstrates that even in areas where GHG mitigation is not mandated, companies | Accepted. LB/LP will include non-economic benefits of voluntary GHG mitigation in this statement and in the Section 7.9.2. |

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| | | | | | | do invest in GHG mitigation for benefits other than just lower raw material and energy cost or driven by consumer preferences, cost, competitiveness and government regulations. While DuPont has actively addressed climate change for more than 10 years, its approach towards this issue has evolved over the years based on a deeper and better understanding of the underlying science that has been devoped and improved over time. However, already in 2001, in a speech delivered for the WBCSD at the UN and to be found under http://www2.dupont.com/Media_Center/en_US/speeches/holliday_04_18_01.html Chad Holliday provided examples that for DuPont the driver for addressing Climate Change is more than just economic considerations or policy mandates. (Sabine Klages-Buechner, E.I. du Pont de Nemours and Company) | |
| 7-51 | A | 4 | 11 | 4 | 17 | I see this paragraph as belonging to WG II on adaptation and I'm not sure why it is here; see below for a similar comment. (John Nyboer, Simon Fraser University) | Rejected. The chapter outline specifically calls for discussing vulnerability and adaptation. These are addressed in section 7.8 and should be summarized in the Executive Summary. |
| 7-52 | A | 4 | 19 | 4 | 19 | Delete to play (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will delete phrase in editing. |
| 7-53 | A | 4 | 25 | 0 | 0 | Add whether successful now (Ann Gardiner, AEA Technology) | Rejected. Assessment of technology transfer policy is the responsibility of Chapter 13. |
| 7-54 | A | 4 | 31 | 4 | 31 | change actions very large to include actions are very large (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will correct in editing. |
| 7-55 | A | 4 | 31 | 4 | 32 | delete this sentence "As in all IPCC reports, we are constrained to examples that are well-described in the literature." (Government of China Meteorological Administration) | Accepted. LB will delete in editing. |
| 7-56 | A | 4 | 41 | 0 | 0 | F. Al-Ansari: nitrous oxide (N2O), which per unit weight has 296 times the global warming effect compared to CO2, is emitted as a ... (Ben Muirheid , International Fertilizer Industry Association (IFA)) | Rejected. This is an introduction. The GWPs of non-CO2 gases are given later in the chapter when their emissions are discussed in detail. |
| 7-57 | A | 4 | 43 | 4 | 44 | The quantity of HFC-22 used in foam blowing is small (~6% of production). On the | Accepted. LB will change in editing. |

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| | | | | | | other hand the amount used as a raw material for fluorpolymers is well over a quarter of production and is growing. Suggest deletion of "also used in foam blowing" and substitution with also used as a raw material for fluoropolymers. (Archie McCulloch, Marbury Technical Consulting) | |
| 7-58 | A | 4 | 43 | 4 | 44 | This statement should be "HFC-23 is emitted as a by-product…..". (Nick Campbell, ARKEMA SA) | Accepted. LB will correct in editing |
| 7-59 | A | 4 | 44 | 4 | 44 | The two key uses of HCFC-22 are as a refrigerant and as a feedstock for synthetic polymers. Recommend deleting "also used in foam blowing" and replacing it with "and feedstock for synthetic polymers" U.S. Government (Government of U.S. Department of State) | Accepted. LB will change in editing. |
| 7-60 | A | 4 | 46 | 0 | 0 | F. Al-Ansari: in semiconductor manufacture; The above fluorocarbons as GHG will cause the depletion of ozone layer. (Ben Muirheid , International Fertilizer Industry Association (IFA)) | Rejected. There is no need to introduce ozone depletion in this chapter. |
| 7-61 | A | 4 | 47 | 4 | 48 | should read: sulphur hexafluride(SF6) is emitted from production of flat panel screens ( liquid crystal display) and semi-conductors, magnesium die casting, many military applications, manufacture, use and decommissionng of electrical equipment, aluminium melting, nuclear fuel cycles, medical applications and many others. See IPCC 2006 Guidelines ,Vol,3-IPPU, Chapter 8 (Friedrich Plöger, Siemens AG) | Noted. More detail than appropriate for the Introduction. However, JH will include if space available.. |
| 7-62 | A | 4 | 49 | 0 | 0 | F. Al-Ansari: methane (CH4) which is 23 times stronger ( for a given weight averaged over 100 years) than CO2 has a higher potential global warming effect, is emitted as a by product of some chemical processes; and (Ben Muirheid , International Fertilizer Industry Association (IFA)) | Rejected. This is an introduction. The GWPs of non-CO2 gases are given later in the chapter when their emissions are discussed in detail. |
| 7-63 | A | 4 | 54 | 4 | 54 | "offsite management of industrial wastes is covered in Chapter 10." FYI, chapter 10 only covers industrial wastewater that is transported to municipal wastewater treatment plants. I believe we agreed previously that Chapter 7 would handle industrial waste managed by industry whether this is done (by industry) either onsite or offsite of its place of generation, while chapter 10 would include industrial waste transported to and managed by the municipal sector. Please let's clarify this issue. | Noted. Chapter 7 will take special purpose incinerators into account. Co-mingled waste will be addressed by Chapter 10. LB/JH responsible. |

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| | | | | | | (Jean Bogner, Landfills +, Inc) | |
| 7-64 | A | 5 | 21 | 5 | 22 | These lines refer to a summary of technology process in the industrial sector in 7.11, but 7.11 is on RDD&D? Do you mean the technology process from research to diffusion?<br>(John Kessels, Energy Research Centre of the Netherlands) | Accepted. The reviewer is correct. LB will change text in editing. |
| 7-65 | A | 5 | 26 | 5 | 29 | The focus on energy-intensive industries is understandable given the large emissions. However, more attention could be paid to light industries, due to the importance iof these sectors in many economies for job generation, as well as its growing role in developing economies (decreasing role of heavy industries), the role of SMEs (see the next paragraph in the text), and the potentially large mitigation potential (expressed in %).<br>(Government of European Community / European Commission) | Noted. The justification for focusing on energy-intensive industries is because globally they are the source of GHG emissions. There is some discussion of other industries in Section 7.4.8, but space limitations preclude a detailed discussion. |
| 7-66 | A | 5 | 27 | 0 | 0 | I don't think that non-ferrous metals is an energy intensive industry (see IEA energy balances for OECD and non-OECD countries). Instead the food processing industry uses more fuel. When using "forest products" I think of wood, where in fact pulp and paper production is meant. To avoid confusion I recommend to use the familiar name "pulp and paper production".<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Rejected. Non-ferrous metals are always included in lists of energy-intensive industries. Will use pulp and paper as name of industry.. |
| 7-67 | A | 5 | 33 | 5 | 0 | The paper points out that SMEs are “structurally important” in many developing countries and argues that they are a “special challenge” because of economic or technical limitations, yet it doesn’t offer any suggestions on how to reach SMEs in developing countries. ITP’s Industrial Assessment Centers are one strategy that has experienced success in the US that could be applied to many developing countries with relative ease. Industrial Assessment Centers are training programs at Universities across the country that give college students the skills to do energy saving assessments. Assessments are then conducted at SMEs across the country. Spell out ITP wherever mentioned in text which refers to Industrial Technologies Program.Sections 7.1.2 and 7.1.3 both share the same title (Development Trends). U.S. Government<br>(Government of U.S. Department of State) | Accepted. JR to evaluate and incorporate into text if appropriate. |

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| 7-68 | A | 5 | 40 | 7 | 5 | title of 7.1.2 and 7.1.3 ar same<br>(Yanjia Wang, Tsinghua University) | Accepted. 7.1.3 should be Emission trends. LB will correct on editing. |
| 7-69 | A | 5 | 42 | 5 | 42 | Delete is also taking place and when I refered to 7.7 I found nothing on SMEs or any examples unless you meant minimize water use and carbon emissions?<br>(John Kessels, Energy Research Centre of the Netherlands) | Accepted. JR will correct. |
| 7-70 | A | 5 | 42 | 5 | 42 | The paper points out that SMEs are “structurally important” in many developing countries and argues that they are a “special challenge” because of economic or technical limitations, yet it doesn’t offer any suggestions on how to reach SMEs in developing countries. ITP’s Industrial Assessment Centers are one strategy that has experienced success in the US that could be applied to many developing countries with relative ease. Industrial Assessment Centers are training programs at Universities across the country that give college students the skills to do energy saving assessments. Assessments are then conducted at SMEs across the country. Spell out ITP wherever mentioned in text which equals Industrial Technologies Program. U.S. Government<br>(Government of U.S. Department of State) | Accepted. JR to evaluate and incorporate into text if appropriate. |
| 7-71 | A | 5 | 42 | 5 | 42 | Delete "is taking place" after "R&D." Also, the reference for "this sector" is not clear. Suggest replacing with "SMEs" or "Industry" as appropriate. U.S. Government<br>(Government of U.S. Department of State) | Accepted. JR will correct. |
| 7-72 | A | 6 | 12 | 6 | 14 | Clarify to make the point that this refers to the portion that developing countries occupy in the world markets for these products. U.S. Government<br>(Government of U.S. Department of State) | Accepted. LB will clarify in editing. |
| 7-73 | A | 6 | 14 | 6 | 16 | Reword sentence to: “Since many facilities in developing nations are new, they sometimes incorporate the latest technology in the design and building of new facilities and have the lowest specific emissions rates.” U.S. Government<br>(Government of U.S. Department of State) | Accepted. LB will consider in editing. |
| 7-74 | A | 6 | 14 | 6 | 16 | Have the studies consulted on lowest specific emissions rates been supported by actual measurement of energy use in these facilities with new technology? Have developing nations consistently implemented and commissioned the new | Noted. Each of these claims is referenced with what the authors believe is a credible reference (including some from the U.S. |

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| | | | | | | technology to achieve the full potential of energy savings? And, are these findings supported by measurement and observation or only by estimates and observation? U.S. Government (Government of U.S. Department of State) | government). They are also accepted by appropriate international trade associations. |
| 7-75 | A | 6 | 17 | 0 | 19 | The text refers to the "huge need for technology transfer"; however, in the aluminium sector (and I suspect in other sectors also) the real issue is a need for capital investment. Modern technology is available and the implementation of the most modern technologies with the lowest GHG emissions capability is really a function of the marketplace for capital. (Jerry Marks, International Aluminium Institute) | Accepted. A comment about barriers to technology transfer will be included. LB will add in editing. |
| 7-76 | A | 6 | 17 | 6 | 19 | Statement on technology transfer implies hardware. It is important to be specific on software and knowhow as a tool for reducing emissions eg industrial energy management technics. (Norbert Nziramasanga, Southern centre for Energy and Environment) | Accepted. LB will add text to expand the definition of technology to include software and know how. This is done later in the chapter but is appropriate at this point. |
| 7-77 | A | 6 | 21 | 6 | 38 | This discussion is very generic. Is this discussion relevant given the scope of the report? (Government of European Community / European Commission) | Accepted. JR will address in rewrite. |
| 7-78 | A | 6 | 24 | 6 | 24 | Is the IEA (2006) reports: missing a quote or is it refering to the last few lines? (John Kessels, Energy Research Centre of the Netherlands) | Accepted. The next few lines are a quote and were supposed to be indented. LB will correct in editing. |
| 7-79 | A | 6 | 26 | 6 | 30 | the efforts made is not just on coke-producing, but casting, feterlize, refinary and power sectors too. (Yanjia Wang, Tsinghua University) | Noted. Noted. Example will be drawn from cement industry. JH to supply LB with reference. |
| 7-80 | A | 6 | 26 | 6 | 28 | Do you have a reference for this statement on the chinese govt trying to ban the use of small-scale coke-producing facilities? (John Kessels, Energy Research Centre of the Netherlands) | Accepted. The reference, IEA (2006), will be added. |
| 7-81 | A | 7 | 0 | 7 | 0 | The "Centrally planned" in table 7.1 and in other tables or text should be deleted". (Government of China Meteorological Administration) | Accept. LP will change name of region. |
| 7-82 | A | 7 | 2 | 0 | 0 | Page 7: treatment of CHP should be discussed. If industrial CHP were allocated to | Noted. The original WG III Outline placed the |

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| | | | | | | industry, its CO2 balance would look better.<br>(Dolf Gielen, International Energy Agency) | discussion of CHP in the Chapter 4. They have not discussed it in any detail. |
| 7-83 | A | 7 | 11 | 7 | 12 | "The developing nations' share .....in 2002". Growth of emissions of developing nations from 18% in 1971 to 37% in 2002 as stated in the text needs to be presented with a qualifying sentence which reflects their higher energy need in initial phases of economic growth.<br>(Government of India) | Noted. The reason for the growing share of energy use by developing nations is more their growing share of global economic activity.<br>LP will consider in rewrite. |
| 7-84 | A | 7 | 16 | 7 | 25 | Table 7.2 shows emissions by country or region. It is also important to show global emissions by industry as a way of showing whether there is an overall improvement in the GHG impact of each industry taking into account the relocation of production facilities.<br>(Norbert Nziramasanga, Southern centre for Energy and Environment) | Noted. Some of this information is in Table 7.8 |
| 7-85 | A | 7 | 17 | 9 | 0 | Tables 7.1, 7.2, 7.3 A Emissions must be presented in per capita terms and not only in absolute terms.<br>(Government of India) | Rejected. While it might make sense to show per capita emission for a whole economy, it does not make sense to show emissions from the industrial sector on this basis. |
| 7-86 | A | 8 | 19 | 9 | 49 | The data from references US EPA 2006b and 2006c are from a single source that has been subject only to the most rudimentary peer review. They are not consistent with data in the IPCC/TEAP SROC, which covers the same subject matter and was extensively peer reviewed. For example, the historical emissions of HFC-23 quoted in Table 7.3.B are not consistent with its measured atmospheric concentrations. Those quoted in the SROC are. Furthermore, the projections for HFC-23 in Table 7.3.B do not take into account the growth in HCFC-22 production that is occurring now in India and China. This is considered in SROC. The chapter would be shortened by a page and would be made more consistent and less confusing if these tables and the associated text were deleted. They add nothing to the arguments, it is not possible for the reader to relate the quoted values to any others in the report and, as discussed above, they are inaccurate.<br>(Archie McCulloch, Marbury Technical Consulting) | Noted. CD will evaluate and change text if appropriate. JH to supply additional reference. |
| 7-87 | A | 8 | 19 | 9 | 49 | The data from references US EPA 2006b and 2006c are from a single source that | Noted. CD will evaluate and change text if |

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| | | | | | | has been subject only to the most rudimentary peer review. They are not consistent with data in the IPCC/TEAP SROC, which covers the same subject matter and was extensively peer reviewed. For example, the historical emissions of HFC-23 quoted in Table 7.3.B are not consistent with its measured atmospheric concentrations. Those quoted in the SROC are. I also believe that the US EPA reported whilst published in 2006 actually uses data sources that pre-date the date used in the IPCC/TEAP Special Report. Furthermore, the projections for HFC-23 in Table 7.3.B do not take into account the growth in HCFC-22 production that is occurring now in India and China. This is considered in SROC. The chapter would be shortened by a page and would be made more consistent and less confusing if these tables and the associated text were deleted. They add nothing to the arguments, it is not possible for the reader to relate the quoted values to any others in the report and, as discussed above, they are inaccurate.<br>(Nick Campbell, ARKEMA SA) | appropriate. JH to supply additional reference. |
| 7-88 | A | 9 | 1 | 0 | 0 | Page 9: what about CFC emissions, notably in China? Can you quantify them?<br>(Dolf Gielen, International Energy Agency) | Rejected. CFCs emitted from buildings, products and wastes. |
| 7-89 | A | 9 | 9 | 9 | 9 | Given the importance of adipci acid and caprolactam as N2O emission sources, we are surprised that there are no emission estimates. What is the reference for this statement?<br>(Government of European Community / European Commission) | Noted. Adipic emission given with nitric acid. Reference for caprolactam production will eb evaluated. |
| 7-90 | A | 9 | 19 | 9 | 20 | Are these emissions included in Chapter 6, if they are excluded in Chapter 7?<br>(Government of European Community / European Commission) | Noted. Chapter 6 includes an estimate of HFC and PFC emissions from the buildings sector. |
| 7-91 | A | 9 | 20 | 0 | 0 | Table 7.3; PFC emissions. The historical data for 1990 and 2000 for PFC emissions appear quite reasonable; however the projections fo 2010 and 2020 are higher than can be expected. New capacity being commissioned will continue to drive emissions lower on a per tonne aluminium produced basis, as will improvments in work practices and improved control algorithms. It's unrealistic to project such a rise in PFC emissions of some 20% from 2000 through 2010. Indeed the data through 2004 from IAI anode effect survey data (IAI,2004 Anode Effect Survey, 2006.) shows sitll further decreases in PFC emissions per tonne aluminium | Noted. CD will evaluate in rewrite. |

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| | | | | | | after 2000.<br>(Jerry Marks, International Aluminium Institute) | |
| 7-92 | A | 9 | 21 | 0 | 0 | "Table 7.3.B. This is a small point, but 'HFC-23 Emissions from HFC-22 Production' should change to 'HFC-23 Emissions from HCFC-22 Production.'<br>(Koichi Mizuno, National Institute of Advanced Industrial Science and Technology) | Accepted. LB will correct in editing. |
| 7-93 | A | 9 | 21 | 9 | 0 | In the third column of industrial sector "HFC-23 Emissions from HFC-22 Production" of Table 7.3B, the word "HFC-22" should be replaced with "HCFC-22".<br>(Government of Japan) | Accepted. LB will correct in editing. |
| 7-94 | A | 11 | 0 | 0 | 0 | The examples quoted for Iron & Steel are all existing and implemented in the advanced steel producing companies. They do not therefore provide much leeway for cutting GHG emissions. 10% improvement is the best estimate of improvement accessible. Some Steel mills do not use all of them, as some can only be implemented with increased operating cost: they do not belong to the "no regret" solutions (i.e. top-gas pressure recovery in most of Europe, for example). Some of the information is NOT correct: Smelting Reduction (not smelt reduction) does not cut emissions, quite the contrary, in spite of commercial claims by companies marketing these processes. Switching from to scrap is also a sophism, as all the scrap available today is already used: a particular company can use more scrap, but another one will have to do without it; the global balance in terms of CO2 emissions is nil. Recycling is applied at a very high level in the world as far as steel is concerned: some small improvement may be possible (10%?), but at considerable extra-cost, both monetary and probably also energetically (LCA). Allying CCS to the BF is a major reshuffling of the process and will need long-term breakthrough R&D.<br>(Jean-Pierre Debruxelles, EUROFER) | *Use response from Technical Summary.* |
| 7-95 | A | 11 | 0 | 11 | 0 | In the cell of "sector wide" and "Renewable" of Table 7.4,add "hydropower".<br>(Government of China Meteorological Administration) | Noted. Table 7.4 cannot be comprehensive. LB will add additional points to the extent that |

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| | | | | | | | space is available. |
| 7-96 | A | 11 | 0 | 11 | 0 | In the cell of "sector wide" and "Fuel switching" of Table 7.4,besides"Coal to nature gas",add "coal to oil"<br>(Government of China Meteorological Administration) | Accepted. LB will change in editing |
| 7-97 | A | 11 | 1 | 0 | 0 | Table 7.4 should be complemented with the following line: Sector: Electrical Equipment--Energy Efficiency: Reduction of electricity transmission and distribution losses---Nil-Nil-Nil---Product Change: Improved tightness. Reduced equipment charges---Material Efficiency: Reduction handling losses, all life cycles---Non-CO2 GHG: SF6---Nil; refer to and list under References: J.Harnisch and S.Wartmann, 2005: Reductions of SF6 Emissions from High and Medium voltage Electrical Equipment in Europe<br>(Friedrich Plöger, Siemens AG) | Noted. Table 7.4 cannot be comprehensive. LB will add additional points to the extent that space is available. |
| 7-98 | A | 11 | 1 | 0 | 0 | Table 7.4; Table should indicate the substitution of low GWP substitutes for magnesium production and casting for the high GWP SF6 that was common practice in the past.<br>(Jerry Marks, International Aluminium Institute) | Noted. Table 7.4 cannot be comprehensive. LB will add additional points to the extent that space is available. |
| 7-99 | A | 11 | 1 | 0 | 0 | "Table 7.4. The same comment as on Table TS.14." Please see my comment of No.1.<br>(Koichi Mizuno, National Institute of Advanced Industrial Science and Technology) | Noted. LB will ask the TSU to clarify this comment. |
| 7-100 | A | 11 | 1 | 11 | 2 | No items are (yet?) indicated in italic in this table.<br>(Government of Belgium) | Accepted. The italics will be added back. LB responsible. |
| 7-101 | A | 11 | 2 | 11 | 0 | Several technologies referred to for cement in table 7.4. must at best be referred to as " Under demonstration or developing". They should hence be quoted in italics. This relates to "Fluidized bed kiln" under "Energy Efficiency, "Drying with gas turbine" under "Power Recovery", and "CO2/O2 combustion in kiln" under "CO2 Sequestration"<br>(Claude LOREA, CEMBUREAU, The European Cement Industry) | Accepted. The italics will be added back. LB responsible. |
| 7-102 | A | 11 | 2 | 11 | 0 | Several technologies referred to for cement in table 7.4. must at best be referred to | Accepted. The italics will be added back. LB |

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| | | | | | | as " Under demonstration or developing". They should hence be quoted in italics. This relates to "Fluidized bed kiln" under "Energy Efficiency, "Drying with gas turbine" under "Power Recovery", and "CO2/O2 combustion in kiln" under "CO2 Sequestration"<br>(Claude LOREA, CEMBUREAU, The European Cement Industry) | responsible. Gas turbines are mature technology. |
| 7-103 | A | 11 | 2 | 0 | 0 | When using "forest products" I think of wood, where in fact pulp and paper production is meant. To avoid confusion I recommend to use the familiar name "pulp and paper".<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Accepted. LB will change in editing. |
| 7-104 | A | 11 | 2 | 0 | 0 | In cell Non-CO2 HG and non-ferrous metals, add: "SF6 controls (magnesium)"<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Noted. Table 7.4 cannot be comprehensive. LB will add additional points to the extent that space is available. |
| 7-105 | A | 11 | 2 | 0 | 0 | In cell Non-CO2 HG and chemicals, replace: "HCFC"by "HFC"<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Accepted. LB will correct in editing. |
| 7-106 | A | 11 | 2 | 0 | 0 | Add a row for refineries and add e.g. under Fuel switching: "more utilisation of refinery gas and LPG" (or more flaring instead of gas venting)<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Noted. Table 7.4 cannot be comprehensive. LB will add additional points to the extent that space is available. |
| 7-107 | A | 11 | 11 | 14 | 15 | Policy makers should be made aware of the new literature on soil and the reduction of CO2 sequestration as this will have an influence on key mitigation measures in soils. Literature available: Jones, C; Cos, P; and Huntingford, C (2003) Uncertainty in climate-carbon-cycle-projections associated with the sensitivitiy of soil respoiration to temperature, Tellus Vol 55, Is 2 p.642 April. Heath, J et al (2005) Rising Atmospheric CO2 Reduces Sequestration of Root-Derived Soil Carbon, in Science 9 September, Vol 309, no, 5741pp1711-1713 and Kirschbaum, M, (2004) Soil Repiration under prolonged soil warming: are rate reductions caused by acclimation or substrate loss? in Global Change Biology, Vol 10, Issue 11, page 1870 November.<br>(Kirsten Macey, Climate Action Network Europe) | Rejected. This comment does not relate to Chapter 7. It is relevant to Chapters 8 and 9. LB will notify TSU. |
| 7-108 | A | 12 | 9 | 12 | 10 | It is claimed that a variety of environmental management tools are available to reduce GHG emissions, often without capital investment or increased operating | Noted. It was not the intent of the chapter to say that investment in energy efficiency was |

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| | | | | | | costs (page 12, line 9-10). This might very well be the case, but to indicate that CEOs do not want to implement such tools as a general rule is not well documented. This is an example of a general attitude through out this chapter of saying that profitable energy saving investments - or environmental management tools as in this case - within industry can easily be found but is not applied as a generale rule. Surely it is possible to find examples, and this is what this chapter contains, many examples of how to deal with energy savings. However, there is no facts to support a general conclusion that cost-efficient investments in energy-efficient technologies or management systems do not happen. The chapter needs in general to be looked through to avoid such generalisations which are building on cases and examples. (Helle Juhler-Kristoffersen, Confederation of Danish Industries) | not happening, but rather to demonstrate that there was a large additional potential. Chapter team will reconsider draft from this perspective. |
| 7-109 | A | 12 | 9 | 12 | 10 | At this point in the chapter, it needs to state the fact that when these investments are not made, this might very well be because they do not meet the internal hurdle rate of the company. If these investments in cost-efficient energy savings etc. were made, they would push aside better, more profitable and more innovative investments made by the company. The risk would be a distortionary impact on the company with less innovation taking place in the company. (Helle Juhler-Kristoffersen, Confederation of Danish Industries) | Noted. It was not the intent of the chapter to say that investment in energy efficiency was not happening, but rather to demonstrate that there was a large additional potential. Chapter team will reconsider draft from this perspective. |
| 7-110 | A | 12 | 9 | 12 | 10 | It is claimed that a variety of environmental management tools are available to reduce GHG emissions, often without capital investment or increased operating costs (page 12, line 9-10). This might very well be the case, but to indicate that CEOs do not want to implement such tools as a general rule is not well documented. This is an example of a general attitude through out this chapter of saying that profitable energy saving investments - or environmental management tools as in this case - within industry can easily be found but is not applied as a general rule. Surely it is possible to find examples, and this is what this chapter contains, many examples of how to deal with energy savings. However, there is no facts to support a general conclusion that cost-efficient investments in energy-efficient technologies or management systems do not happen. The chapter needs in | Noted. It was not the intent of the chapter to say that investment in energy efficiency was not happening, but rather to demonstrate that there was a large additional potential. Chapter team will reconsider draft from this perspective. |

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| | | | | | | general to be looked through to avoid such generalisations which are building on cases and examples.<br>(,) | |
| 7-111 | A | 12 | 9 | 12 | 13 | Would like to see the introduction widened by showing industry's change of attitude and working practices towards energy and climate issues. A reference may be Chad Holliday: Sustainable Growth - the DuPont Way, Harvard Business Review 2001, http://harvardbusinessonline.hbsp.harvard.edu/relay.jhtml?name=itemdetail&id=R0108J<br>(Kjell Oren, Norsk Hydro ASA) | Noted. LB will consider in rewrite. |
| 7-112 | A | 12 | 15 | 12 | 20 | There are some issues regarding volunteer policies that should be addressed although I think it better fits in below in section 7.9<br>(John Nyboer, Simon Fraser University) | Rejected. The comment gives no indication of the reviewer's concern. |
| 7-113 | A | 12 | 19 | 12 | 19 | Canada also promotes energy audits in the industrial sector though its "Canadian Industry Program for Energy Conservation" and its "Industrial Energy Inovators", programs run by the Industry Programs Division of Natural Resources Canada. See http://oee.nrcan.gc.ca/industrial/financial-assistance/existing/audits/index.cfm?attr=24 or http://oee.nrcan.gc.ca/industrial/opportunities/innovator/index.cfm?attr=24<br>(John Nyboer, Simon Fraser University) | Accepted. LB will add Canada in editing. |
| 7-114 | A | 12 | 19 | 12 | 20 | .. "e.g India (BEE n.d)" may be replaced by "e.g India through Bureau of Energy efficiency (GOI 2004, 2005)''. These references are there in the List of References.<br>(Government of India) | Accepted. LB will make change in editing. |
| 7-115 | A | 12 | 35 | 0 | 0 | Why?<br>(Ann Gardiner, AEA Technology) | Rejected. Space limitations preclude presenting full details of referenced studies. Reviewer can go to reference for more detail. |
| 7-116 | A | 13 | 11 | 0 | 0 | Benchmarking. The the global aluminium industry's benchmarking program, managed through the International Aluminium Institute (IAI), should be highlighted in this section. This benchmarking program is particularly noteworthy in that it covers the global primary industy through annual surveys. Data is | Noted. Al industry programs are discussed in detail in section 7.4.2. LB will provide a cross reference, if appropriate. |

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| | | | | | | analyzed and reported back to top company management who can identify their specific facilities within a coded data set of facilites operating with similar technologies. This comparative analysis facilitates setting PFC emissions reduction goals and has been an effective tool in reducing PFC emissions by over 70% from 1990 through 2004. The IAI has set a global objective to reduce PFC emissions per tonne aluminium by 80% by 2010 from the 1990 baseline. The benchmarking program is described in Bjerke et al, Light Metals 2004, pp 367 - 372 and Marks et al, Non-CO2 Greenhouse Gases: Scientific Understanding, Control Options and Policy Aspects, edited by J. van Ham, Millpress, Rotterdam, 2002. (Jerry Marks, International Aluminium Institute) | |
| 7-117 | A | 13 | 11 | 13 | 21 | Insufficient recognition of benchmarking as a means to encourage improvement through peer pressure. In this context, the global aluminium industry's IAI benchmarking is a good example in that it covers the global primary industry through annual surveys covering, for example, energy use and PFC emissions performance. The survey data is converted into deidentified benchmarking graphs, which are sent to company senior management. Such comparative data analysis has helped the setting of demanding emissions reduction goals, which have contributed to a reduction in PFC emissions per tonne of aluminium of over 70% from 1990 to 2004. (IAI 2004 Anode Effect Survey) (Robert Chase, International Aluminium Institute) | Noted. Al industry programs are discussed in detail in section 7.4.2. LB will provide a cross reference, if appropriate. |
| 7-118 | A | 13 | 11 | 13 | 11 | Delete "Benchmarking." (Robert Chase, International Aluminium Institute) | Noted. Initial phrases were supposed to be in italics, which disappeared in transmission. LB will correct in editing. |
| 7-119 | A | 13 | 23 | 13 | 41 | I wonder if it might be possible to reduce the text by placing the numbers in some form of table (John Kessels, Energy Research Centre of the Netherlands) | Noted. LB will consider in editing. |
| 7-120 | A | 13 | 24 | 13 | 24 | Suggest to list countries name next to regions: Flanders (Belgium). (Government of Belgium) | Accepted. LB will correct in editing. |
| 7-121 | A | 13 | 24 | 13 | 0 | The list of governments that have supported the development of benchmarking programs is: "Canada, Flanders, Netherlands, Norway, and the United States". | Accepted. LB will correct in editing. |

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| | | | | | | Flanders, although it has its own government, is not recognized as a wholly sovereign country. For consistency, Flanders should be deleted and replaced with Belgium, or the local regions of all the other countries supporting the development of benchmarking programs should be included in the list. (Government of Japan) | |
| 7-122 | A | 13 | 49 | 0 | 0 | Benchmarking is also used as part of the new entrant reserve for EU emissions trading scheme in a number of countries (Ann Gardiner, AEA Technology) | Rejected. EU use of term is not what is meant in this section. |
| 7-123 | A | 14 | 22 | 14 | 22 | "In view of the low energy efficiency of industries in many developing countries in particular Africa...." to be replaced by "In Africa...." . Because it is from 2001 reference and situation in many developing countries have changed. The current text does not reflect the true picture. (Government of India) | Rejected. Reference is not limited to Africa. |
| 7-124 | A | 14 | 22 | 14 | 31 | The impact of management measures on emission mitigation potentials is only partly included in the cost and potentials section (only for energy intensive industries and electric motors). These statements would warrant inclusion in the cost and potentials estimates. (Government of European Community / European Commission) | Noted. Will add note to Table 7.8 indicating that some categories of energy saving could not be estimated. EW will draft note. |
| 7-125 | A | 14 | 42 | 14 | 42 | Add after procedures. Electrical transmission losses in Europe are currently estimated at 7 % of the electricty generation corresponding to about 60 million tons of CO2. See: J.Harnisch and S.Wartmann, 2005: Reductions of SF6 Emissions from High and Medium voltage Electrical Equipment in Europe (Friedrich Plöger, Siemens AG) | Rejected. Transmission losses are discussed in Chapter 4. |
| 7-126 | A | 14 | 52 | 15 | 16 | The steam system measures discussed here do not seem to be included in the assessment of the mitigation potential for other industries (only for the selected energy intensive sectors). This would warrant inclusion in the cost and potentials estimates. (Government of European Community / European Commission) | Noted. Will add note to Table 7.8 indicating that some categories of energy saving could not be estimated. EW will draft note. |
| 7-127 | A | 15 | 12 | 15 | 16 | Zero carbon electricity as a concept is not universally recognised or accepted (Ann Gardiner, AEA Technology) | Noted. Term is clear if not universally accepted. |

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| 7-128 | A | 15 | 14 | 0 | 0 | Missing part of sentence<br>(Ann Gardiner, AEA Technology) | Noted. The sentence seems clear to the CLA. |
| 7-129 | A | 15 | 17 | 15 | 50 | This section should be modified to make it clear that burning waste materials that are derived from fossil fuels (e.g. plastics) does not necessarily result in lower atmospheric CO2. It is only if the fossil fuel-derived waste (e.g. plastics) would have been burned without energy recovery instead of being used as fuel that an overall reduction in GHG emissions might occur. To imply that the burning of plastic waste, or other fossil-fuel derived waste, automatically results in GHG reductions violates IPCC carbon accounting guidelines which specifically require that only biomass-based waste material be considered carbon neutral. Plastic-based wastes (for instance) only achieve GHG reductions if they otherwise would have been burned without energy recovery. Just because something is a waste material does not mean that using it as fuel reduces GHG emissions.<br>(Reid Miner, NCASI) | Accepted. LB will clarify in editing. |
| 7-130 | A | 15 | 18 | 0 | 0 | In this section I miss more utilisation of refinery gas, residual chemical gas and blast furnace gas, which may not be fully collected and/or used energetically, but instead partly vented or flared. Also LPG produced by refineries is not fully utilised in many countries, but instead partly flared by refineries.<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Accepted. LB will add in editing. |
| 7-131 | A | 15 | 27 | 15 | 29 | This statement (costs, likelihood biomass use) is not backed by a reference. Please provide a reference or delete.<br>(Government of European Community / European Commission) | Accepted. LB will find reference or delete. |
| 7-132 | A | 15 | 29 | 0 | 0 | Add: "..cost, except for the wood/furniture industry, and its greater.."<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Accepted. LB will address in editing. |
| 7-133 | A | 15 | 31 | 15 | 50 | Whether using plastics as a fuel substitute reduces GHG emissions is debatable: plastics, more often than not, are landfilled and therefore do not end up as GHG. If they are burned in modern incinerating plants, the energy they generate is recovered. The potential for using waste plastics (e.g. Shredder Residues) in the Steel Industry is very limited: the potential compared to the fossil fuel consumption is probably at the level of a few %: the example quoted for Japan (0.6 Mt/annum) is | Noted. KT will consider in editing. |

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| | | | | | | to be compared to 200 Mt, with the caveat of whether it does cuts emissions or not. Composition is the main cause for the limitation, such as phosphorus, zinc and sulphur, and can raise formidable challenges; toxic emissions are also an issue. Waste also replaces waste, not necessarily fossil fuel, so that additivity again is not obvious: animal feed, burned in cement kilns for example, has replaced some of the tyres, as it came with larger subventions! (Jean-Pierre Debruxelles, EUROFER) | |
| 7-134 | A | 15 | 40 | 0 | 0 | Page 15, line 40: while the Japanese industry is just starting to use alternative fuels, this is already widespread in Europe. EU-19 963 ktoe vs. 103 ktoe for Japan in 2004, according to IEA statistics. (Dolf Gielen, International Energy Agency) | Noted. KT will ask reviewer for source of information and add to section as appropriate. |
| 7-135 | A | 15 | 44 | 0 | 0 | Regulatory regime is an important consideration for this option (Ann Gardiner, AEA Technology) | Noted. The importance of regulatory regime is noted in the next paragraph. |
| 7-136 | A | 15 | 46 | 15 | 50 | The second sentence of this paragraph starts with "however", suggesting that the potential of waste fuels could be lower than the potential given in the previous sentence. We assume that Humphreys and Mahasenan did include such considerations in their potential, as it is relatively low given the statements in the previous paragraphs on Heidelberg Cement, and data from industry in Europe and US. (Government of European Community / European Commission) | Accepted. LB will change in editing. |
| 7-137 | A | 16 | 15 | 0 | 25 | Please clarify what low-temperature is. Now in China, we are promoting a technology that recover low-temperature waste heat at cement plant (about 350C) for power generation. In this sence, low-temperature waste heat is not just for preheating boiler feed water. (Yanjia Wang, Tsinghua University) | Rejected. 350 C is well above the usual definition of low temperature heat.. |
| 7-138 | A | 16 | 23 | 16 | 32 | Energy efficiency in the Steel Industry is much higher than in other energy-intensive industries. Process integration studies do not exhibit any significant savings that have been overlooked in the best run Steel Mills. The average figure of 10% quoted in the text is not true in this case. (Jean-Pierre Debruxelles, EUROFER) | Reject. Comparison is against average not best run steel mills. |

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| 7-139 | A | 16 | 23 | 16 | 32 | Page 16, lines 23-32: heat integration is already widely applied in the petrochemical industry. I wonder about the accuracy of the 10% estimate. I suppose this is a very rough estimate, not supported by detailed bottom-p estimation? If so, I would suggest to clarify this point, and may be recommend further analysis in this area. (Dolf Gielen, International Energy Agency) | Rejected. Supported by appropriate reference. |
| 7-140 | A | 16 | 45 | 16 | 45 | There is no section 4.4.1.3 in Chapter 4? (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will correct in editing. |
| 7-141 | A | 17 | 5 | 17 | 10 | Canada completed a study as well that reviewed Cogeneration potentials for GHG reduction. Laurin, A., J. Nyboer, C Strickland, N Rivers. 2004. Strategic Options for Combined Heat and Power in Canada. MK Jaccard and Associates. Completed for Office of Energy Efficiency, Natural Resources Canada. (John Nyboer, Simon Fraser University) | Noted. Reference is already cited elsewhere in Chapter. |
| 7-142 | A | 17 | 12 | 21 | 0 | Pages 17-21. It should be stressed that this does not cover the full potential for emission reductions in iron and steel. Increased blast furnace size, better coke quality etc. are missing (Dolf Gielen, International Energy Agency) | Noted. Chapter gives examples only. Total list would have to include too many technologies. |
| 7-143 | A | 17 | 12 | 211 | 0 | If you need another estimate of emissions reduction potentials in iron and steel: 800-1100 Mt in 2050, compared to the baseline scenario 2050, according to Gielen and Podkanski (2006). This would include 40% CCS, and 30% efficiency and fuel switching. Gielen, D.J., Podkanski, J. (2006) Technological Potentials for CO2 emission reduction in the Global Iron and Steel Industry. Proceedings of the Ishii symposium on sustainable ironmaking. Research seminar, 2-3 March 2006, Sydney. Published by the Cooperative Research Centre for Coal in Sustainable Development CCSD, Brisbane, Australia (Dolf Gielen, International Energy Agency) | Noted. Another estimates not needed. |
| 7-144 | A | 17 | 14 | 17 | 28 | You may want to add recent activities coordinated in a IEA task on solar industrial process heat. Details on the potential are given in (http://www.solarpaces.org/POSHIP_FinRep.zip). Details on the activities of the new IEA task can be found at( http://www.solarpaces.org/task_iv.htm) (Robert Pitz-Paal, German Aerospace Centre (DLR)) | Accepted. LB will check reference and add text if applicable. |

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| 7-145 | A | 17 | 23 | 17 | 24 | The text states that biomass fuels "will achieve zero CO2 emissions only if the biomass is grown sustainably." This text unnecessarily confuses the concept of biomass carbon neutrality. We suggest that some different wording would convey the important point without confusing the reader about the basis for the reporting convention on biomass carbon. We suggest that the text should say, "The overall benefits of biomass fuels can be negated if the biomass is obtained in ways that deplete biomass carbon stocks." (Reid Miner, NCASI) | Noted. The suggested wording is less clear than the original. LB will look for a definition of sustainably grown biomass that can be added as a footnote. |
| 7-146 | A | 17 | 31 | 17 | 44 | The comment on the low CO2 emissions of the EAF steelmaking route is right, at least as long as electricity is moderately carbon-lean. However, this does not mean that this provides any potential for cutting CO2 emissions at the world level as scrap is used to its full potential today and this will continue to be the case in the future. From a practical standpoint, this means that EAF shops have been built all over the world to accommodate the offer of scrap very closely. (Jean-Pierre Debruxelles, EUROFER) | Rejected. Scrap supply is growing. Chapter does not suggest that scrap route can supply whole world's need. |
| 7-147 | A | 17 | 32 | 17 | 44 | There are several research on cement recycling process and its CO2 reduction effect, such as "Shima, H. et al., Journal of Advanced Concrete Technology, 2005, Vol. 3, No. 1, pp53-67" and "Katsuyama, Y., et al., Environmental Progress, 24 (2), pp.162-170, 2005". These research should be mentioned in this section. (Yukio Yanagisawa, The University of Tokyo) | Noted. RM will obtain reference for EW who will evaluate. |
| 7-148 | A | 17 | 40 | 17 | 40 | Rewrite industry is now constitutes to industry now constitutes… (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will change in editing. |
| 7-149 | A | 17 | 50 | 17 | 52 | For the European Union estimates of the potential production of materials from renewable resources have been made in the framework of ECCP-1. (Government of European Community / European Commission) | Noted. JH will evaluate. |
| 7-150 | A | 17 | 51 | 17 | 52 | Page 17 lines 51-52: for biomaterials potentials, see Patel et al., (Dolf Gielen, International Energy Agency) | Noted. EW will get reference and evaluate. |
| 7-152 | A | 18 | | 18 | 10 | The description should not be limited to geological storage according to the SRCCS | Accepted. LB will replace with the SRCCS |

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| | | | | | | SPM. The description should be changed to "In both cases the captured CO2 can then be stored in geological formations, in the ocean, in mineral carbonates, or for use in industrial processes." (Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE)) | text. |
| 7-166 | A | 18 | 0 | 21 | 0 | In conclusion, the Steel Industry, which accounts for about 6% of the world CO2 emissions, has very little leeway today for cutting its emissions: the only one available in the short term is to upgrade steelmaking technology to the best available ones in the whole world. Using more scrap is a sophism! Using DRI is very much limited by the price of gas in the present and by its long term availability in the longer term (peak gas). The only path towards significant reductions is the development of breakthrough technologies, that will take time (15-20 years) for being commercially implemented and having an impact on emissions, and will add to the cost of making steel. It will need to have all world operators paying the same price for CO2 to stand a change to become industrial practice in a the world market economy. (Jean-Pierre Debruxelles, EUROFER) | Noted. More detail than space will permit. |
| 7-151 | A | 18 | 1 | 0 | 3 | CCS could also be applied to emissions from biomass. (Government of Sweden) | Noted. Need specific application in industry sector. |
| 7-153 | A | 18 | 12 | 18 | 12 | Rewrite also discusses of industrial uses to also discusses industrial uses….. (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will correct in editing. |
| 7-154 | A | 18 | 14 | 21 | 51 | Section 4.4.3.4 discusses CCS in relation to energy production, while in chapter 7 CCS is discussed in relation to industrial processes. This is not clear from this reference, and the power specific figures in 4.4.3.4 may therefore be misinterpreted. (Government of Belgium) | Accepted. The cross-reference is not needed and LB will delete in editing. |
| 7-155 | A | 18 | 15 | 18 | 17 | Unclear whether it is als a reduction compared to EAF (e.g. with an average fuel mix for the electricity generation). (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Rejected. Comment does not make sense. |
| 7-156 | A | 18 | 17 | 0 | 0 | I miss that as a notable except in Brazil a part of primary steel is produced with charcoal as reducing agent instead of coke or coal. | Rejected. The use of charcoal for steelmaking in Brazil is discussed on Pg 21, lines 44-46. |

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| | | | | | | (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | |
| 7-157 | A | 18 | 20 | 18 | 21 | I have problems with this sentence for the following reasons: (1) The SR-CCS is a voluminous report, and it is therefore recommendable to detail the very general statement 'many challenges' at least to some extent. (2) I was a bit surprised wen reading this paragraph, as CO2-rich process streams are generally considered as early CCS oportunities, but didn't check back to the SR-CCS to see what is exactly stated there. Is it possible that there is confusion with the H2 economy? (Government of Belgium) | Accepted. CO2-rich streams are considered early opportunities for CCS, but the technology is still at the demonstration stage. LB will amplify on the phrase “many challenges” to make its meaning cleared. |
| 7-158 | A | 18 | 22 | 18 | 29 | Implementing CCS in the Steel Industry is under intensive investigation, especially in the European ULCOS program. The best potential implementation is related with the blast furnace, by integrating the CCS in the process (oxygen use and pre-combustion capture): it is a major breakthrough research program, which needs about 10 more years before a first commercial implementation can be imagined. Today, it is not a "no regret" technology. The estimate of the cost (20-30$/t CO2) is much too optimistic: it will cost at least twice this much, and of course only if the R&D work is successful. Smelting Reduction is arguing for an easier CCS, due to a higher concentration of CO2 in the flue gas, but this is not demonstrated yet in commercial processes and the time scale for doing this is the same as that of the BF or longer: ULCOS is also investigating this route (ISARNA process) and this is also breakthrough research. (Jean-Pierre Debruxelles, EUROFER) | Rejected. Reviewer is speculating without supporting reference. |
| 7-159 | A | 18 | 25 | 18 | 25 | Rewrite in 2030 a cost to in 2030 at a cost….. (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will correct in editing. |
| 7-160 | A | 18 | 30 | 0 | 40 | Oxy-fuel can reduce pollutant emission in combustion process, but the emissions from producing energy required to produc oxygen could increase. Is there a life-cycle comparision? (Yanjia Wang, Tsinghua University) | Noted. LB will search for appropriate reference. |
| 7-161 | A | 18 | 34 | 0 | 0 | Page 18, line 34: a 73% saving of natural gas use because of oxyfueling is extreme and certainly not representative. Note that oxyfueling only results in important advantages if very high temperatures are needed. A 50% saving may be possible in | Accepted. LB will add additional information to show range of savings. |

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| | | | | | | steel reheating furnaces, and 30-40% in small-scale glass furnaces. DOE states that oxyfueling results in 15% energy savings for large glass furnaces: http://darwin.nap.edu/books/0309074487/html/137.html (Dolf Gielen, International Energy Agency) | |
| 7-162 | A | 18 | 36 | 18 | 36 | The Jupiter Oxygen Corp powerpoint presentation is grey literature and I wondered if they also had a report that had been published that could also be referenced. (John Kessels, Energy Research Centre of the Netherlands) | Noted. Much of the background for this information is in papers jointly published with US DOE. |
| 7-163 | A | 18 | 41 | 0 | 0 | I would insert here a separate section on energy savings by capturing and use of by-product gases (e.g. coke oven gas, blast furnace gas, refinery gas and residual chemical gas) and use it for energy purposes instead of venting or flaring; and a section on CO2 reduction by temporary capturing and re-use (e.g. for beverages or the pure CO2 supply industry), thereby avoiding fuel combusting by those CO2 users/sellers only to generate it themselves. (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Noted. Space limitation does not allow inclusion of separate sections to discuss these relatively minor contributors to GHG mitigation. LB will add additional text as appropriate to cover the concepts. |
| 7-164 | A | 18 | 42 | 0 | 0 | In general this section is very much US biased, only using EPA as reference and not mentioning other data sources e.g. EDGAR 3.2 FT2000. Also some significant US emissions, such as SF6 from circuit breakers in HV electrical transmission/distribution equipment are not mentioned (in section 7.4.8) (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Rejected. This comment does not make sense for section 7.4 as a whole. EDGAR database quoted where applicable. |
| 7-165 | A | 18 | 44 | 18 | 0 | The case for scrap steelmaking is not argued properly, as already pointed out in the previous comments. DRI made from natural gas looks of course a much more proper argument, that can cut emissions: the share of DRI production today is limited by the cost of natural gas. (Jean-Pierre Debruxelles, EUROFER) | Rejected. Scrap supply is growing. Chapter does not suggest that scrap route can supply whole world's need. |
| 7-167 | A | 19 | 1 | 0 | 0 | Page 19 top 10575 is wrong. 1129 Mt in 2005. (Dolf Gielen, International Energy Agency) | Accepted. LB will correct in editing. |
| 7-168 | A | 19 | 5 | 19 | 15 | In section 7.4.1 on Iron and Steel, I have problems seeing the link between the 10575 Mt mentioned in line 5 on page 19 and the 756 Mt mentioned in line 9.<br><br>(Nils-Axel BRAATHEN, OECD) | Accepted. LB will correct in editing. |

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| 7-169 | A | 19 | 5 | 19 | 5 | "the most world's important" should change to "the world's most important" (Government of China Meteorological Administration) | Accepted. LB will correct in editing. |
| 7-170 | A | 19 | 5 | 19 | 5 | "10575 Mt" should be corrected as "1057.5 Mt" (Government of China Meteorological Administration) | Accepted. LB will correct in editing. |
| 7-171 | A | 19 | 14 | 0 | 0 | Page 19, line 14: to my knowledge DRI can be used and is used in blast furnaces (Dolf Gielen, International Energy Agency) | Rejected. Use of DRI in blast furnaces highly limited. |
| 7-172 | A | 19 | 15 | 19 | 17 | We assume it is UP TO 50% savings, as it would strongly depend on the share of DRI used in the EAF. (Government of European Community / European Commission) | Accepted. LB will change in editing. |
| 7-173 | A | 19 | 17 | 0 | 0 | Page 19 line 17: reference Hidalgo 2005 is missing from the list. It should also be pointed out that about 10% of all DRI is produced from coal. (Dolf Gielen, International Energy Agency) | Accepted. LB will add Hidalgo to reference list. Comment on DRI from coal rejected – miniscule portion of global production. |
| 7-174 | A | 19 | 17 | 0 | 0 | [The source 'Hidalgo et al. (2005)' mentioned in line 17 is not in the list of references.]<br><br>(Nils-Axel BRAATHEN, OECD) | Accepted. LB will add Hidalgo to reference list |
| 7-175 | A | 19 | 25 | 19 | 26 | Substitute "3.1-3.8 tCO2 (0.84-1.04 tC) in China and India (Kim and Worrell, 2002a)" with "2.1-2.5 tCO2 (0.56-0.68 tC) in China (China Steel Statistics 2005) and 3.1-3.8 tCO2 (0.84-1.04 tC) in India (Kim and Worrell, 2002a)." , where emissions for steel production in China are estimated according to the comprehensive energy intensity figures. (Government of China Meteorological Administration) | Rejected. Methodology used to derive estimates has not been published. |
| 7-176 | A | 19 | 30 | 0 | 0 | Page 19, figure 7.2: this figure is really outdated, can you put the 2003 or 2004 figures? Because of the growth in China, it has changed significantly. (Dolf Gielen, International Energy Agency) | Accepted. KT will update. |
| 7-177 | A | 20 | 11 | 0 | 0 | Page 20, figure 7.3: The figure is interesting but a bit misleading. It represents a random selection of options that make sense in certain countries with high electricity prices. It is not an analysis of the full emission reduction potentials in 2030. For example closure of small blast furnaces, better coke quality, pre- | Noted. RM/KT will revise text to address reviewer concerns. |

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| | | | | | | reduction in the sintering process, oxyfueling, waste plastic injection, increased use of PCI are all missing. To my knowledge the reference is wrong, these are not IISI figures. Also the assumption of a fixed efficiency in the reference scenario makes this graph hard to understand. For example in China things are changing at a very rapid pace, so this graph may represent what is already happening autonomously, not the emissions reduction potential. All of this would warrant more explanation, if you keep it. Personally I would take the graph out. (Dolf Gielen, International Energy Agency) | |
| 7-178 | A | 20 | 22 | 21 | 10 | The argument on the potential for the progress in efficiency of China is right in principle. However, it should be noted that the new capacity added every year in China is at the level of excellence of Western Europe or Japan. (Jean-Pierre Debruxelles, EUROFER) | Rejected. Not all new capacity in China is at high level of efficiency. |
| 7-179 | A | 20 | 26 | 20 | 27 | The methodology of the study (here a "Monte-Carlo approach") is irrelevant to policy. This sentence could be removed. (ANTOINE BONDUELLE, Université Lille II) | Noted. KT will consider in rewrite. |
| 7-180 | A | 21 | 6 | 21 | 10 | “Birats” should be corrected as “Birat”. Emissions, in the boundary selected in ULCOS, are 1.85 t CO2/t of steel coil. The potential of 50% cut brings this down to 0. Of course, anything in between is possible. None of the solutions investigated are no regret. (Jean-Pierre Debruxelles, EUROFER) | Accepted. LB will correct in editing. |
| 7-181 | A | 21 | 10 | 21 | 10 | The Ultra Low Steel Making Program (ULCOS) is a key project for this chapter. But the author quoted is misspelled : Jean-Pierre Barat (no s) in the text and in the reference. Another reference for this work could be Birat J.P. 2002, "Innovation parardigm for the steel industry of the 21st century" in Revue de la Métallurgie, Paris, N 11 (November 2002), pp.957-979 (ANTOINE BONDUELLE, Université Lille II) | Accepted. LB will correct in editing. |
| 7-182 | A | 21 | 10 | 0 | 0 | Page 21, line 10: Birats should be Birat (Dolf Gielen, International Energy Agency) | Accepted. LB will correct in editing. |
| 7-183 | A | 21 | 12 | 0 | 0 | It is very difficult to judge the relevance and usefulness of many of the estimates of potential or actual energy efficiency improvements given in this section. For | Noted. Chapter has to cover a range of literature. |

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| | | | | | | example, on page 21:<br>Okazaki, et al. (2004) estimate that approximately 10% of total energy consumption in steel making could be saved through improved energy and materials management. Mozorov and Nikiforov (2002) reported an even larger 21.6% efficiency improvement in a Russian iron and steel facility.<br><br>(Nils-Axel BRAATHEN, OECD) | |
| 7-184 | A | 21 | 17 | 0 | 0 | Is the last estimate (probably made in a very inefficient, old plant that has been modernised) to be interpreted as saying that the energy efficiency of all the worlds steel industry could be increased by more than 20%??? How much would it cost to achieve even 'only' a 10% improvement? How large would the benefits of such an improvement be? What kind of policy could best trigger the 'right' amount of efficiency improvements?<br><br>(Nils-Axel BRAATHEN, OECD) | Rejected. Study is for U.S. steel industry, not a single plant and is not applicable to whole world. |
| 7-185 | A | 21 | 18 | 21 | 30 | I recognize this refers to I&S but the statement on economics is generally applicable. In fact, the whole notion of "potential reductions" is very economics based, if you think of what is actually acheivable. When we did an analysis for the Canadian federal gov't we used two models, one an optimization model using social discount rates and perfect foresight and another using hurdle rates with no foresight that uses behavioural parameters derived from historical responses to costs. The upshot of the report strongly supports your first line here - you could almost convert the statment from "Econmics may..." to "Economics does..." and perhaps include this as an overview statement for the whole section or it could be introduced in Section 7.5 (p. 37ff). We published the report as: Jaccard, M., R. Loulou, A. Kanudia, J. Nyboer, A. Bailie, and M. Labriet. 2003. Methodological contrasts in costing GHG abatement policies: Optimization and simulation modeling of micro-economic effects in Canada. European Journal of Operations Research 145, no. 1: 148-164.<br>(John Nyboer, Simon Fraser University) | Rejected. Beyond scope of chapter. |

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| 7-186 | A | 21 | 18 | 21 | 32 | The figures quoted are very rough and no more than orders of magnitude.<br>(Jean-Pierre Debruxelles, EUROFER) | Noted. |
| 7-187 | A | 21 | 40 | 21 | 50 | This paragraph restates things that have already been mentioned before. Whether using plastics or other wastes as a fuel substitute reduces GHG emissions is debatable: plastics, more often than not, are landfilled and therefore do not end up as GHG. If they are burned in modern incinerating plants, the energy they generate is recovered. The potential for using waste plastics (e.g. Shredder Residues) in the Steel Industry is very limited: the potential compared to the fossil fuel consumption is probably at the level of a few %: the example quoted for Japan (0.6 Mt/annum) is to be compared to 200 Mt, with the caveat of whether it does cuts emissions or not. Composition is the main cause for the limitation, such as phosphorus, zinc and sulphur, and can raise formidable challenges; toxic emissions are also an issue. Waste also replaces waste, not necessarily fossil fuel, so that additivity again is not obvious: animal feed, burned in cement kilns for example, has replaced some of the tyres, as it came with larger subventions!<br>(Jean-Pierre Debruxelles, EUROFER) | Taken into account. Same as 7-133. |
| 7-188 | A | 21 | 46 | 0 | 0 | "has been" should be "is" since this is still the case (although decreasing).<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Accepted. LB will correct in editing. |
| 7-189 | A | 22 | 11 | 0 | 0 | Add: "PFC for aluminium or SF6 for magnesium, .."<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Accepted. LB will change in editing. |
| 7-190 | A | 22 | 15 | 22 | 15 | Table 7.5 columns not aligned and the total in the Global CO2 emissions right column adds up to 90,939 not 91,000<br>(John Kessels, Energy Research Centre of the Netherlands) | Noted. LB will align columns in editing. Given the accuracy of the numbers, rounding to 91,000 is appropriate. An approximate sign will be added to indicate that it is not an exact number. |
| 7-191 | A | 22 | 15 | 0 | 0 | Table: Convert units to Mt (as in Table 7.6); rank them cf. size; add asterix to prim. alu and magnesium and add note: * In addition, this is a significant source of PFC emissions (alu) or SF6 emissions (magn.), about 69 and 16 Mt CO2-eq., respectively (Olivier et al., 2005; EPA, 2001). Ref: Olivier, J.G.J., Van Aardenne, J.A., Dentener, F., Ganzeveld, L. and J.A.H.W. Peters (2005). Recent trends in | Accept comments on conversion and alignment. LB will change in editing. Reject comment on non-CO2 gases. Already presented in Table 7.3b. |

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| | | | | | | global greenhouse gas emissions: regional trends and spatial distribution of key sources. In: Non-CO2 Greenhouse Gases (NCGG-4), A. van Amstel (coord.), page 325-330. Millpress, Rotterdam, ISBN 905966 043 9. (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | |
| 7-192 | A | 22 | 15 | 0 | 0 | Is unit of Magnesium (4) correct? - see value in Tabe 7.6 (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Accepted. Should 4 Mt. LB will change in editing. |
| 7-193 | A | 22 | 15 | 0 | 0 | Page 22, table 7.5: All of this is of secondary importance. May be delete, or add indirect emissions? (Dolf Gielen, International Energy Agency) | Rejected. Information not generally available. |
| 7-194 | A | 22 | 19 | 0 | 20 | The text notes that there are "significant amounts of fluorinated GHGs have been reported from the refining and casting steps." The statement appears to generally relate to all the non-ferrous metals and presents an erronous image of the industry. The only significant fluorinated GHG emissions that I am aware of are emissions of SF6 and its fluorinated ether replacements used in magnesium production and casting, and, a very minor useage of a fluorinated degassing compound used in Germany in casting of some specialized aluminium alloys. I would recommend some rewording to the specific applications and an estimate of the actual emissions to put these emissions in context. I believe that they are pretty minor compared with the other emissions being discussed. Perhaps a reference would help also. (Jerry Marks, International Aluminium Institute) | Noted. JH will check. |
| 7-195 | A | 22 | 27 | 0 | 0 | Add: There are a very limited number of manufacturers in 44 countries (Gibbs et al, 1999).Ref: PFC Emissions from Primary Aluminium Production; in: NGGIP, Background Papers - IPCC Expert Meetings on Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories; http://www.ipcc-nggip.iges.or.jp/public/gp/bgp/3_3_PFC_Primary_Aluminium_Production.pdf). (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Rejected. The reference is old and whether there are “a very limited number of manufacturers” is a value judgment which it is not necessary to make. |
| 7-196 | A | 22 | 30 | 0 | 0 | Add the word "primary" before the word aluminium in the sentence. As recycling accounts for about a third of aluminium produced, the sentence relates directly to only the primary production process. | Accepted. LB will change in editing. |

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| | | | | | | (Jerry Marks, International Aluminium Institute) | |
| 7-197 | A | 23 | 7 | 0 | 0 | This sentence implies that a complete disruption in alumina flow is necessary to cause anode effect. While it is true that a disruption will result in anode effect, more frequently anode effects result from the rate of feeding of alumina not being synconrized with the rate of electrolysis allowing the concentration of alumina to fall to levels that will not support the constant current electrolysis reaction.<br>(Jerry Marks, International Aluminium Institute) | Accepted. LB will correct in editing. |
| 7-198 | A | 23 | 8 | 0 | 9 | The reference to the GWPs noted is IPCC 2001. I don't believe that these GWP figures were noted until after that time, consistent with the IPCC TAR.<br>(Jerry Marks, International Aluminium Institute) | Noted. Per instructions from Co-Chair, LB will change values to those used by UNFCCC. LB ill also add footnote explaining why these values were used. |
| 7-199 | A | 23 | 13 | 0 | 0 | The text implies that a switch might be made from Vertical Stud Soderberg technology to Center Work or Point Feed Prebake technology. The text should be revised to indicate "Even larger reductions in emissions can be achieved by upgrading older cell technology (e.g. Vertical Stud Södeberg or Side Worked Prebake) by the addition of point feeders to better control alumina feeding. The cost of such a retrofit can be offset through improved productivity." This path is a reasonable upgrade path. Clearly the replacement of older technology by new prebake technology will also have a substantial impact on reducing PFC emissions; however, the cost for such a capital investment is very high, upward of US$1billion. The use of the terms "minor" and "major" retrofits are very specific to the EPA report and would mean nothing to the reader unless a detailed study were made of the referenced EPA report.<br>(Jerry Marks, International Aluminium Institute) | Accepted. LB will correct in editing. |
| 7-200 | A | 23 | 25 | 0 | 27 | The text states that the noted PFC reductions have been made at low or no cost and then goes on to correctly state that much of the reductions are due smelter conversion, retrofit or replacement. It is true that substantial PFC reductions have been achieved through low cost application of work practices and use of more sophisticated control software. However, PFC reductions achieved through smelter upgrades and replacements are capital intensive typically involving investments of | Noted. The capital cost involved in smelter upgrades is large, but they yield economic benefits, and if evaluated in terms of $t/CO2-eq. avoided, the existing chapter text is correct. |

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| | | | | | | tens of millions of dollars.<br>(Jerry Marks, International Aluminium Institute) | |
| 7-201 | A | 23 | 27 | 0 | 0 | Add: However, of the 30% production by non-IAI members, many smelters still use older technology, e.g. in the former USSR countries.<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Noted. The reviewer is probably correct, but a reference is needed to support this addition. LB will ask the TSU to contact the reviewer for a suitable reference. |
| 7-202 | A | 23 | 30 | 0 | 0 | "..believed to be much smaller.."<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Accepted. LB will change in editing. |
| 7-203 | A | 23 | 35 | 0 | 0 | add after control: ", in particular also by non-IAI members,"<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Rejected. The statement is true for all producers, whether they are IAI members or not. |
| 7-204 | A | 24 | 17 | 0 | 0 | Table 7.6. The last line of Table 7.6, Total Emissions for Non-Ferrous Metals should be adjusted down given the two substantial changes in the data contributing to this total.<br>(Jerry Marks, International Aluminium Institute) | Noted. LB will make the appropriate change based on the disposition of comments 7-205 to 7-209. |
| 7-205 | A | 24 | 17 | 0 | 0 | Table 7.6. The CO2 value for aluminium "mining and refining" appears much too high. The IAI 2003 LCA analysis showed an average of 0.048 tCO2/t bauxite mined, and, 5.174 t bauxite/t primary aluminium produced. Multiplying gives 0.25 t CO2/t Al for mining. For refining the same report gives 0.991 t CO2/t alumina refined and 1.925 t refined alumina/t Al. Multiplying gives 1.9 t CO2/t Al for the refining process. Adding these two together gives a total of 2.15 t CO2/t Al total for mining and refining. Multiplying this 2.15 by the 2004 primary production of 29.9 million tonnes primary aluminium produced gives a total of 64 million tonnes CO2 emissions. The figure of 109 million tonnes in the table refers to 1995 primary production. IAI data shows that in 1995 a total of 19.6 million tonnes of primary aluminium was produced. Multiplying this 19.6 million tonnes primary by 2.15 t CO2/t Al gives 42 million tonnes CO2, less than half the figure mentioned in the table.<br>(Jerry Marks, International Aluminium Institute) | Noted. JH will check. |
| 7-206 | A | 24 | 17 | 0 | 0 | Table 7.6. The CO2 value for aluminium "electricity" appears much to high. The | Noted. JH will check. |

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| | | | | | | IAI data show individual facilities electricity input varies from near zero for hydro supplied facilities to as high as 20.8 tCO2/t Al for facilities supplied from some coal sources, with a global average of 5.8 tCO2/t Al produced. Applying this value of 5.8 to 2004 production data gives a global emission of 173 million tonnes CO2, a value which is considerably lower than the 300 million tonnes noted in the table. Applying the 5.8 to 1995 global primary production of 19.6 million tonnes of aluminium gives 114 million tonnes CO2, about 1/3 of the value noted in Table 7.6. (Jerry Marks, International Aluminium Institute) | |
| 7-207 | A | 24 | 17 | 0 | 0 | Table 7.6. The CO2 value for aluminium "electricity" ist too high. International Aluminium Insttute data show individual facilities electricity input varies from near zero for hydro supplied facilities to as high as 20.8 tCO2/t Al for facilities supplied from some coal sources, with a global average of 5.8 tCO2/t Al produced. Applying this value of 5.8 to 2004 production data gives a global emission of 173 million tonnes CO2, a value which is considerably lower than the 300 million tonnes noted in the table. Applying the 5.8 to 1995 global primary production of 19.6 million tonnes of aluminium gives 114 million tonnes CO2, about 1/3 of the value noted in Table 7.6. (,) | Noted. JH will check. |
| 7-208 | A | 24 | 17 | 0 | 0 | Table 7.6: I believe 35 Mt for PFC from aluminium is incorrect, i.e. incomplete, only covering the cicumstances of the IAI members, while neglecting the old tech. used in the 30% production bu non-members. E.g. compare with EDGAR 3.2 FT2000: 69 Mt CO2-eq. (Olivier et al., 2005). Ref: Olivier, J.G.J., Van Aardenne, J.A., Dentener, F., Ganzeveld, L. and J.A.H.W. Peters (2005). Recent trends in global greenhouse gas emissions: regional trends and spatial distribution of key sources. In: Non-CO2 Greenhouse Gases (NCGG-4), A. van Amstel (coord.), page 325-330. Millpress, Rotterdam, ISBN 905966 043 9. (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Noted. JH will check. |
| 7-209 | A | 24 | 17 | 0 | 0 | I wonder what the basis is of the EPA estimate of 16 Mt for diecasting. RAND reports annual sales to the magnesium industrie in the 1990-2003 period normally between 150 and 400 ton, which corresponds to 3 to 9 Mton CO2-eq. | Noted. JH will check. |

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| | | | | | | (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | |
| 7-210 | A | 24 | 20 | 0 | 35 | Please clarify direct or indirect emission. When talk about pharmaceutical manufacture, it seems only say direct emission, but at page 29 line 13, you say indirect emission that confuse the readers<br>(Yanjia Wang, Tsinghua University) | Accepted. LB will clarify in editing. |
| 7-211 | A | 24 | 27 | 0 | 0 | F. Ledoux: § 7.4.3. In some cases, these emissions also include feedstock. In case of ammonia, most of the natural gas used is used as raw material feedstock (Hydrogen “H” in ammonia NH3 is mostly coming from methane CH4).<br>(Ben Muirheid , International Fertilizer Industry Association (IFA)) | Accepted. Fugitive emissions of CH4 from process that use CH4 as a feedstock will be added to the list of emissions. However, since the CH4 is converted in the chemical process, it is not appropriate to consider all CH4 used in ammonia manufacture as part of the GHG emissions from the chemical industry. LB will correct in editing. |
| 7-212 | A | 25 | 16 | 25 | 35 | It is mentioned that in the steam cracking process significant reductions are possible. Fact is, that an existing installation with a given technology only have a small reduction potential. The CO2-emission depends on the age of the installation and the used technology. In most cases reduction only can be realized by shutting down the existing insatllation and construction of a completely new installation. Improvements within an existing installation are very limited. For the European Union the extsisting technology is well discribed in the EU-BREF Large Volume organic Chemicals (link: http://eippcb.jrc.es/pages/FActivities.htm ).<br>(Joerg Rothermel, German Chemical Industry Association) | Noted. The slow rate of capital stock turn-over is discussed as a barrier to GHG mitigation in Section 7.6. The purpose of this section is to describe the technical potential for emission reduction. |
| 7-213 | A | 25 | 37 | 0 | 0 | T. Bruulsema: § 7.4.3.2. The approach taken appears to look at the design efficiency of new ammonia plants, rather than the current average performance. This leads to an impression, particularly in the Technical Summary (page 63 line 19) that little improvement is expected going forward from present. In fact, the global average is likely to improve considerably as new plants replace old. However, improvement in efficiency may be hampered by constraints in natural gas supply in North America. These constraints on natural gas supply and their impact on N manufacture should be discussed. | Noted. The last two sentences of the paragraph address these concerns. Space limitations preclude the detailed discussion suggested by this comment. |

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| | | | | | | (Ben Muirheid , International Fertilizer Industry Association (IFA)) | |
| 7-214 | A | 25 | 44 | 0 | 0 | F. Ledoux: § 7.4.3.2. Design energy consumption including energy consumption understood as such (about 1/3 in total in modern plants), plus hydrocarbons used as raw materials (about 2/3 of total).<br>(Ben Muirheid , International Fertilizer Industry Association (IFA)) | Rejected. Unnecessary detail. |
| 7-215 | A | 25 | 44 | 25 | 44 | We assume it should be 28.0 GJ/tNH3, to be consistent with the figures given in line 47 of page 25<br>(Government of European Community / European Commission) | Accepted. LB will correct in editing. |
| 7-216 | A | 26 | 10 | 0 | 0 | F. Ledoux: § 7.4.3.2. … based on natural gas. Retrofit of old plants, is feasible and may offer a potential for improved efficiency." Nevertheless the observed trend is contrary in some large production countries such as China, where there is a massive take over by coal, building coal gasification unit upfront ammonia plant. This is due to the high gas-price and energy market requirements, versus coal availability and political decisions.<br>(Ben Muirheid , International Fertilizer Industry Association (IFA)) | Noted. The purpose of this section is to discuss the technical potential for GHG emission reduction. High gas price and other considerations are barriers to achieving that potential and should be discussed in Section 7.6. |
| 7-217 | A | 26 | 10 | 0 | 0 | China and India pose interesting case studies for ammonia production efficiency in developing countries. Together these two countries account for almost half of world ammonia production. Chinese ammonia production amounted to 43.3 Mt in 2004, almost 30% of global production. This makes China the largest ammonia producer in the world. The Chinese production is unique because of its feedstock mix. 63% of all ammonia is derived from coal, 17% from oil products and only 20% from natural gas. The coal based production can be split into medium and small scale plants, with a share of 10 and 90% of production. The energy efficiency depends on the feedstock type and the scale of production: 34, 42, 55 and 53 GJ/t ammonia for gas based, oil based, medium sized coal based and small scale coal based production. The average energy use amounted to 46 GJ/t ammonia in 2004. 2.4 Mt of the coal based production uses Western technology with a plant size of about 0.4 Mt/yr. Many more of such plants are planned. Higher gas prices may result in a wider uptake of this coal based technology. New coal-based plants are being built routinely in China. Eighth of the Chinese plants in operation were using Western | Noted. LB will evaluate reference and add information as appropriate. |

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| | | | | | | gasification technology (GE and Shell technology) in 2004, accounting for 2.4 Mt ammonia capacity. Another 17 plants of the same type, equaling 8.3 Mt ammonia capacity, were planned. India is currently the second largest producer in the world. The Indian ammonia production reached 13.0 Mt in 2004. Half of the Indian production capacity is based on natural gas, the remainder uses naphtha and fuel oil. Gas based plants used on average 36.5 GJ/t ammonia in 2000-2001, naphtha based plants 39.9 GJ/t and fuel oil based plants 58.4 GJ/t. The fact that these two countries represent half of world production points to the fact that developing countries must be included in a framework that aims for efficiency in global ammonia production. Also these two cases show that the feedstock situation must be taken into account when energy efficiencies are compared. Finally the energy efficiency of similar installations is similar in industrialized and developing countries, and a limited number of equipment suppliers are responsible for most new installations. Therefore a global technology development approach is needed. Source: Gielen, D.J. (2006) ENERGY EFFICIENCY AND CO2 EMISSION REDUCTION: OPPORTUNITIES FOR THE FERTILISER INDUSTRY Paper presented at the International Fertilizer Association Technical Symposium, 25-28 April 2006, Vilnius, Lithuania<br>(Dolf Gielen, International Energy Agency) | |
| 7-218 | A | 26 | 14 | 0 | 0 | F. Ledoux: § 7.4.3.2. Half of CO2 generated is used in the production of urea, but this CO2 is fixed temporarily only, and will be released once urea is spread on the field. Such CO2 in urea does not lighten overall atmospheric CO2 balance (remark: as in your table page 38, in which is rightly considered the totality of CO2 really made when making NH3, including CO2 later used into urea<br>Use of CO2 in nitrophosphate industry (side CaCO3 production) leads to an improved CO2 balance from “Kyoto point of view”, because this synthetic CaCO3 can either be stored stabily as such, or it can be used for CAN production, replacing in such case natural carbonates that should otherwise be mined.J31<br>(Ben Muirheid , International Fertilizer Industry Association (IFA)) | Accepted. LB will add comments about the fate CO2 from fertilizers to the text. |
| 7-219 | A | 26 | 17 | 0 | 0 | F. Ledoux: § 7.4.3.2. Further significant reduction of GHG emissions could be | Noted. Clearly, if CCS were applied in |

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| | | | | | | achieved by using low carbon or carbon free hydrogen which could be obtained through the application of CCS technology, (note: thus subsequently preferring ammonium nitrate to urea as end product (since CO2, stored underground by CCS technology, would no more be available for urea production), biomass gasification, etc etc.<br>(Ben Muirheid , International Fertilizer Industry Association (IFA)) | ammonia plants, it would be applied only to the fraction of CO2 not need for further fertilizer processing. |
| 7-220 | A | 26 | 20 | 26 | 24 | It is true that the chlorine manufacturing by membrane technology is more electricity efficient. But the produced sodium hydroxide solution as a very important by product is produced in a much lower concentration than with other technologies which makes it necessary to concentrate the solutio by using additional heat. This means that the total energy reduction is lower than the reduction of electricity consumption<br>(Joerg Rothermel, German Chemical Industry Association) | Noted. Since membrane technology for Cl manufacture was discussed in the TAR, it is not discussed in detail in this report. |
| 7-221 | A | 27 | 5 | 27 | 7 | Source?<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Accepted. LB will add references in editing. |
| 7-222 | A | 27 | 23 | 0 | 0 | Add: Global total emissions of N2O from caprolactam production, in 2000 estimated at 3.7 Mt, is estimated at about 10 to 15 Mt CO2-eq. (EDGAR 4; Olivier, pers. comm.)<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Accepted. LB will add this new information in editing. |
| 7-223 | A | 27 | 25 | 27 | 35 | This is a sound, succinct and accurate summary of SROC<br>(Archie McCulloch, Marbury Technical Consulting) | Noted – with thanks. |
| 7-224 | A | 27 | 28 | 0 | 0 | Add before "HCFC-22": "There are a very limited number of HCFC-22 manufacturers. Present global emission are estimated at about 77 Mt CO2-eq. using an average unabated emission factor of 2.3% (EDGAR 3.2 FT2000; Olivier et al., 2005). Ref: Olivier, J.G.J., Van Aardenne, J.A., Dentener, F., Pagliari, V., Ganzeveld, L.N. and J.A.H.W. Peters, 2005, Recent trends in global greenhouse gas emissions: regional trends 1970-2000 and spatial distribution of key sources in 2000. Env. Sc., 2 (2-3), 81-99. DOI: 10.1080/15693430500400345.<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Accepted. The statement about a very limited number of manufacturers is a value judgment that does not have to be made. LB will add the additional data about emissions in editing, but use data from 2006 IPCC Guidelines. JH will supply. |
| 7-225 | A | 27 | 37 | 0 | 0 | I miss a discussion on the utilisation of refinery gas which may not be fully | Accepted. LB will add in editing |

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| | | | | | | collected and/or used energetically, but instead partly vented or flared. Also LPG produced by refineries is not fully utilised in many countries, but instead partly flared by refineries.<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | |
| 7-226 | A | 27 | 48 | 27 | 50 | REPLACE: "Worrell and Galitsky (2005), based on a survey of U.S. refinery operations, found that most petroleum refineries can economically improve energy efficiency by 10-20%, and provided a list of over 100 potential energy saving steps."<br>WITH: "Worrell and Galitsky (2005), based on a survey of some U.S. refinery operations, found that some petroleum refineries may be able to improve energy efficiency by 10-20%, and provided a list of over 100 potential energy saving steps."<br>Worrell and Galitsky did not demonstrate that "most" petroleum refineries can "economically" improve energy efficiency by 10-20%. The words "most" and "economically" should be deleted.<br>A significant part of their study and conclusions are based upon vendor data linked to a limited number of refineries that tends to be optimistic with respect to operating conditions and cost, or upon assumed "typical" operating conditions and "representative" refinery technology. This in no way captures the variations in operating conditions and process technologies that exist across the wide variety U.S. refineries with different mixes of diferent types of equipment.<br>A more accurate characterization of the W.&G. study would be "some petroleum refineries may be able to improve energy efficiency by 10-20%".<br>It should also be noted that more stringent fuel regulations that have recently been introduced in the U.S. such as ultra-low sulfur diesel, Tier 2 gasoline, and the blending of additional ethanol into low RVP gasolines, as well as an ever more sour crude slate, are factors that will require more process energy per unit of petroleum product output going forward. In fact a reference that is cited in section 7.4.4 (Eidt 2004. p. 19)) suggests that while U.S. and Western European refineries have increased energy efficiency over the last couple of decades (at a rate of | Rejected. Paper is analysis of whole US refining industry. Report has been available for two years without refutation. Data from company programs, e.g. GEMS cited elsewhere in chapter supports conclusion. LB will rewrite statement on Pg. 27, lines 44-45 about refinery energy use to include clean fuel requirements. |

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| | | | | | | approximately 0.5% per year) the energy efficiency of the first quartile of these refineries may be leveling off suggesting that there exists a "practical maximum efficiency" at least over the short run.<br><br>(Russell Jones, API) | |
| 7-227 | A | 28 | 1 | 28 | 11 | section 7.4.4. petroleum refinery : the valid data showing past and future reduction , based only on private company reporting, may be confusing for worlwide basis as mixing various regions (more US, Africa and/or Europe) and external context (1972, 1992, 2004,..). Unfortunately such type of figures are currently under study and no simple benchmark is now available. Should it be possible to mention "reserves on any futures trend according to external context of crude price and technology implementation".<br>(Brigitte POOT, Total s.a.) | Noted. The data presented are valid. LB will add comments on crude price and technology development to the section in editing. |
| 7-228 | A | 28 | 12 | 0 | 0 | Page 28: the global refinery industry's production capacity of hydrogen amounted to 2.1 EJ in 2000. Half of that is from catalytic reforming and half from on-site reforming units (IEA, 2005, pp. 52-55). That gives a CO2 capture potential of 75-85 Mt/yr.IEA (2005) Prospects for hydrogen and fuel cells. IEA/OECD, Paris<br>(Dolf Gielen, International Energy Agency) | Accepted. LB will change estimate of hydrogen production based on these references and on Comment 7-229. |
| 7-229 | A | 28 | 17 | 28 | 18 | section 7.4.4. petroleum refinery : to balance the US refineries use of about 8% of their energy input to produce hydrogen, please find attached a published report of CONCAWE assuming, for the european refinery sector, an increasing of CO2 emissions from 5-6 % for 50ppmS level and up to 3% additionnel for 10ppm S of automotive fuels (table 6 page 16 of the report the impact of reducing sulphur to 10 ppm max in EU automotive fuels) (see www.concawe.be, report nr 8/05 : http://www.concawe.org/DocShareNoFrame/Common/GetFile.asp?PortalSource=156&DocID=7890&mfd=off&pdoc=1)<br>(Brigitte POOT, Total s.a.) | Accepted. LB will change estimate of hydrogen manufacture based on this reference and the references provided in Comment 7-229. |
| 7-230 | A | 28 | 20 | 28 | 23 | Is the CO2 stored underground or used by greenhouses? The latter is reported in the literature (reducing emissions by 300-320 ktCO2/year).<br>(Government of European Community / European Commission) | Noted. LB will evaluate whether to include this discussion based on latest information on projected use. |

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| 7-231 | A | 28 | 31 | 0 | 0 | You should add that cement production is closely related to construction activity, natural resource endowment (eg. Wood) and level of development.<br>(Michael Taylor, International Energy Agency) | Rejected. Construction and economic activity are the major variables. |
| 7-232 | A | 28 | 32 | 0 | 0 | USGS data is available for 2005 and is important, as China is even more important.<br>(Michael Taylor, International Energy Agency) | Accepted. EW will update information to 2005, if available. |
| 7-233 | A | 28 | 40 | 29 | 15 | here includes indirect emission<br>(Yanjia Wang, Tsinghua University) | Accepted. LB will clarify in editing. |
| 7-234 | A | 28 | 45 | 28 | 52 | Could the average emissions intensties be presented in table format instead of text? I refer you to Figure 7.10 page 406 sourced from the WBCSD in the IEA 2006 publication Energy Technology Perspectives: Scenarios and strategies to 2050.<br>(John Kessels, Energy Research Centre of the Netherlands) | Noted. Figure will be used if space allows. EW will develop figure. |
| 7-235 | A | 28 | 48 | 0 | 0 | In this section on cement it would be useful to have an estimate of how much cement is used by the wind energy industry (for the foundations of turbines, and for new access roads). With each modern turbine estimated to require 1000 tonnes of concrete, is it or is it not the case that each modern turbine involves the emission of 222,000 kg of elemental carbon or814,000 kgs of CO2?<br>(Michael Jefferson, World Renewable Energy Network & Congresses) | Rejected. Details on the use of cement are beyond the scope of this chapter. |
| 7-236 | A | 28 | 49 | 28 | 52 | According to the reference of [Worrell et al.2001b], the lowest intensity is 625kgCO2(170Kg C)/ton cement in Japan. Therefore, we would suggest amending as follows: "CO2 emission/t cement vary by region from a low of 700 kg (190 kg C) averaged in Western Europe and in East Asia, to a high of 900, 930, and 935 kg (245, 253, and 255 kg C) in China, India and the United States (Humphreys and Mahasenan, 2002; Worrell, et al., 2001b)".<br>If this is unacceptable, one of the references should be deleted, for example, WBCSD Report 8, 2000 since the data described is obviously inconsistent, some referring to Worrell only, some referring to the WBCSD only and others averaging the two and also, it is not clear how to calculate the emission intensities for Korea and USA.<br>(Claude LOREA, CEMBUREAU, The European Cement Industry) | Taken into account. See comment 7-234 |
| 7-237 | A | 28 | 49 | 28 | 52 | According to the reference of [Worrell et al.2001b], the lowest intensity is | Taken into account. See comment 7-234 |

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| | | | | | | 625kgCO2(170Kg C)/ton cement in Japan. Therefore, I would suggest amending as option 1) or 2). If not, I would suggest to delete one of them, for example, WBCSD Report 8, 2000 since the data described is obviously inconsistent, some referring to Worrell only, some referring to the WBCSD only and others averaging the two and also, it is not clear how to calculate the emission intensities for Korea and USA. Option 1) Emission intensities vary by region from a low of 625 kg CO2 (170 kg C)/ton cement in Japan, 700 kg CO2 (190 kg C) in Western Europe and 800 kg CO2 (219 kg C) in South Korea, to a high of 900, 930, and 935 kg CO2 (245, 253, and 255 kg C) per ton cement in China, India and the United States, respectively (Humphreys and Mahasenan, 2002; Worrell et al., 2001b).Option2) CO2 emission/t cement vary by region from a low of 700 kg (190 kg C) averaged in Western Europe and in East Asia, to a high of 900, 930, and 935 kg (245, 253, and 255 kg C) in China, India and the United States (Humphreys and Mahasenan, 2002; Worrell, et al., 2001b).<br>(Yoshito Izumi, Taiheiyo Cement Corporation) | |
| 7-238 | A | 28 | 49 | 28 | 52 | Option 1) Emission intensities vary by region from a low of 625 kg CO2 (170 kg C)/ton cement in Japan, 700 kg CO2 (190 kg C) in Western Europe and 800 kg CO2 (219 kg C) in South Korea, to a high of 900, 930, and 935 kg CO2 (245, 253, and 255 kg C) per ton cement in China, India and the United States, respectively (Humphreys and Mahasenan, 2002; Worrell et al., 2001b).<br>Option2) CO2 emission/t cement vary by region from a low of 700 kg (190 kg C) averaged in Western Europe and in East Asia, to a high of 900, 930, and 935 kg (245, 253, and 255 kg C) in China, India and the United States (Humphreys and Mahasenan, 2002; Worrell, et al., 2001b).<br>(Eiichi Onuma, 0) | Taken into account. See comment 7-234 |
| 7-239 | A | 28 | 49 | 28 | 52 | Comments: We suggest adopting only one reference. Adopting a few references, it's not clear about calculating the emission intensities. In present draft, some referring to Worrell only, some referring to the WBCSD only and others averaging the two and also, it's inconsistent we think. For example, according to the reference of [Worrell et al.2001b], the lowest intensity is 625kgCO2(170Kg C)/ton cement in | Taken into account. See comment 7-234 |

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| | | | | | | Japan.<br>we suggest to replace as following sentences.<br>"Emission intensities vary by region from a low of 625 kg CO2 (170 kg C)/ton cement in Japan, 700 kg CO2 (190 kg C) in Western Europe and 800 kg CO2 (219 kg C) in South Korea, to a high of 900, 930, and 935 kg CO2 (245, 253, and 255 kg C) per ton cement in China, India and the United States, respectively (Humphreys and Mahasenan, 2002; Worrell et al., 2001b)."<br>(Government of Japan) | |
| 7-240 | A | 29 | 25 | 29 | 26 | "The cement industry is capital intensive and equipment may have a long lifetime,.....". Please replace "may have" with "has".<br>(Claude LOREA, CEMBUREAU, The European Cement Industry) | Accepted. LB will change in editing. |
| 7-241 | A | 29 | 40 | 0 | 0 | You could add that "IEA analysis suggests that mitigation options may be limited if China continues to replace inefficient vertical shaft kilns with more efficient dry process plants, given their significant share of global production. However, incremental improvements in energy intensity can be achieved in most regions, with the growth in the use of clinker substitutes helping to moderate emissions from cement production. However, the strong growth in cement demand will still see CO2 emissions from the industry increase by 80-100% between 2003 and 2050 even with significant action to curb global GHG emissions ( IEA 2006, Energy Efficiency and CO2 Emissions from the Global Cement Industry, paper presented to the joint IEA-WBCSD Workshop on Cement, 4-5 September.)<br>(Michael Taylor, International Energy Agency) | Rejected. Issue is what is in base case. Still many vertical shaft kilns to be replaced offering large mitigation potential. |
| 7-242 | A | 29 | 48 | 29 | 51 | It is our understanding that captive lime kilns at sugar mills do not internally regenerate lime; however, lime kilns found at some drinking water treatment plants do. Thus, we propose revising the sentence on page 29, line 49 to state: Pulp mills and drinking water treatment plants may have captive lime production to internally regenerate lime.<br>We propose the sentence beginning on page 29, line 49 be amended to more correctly state:<br>"Lime is used in a variety of applications including steel, non-ferrous metallurgy, | Rejected. Too much detail for space allowed. |

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| | | | | | | chemicals, pulp and paper, precipitated calcium carbonate (PCC), sugar, mining, drinking water treatment, wastewater and sewage treatment, flue gas desulphurization, fertilizer, manure treatment, soil stabilization and remediation, asphalt, and building construction."<br>(Vladimir Novotny, International Lime Association ILA) | |
| 7-243 | A | 29 | 51 | 29 | 54 | We propose the sentence beginning on page 29, line 51 be amended to more descriptively state: In 2004, developed countries produced approximately 45%, and developing countries approximately 55% of world production, with the largest producers being China, United States, European Union, Russia, Japan, Mexico and Brazil.<br>(Vladimir Novotny, International Lime Association ILA) | Noted. This information can be used only if supported by an appropriate reference. LB will ask the TSU to seek such a reference from the reviewer. |
| 7-244 | A | 29 | 51 | 0 | 0 | "mining, road paving with asphalt, .."<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Rejected. No indication that lime is used in road paving. |
| 7-252 | A | 30 | 0 | 30 | 0 | NEW: We propose the addition of a new opening paragraph, to be inserted at page 30 after above comment to read as follows: "Lime is an important basic material that has been used in a diverse and wide variety of applications around the world for thousands of years. Modern, efficient lime kilns are up to 90% efficient and represent one of the most energy efficient industrial energy conversion processes in the world. Lime kilns are capital intensive, have a minimum life time of 40 years, and there are a limited number of commercial technology providers."<br><br>(Vladimir Novotny, International Lime Association ILA) | Rejected. Does not add critical information. |
| 7-245 | A | 30 | 6 | 30 | 10 | The sentence beginning on page 30, line 6 does not provide an accurate picture of the variability, based on variable limestone chemistry, associated with process emission from lime/dolime production. We propose the sentence beginning on page 30, line 10 be deleted and replaced with the following:<br>"Process emissions for lime/dolime are dependent on the calcium carbonate and magnesium carbonate content of the limestone used, impurities in the limestone (from which there are no process emissions), and on the degree of calcination of the limestone. Theoretical process emissions associated with calcium oxide (from | Accepted. LB will add in editing. |

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| | | | | | | calcium carbonate) are 785 kg CO2/t calcium oxide and associated with magnesium oxide (from magnesium carbonate) are 1092 kg CO2/t magnesium oxide." (Vladimir Novotny, International Lime Association ILA) | |
| 7-246 | A | 30 | 19 | 30 | 26 | The sentence beginning on page 30, line 19 is factually incorrect and misleading in three ways. First, the document referenced as authored by the Canadian Lime Institute (CLI) was in fact not authored by the CLI. The authors were Energistics Group Inc., as can be ascertained from the Disclaimer and Acknowledgment pages of the referenced document. Second, the document does not in any way support the statement that "Emission reductions (5-10% of total emissions) are possible by energy efficiency measures at payback periods of less than three years." Emission reductions in the range of 5-10% of total emissions represents reductions of 12.5-25% of energy related emissions (remember 60% of lime emissions are from the decarbonisation of limestone and simply can not be reduced). Reductions of this magnitude are simply not possible for many kilns and in instances where this magnitude of reduction is physically possible, it is certainly not possible at paybacks of less than three years. Third, the second document referenced in support of this same statement is not included in the bibliography or is incorrectly referenced as Worrell and Galitsky, 2003 when the reference perhaps should have been Worrell and Galitsky, 2004. If this is the case and Worrell and Galitsky, 2004 is the correct reference, we again must stress that lime kilns are a wholly different technology than cement kilns and cement kiln improvement opportunities are not necessarily applicable to lime kilns. We propose the sentence beginning on page 21, line 21 be deleted and replaced with the following: Given that the lime industry is capital intensive and lime kilns have long lives, typically over 40 years, there is limited potential for improvement in the near term.<br><br>(Vladimir Novotny, International Lime Association ILA) | Noted. EW will reexamine reference and ensure that they are correctly cited. |
| 7-247 | A | 30 | 20 | 30 | 21 | The sentence which draws analogies between cement and lime manufacturing beginning on page 30, line 20 is problematic. It is true that emission reductions are in many cases technically possible, though not necessarily economically feasible, | Noted. EW will reexamine reference and ensure that they are correctly cited. |

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| | | | | | | through construction of new, more efficient kilns (although modern, efficient lime kilns at nearly 90% efficiency will be difficult to improve upon) and through improved management of existing kilns, but to say "using similar techniques as the cement industry (see section 7.4.5.1)" is misleading.<br>First, as discussed in section 7.4.5.1, much of the cement industry reduction in CO2 emissions intensity is being achieved by replacing calcined limestone (clinker) with uncalcined materials, e.g., blended cements. Lime is not a blended product. By contrast to cement, the CO2 intensity of lime manufacturing is reduced by maximizing (not diluting) the calcined content.Second, because of the differences in feed materials, product specifications, and technologies, management of cement kilns does not translate to management of lime kilns. For example, lime used for steelmaking (the largest single market for lime) generally requires the use of less efficient straight rotary kilns in order to control the sulphur content of lime. Most improvements in cement kiln technology are not applicable to lime kilns. We propose the sentence beginning on page 30, line 20 be amended to more correctly state: "Emission reductions are possible by construction of new, more efficient lime kilns (Dankers, 1995; IPCC 2001), although this may not be economically feasible (Minerals and Metals Working Group, 1999), and through improved management of existing kilns. In addition, reduction potential is limited by market driven product specifications which can dictate production technology which in turn dictates energy efficiency (Minerals and Metals Working Group, 1999)."<br><br>(Vladimir Novotny, International Lime Association ILA) | |
| 7-248 | A | 30 | 23 | 30 | 24 | We propose the sentence beginning on page 30, line 23 be amended to more accurately state: "Switching to low-carbon fossil fuels can further reduce CO2 emissions but in some cases this results in increased energy use and is uneconomic, or is not available as an option (Minerals and Metals Working Group, 1999)."<br><br>(Vladimir Novotny, International Lime Association ILA) | Rejected. No basis for statement about increasing energy use. Availability and cost of alternate fuels always a consideration. Does not have to be specified in each case. |
| 7-249 | A | 30 | 24 | 30 | 26 | Given that this report is not meant to be policy prescriptive, we think it | Rejected. Statement is not policy-prescriptive. |

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| | | | | | | inappropriate to suggest specifically for lime, as is done starting on page 30, line 23, that it is possible to reduce consumption of lime. First, this sounds policy prescriptive. Second the same could be said for any of the products discussed in Chapter 7 but it appears lime has been singled out for this kind of statement. "We propose deleting the final two sentences of section 7.4.5.2 beginning on page 30, line 23." (Vladimir Novotny, International Lime Association ILA) | |
| 7-250 | A | 30 | 41 | 31 | 7 | The conclusion from the paper of Beerkens and van Limpt (2001) (Beerkens, R.G.C. and J. van Limpt, 2001: Energy Efficient Benchmarking of Glass Furnaces; 62nd Conference on Glass Problems, University of Illinois, October 16-17, 2001) is completely misplaced. The energy benchmarking results show indeed a considerable spread of specific energy consumption figures (glass melting furnaces) throughout the container glass sector and float glass sector. However, energy consumption depends on many (often non controlable or external not to be influenced by the glass producer) factors which could not all taken into account in the benchmark comparison. The glass quality demand, local aspects, type of fuel, furnace capacity, product variation, available raw materials, age of furnace (during furnace lieftimes of 10-15 yerars, energy consumption can increase > 15 -20 %) are important parameters for the specific energy consumption. It is wrong to conclude from the spread in energy consumption figures as done in the report that the potential emission (CO2) reduction is 30-40 %. This is far too high.Beyond this, part of the CO2 emissions from glass furnaces is caused by the carbonate raw materials, for which the potential to reduce CO2 emissions is very limited. (Comment made by Ruud Beerkens author of the original literature reference) (Ruud Beerkens, TNO Science & Industry) | Accepted. JH will rewrite. |
| 7-251 | A | 30 | 41 | 31 | 7 | The conclusion from the paper of Beerkens and van Limpt (2001) (Beerkens, R.G.C. and J. van Limpt, 2001: Energy Efficient Benchmarking of Glass Furnaces; 62nd Conference on Glass Problems, University of Illinois, October 16-17, 2001) is completely misplaced. The energy benchmarking results show indeed a considerable spread of specific energy consumption figures (glass melting furnaces) | Taken into account. Same as 7-250. |

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| | | | | | | throughout the container glass sector and float glass sector. However, energy consumption depends on many (often non controlable or external not to be influenced by the glass producer) factors which could not all taken into account in the benchmark comparison. The glass quality demand, local aspects, type of fuel, furnace capacity, product variation, available raw materials, age of furnace (during furnace lieftimes of 10-15 yerars, energy consumption can increase > 15 -20 %) are important parameters for the specific energy consumption. It is wrong to conclude from the spread in energy consumption figures as done in the report that the potential emission (CO2) reduction is 30-40 %. This is far too high.Beyond this, part of the CO2 emissions from glass furnaces is caused by the carbonate raw materials, for which the potential to reduce CO2 emissions is very limited.<br>(Comment made by Ruud Beerkens author of the original literature reference)<br>(Frédéric VAN HOUTE, Comité Permanent des Industries du Verre Européennes) | |
| 7-253 | A | 31 | 40 | 31 | 40 | Add fullstop<br>(John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will correct in editing. |
| 7-254 | A | 31 | 50 | 33 | 25 | The whole setion of 7.4.6 focus on pulp and paper insudtr, why title of this section is forest products. In China there are many paper plants using straw as feedstock for pulp making. So forest products can not cover paper industry<br>(Yanjia Wang, Tsinghua University) | Accepted. LB will change in editing. |
| 7-255 | A | 31 | 52 | 33 | 24 | A case study concerning potentials for GHG emission reductions in the Swedish pulp and paper sector is presented in:<br>- Möllersten K, Yan J, Westermark M, (2003). Potential and cost-effectiveness of CO2 reductions through energy measures in Swedish pulp and paper mills. Energy 28(7):691 - 710.<br><br>(Kenneth Möllersten, Swedish Energy Agency) | Noted. LB will evaluate the reference. |
| 7-256 | A | 31 | 52 | 33 | 23 | This section is rather weak. It only includes a few mitigation opportunities and does hardly address energy efficiency opportunities. Furthermore, in contrast to the other sections it does not address differences in carbon or energy intensity between regions, while literature is available, e.g. Farla et al. in a 1997 Energy Polic special | Noted. LB (with Reid Miner, Contributing Author) will attempt to strengthen the section. |

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| | | | | | | issue.<br>(Government of European Community / European Commission) | |
| 7-257 | A | 32 | 13 | 0 | 46 | Section 7.4.6.1. System solutions/process integration is not mentioned. Electricity conserving measures and more efficient processes (of particular interest to mechanical pulping) are not mentioned. A project demonstrating the Chemrec black liquor gasification technology is on-going in Sweden. Overall potentials for GHG mitigation in pulp mills including emerging technologies and process integration are presented in: Ecocyclic Pulp Mill – "KAM" – Final Report 1996–2002, KAM Report A100, Swedish Pulp and Paper Research Institute, Stockholm, 2003 and FRAM Final report (complete reference is missing). A case study concerning potentials for GHG emissions in the Swedish pulp and paper sector is presented in: Möllersten K, Yan J, Westermark M, (2003). Potential and cost-effectiveness of CO2 reductions through energy measures in Swedish pulp and paper mills. Energy 28(7):691 - 710.<br>(Government of Sweden) | Noted. LB (with assistance of Reid Miner, Contributing Author) will evaluate the reference and add text as appropriate. |
| 7-258 | A | 32 | 24 | 0 | 0 | CHP barriers are different and include the need to have reasonable certainty of a market for useful heat and electricity and also knowledge of the electricity market<br>(Ann Gardiner, AEA Technology) | Rejected. The statement in the text is correct. |
| 7-259 | A | 32 | 33 | 32 | 33 | Usually, we do not use 'used paper' as a technical term. It should be 'waste paper' in this case. Please check ISO 4046.<br>(Takayuki Okayama, Tokyo University of Agriculture and Technology, Institute of Symbiotic Science and Technology) | Accepted. LB will change in editing. |
| 7-260 | A | 32 | 33 | 32 | 35 | When we describe recycling of materials, the utilization rate is also important as well as the recovery rate. For example, utilization rates of waste paper are much higher than recovery rates in forested developed countries such as Canada, Sweden and Finland. On the other hand, utilization rate is much higher than recovery rate in China<br>(Takayuki Okayama, Tokyo University of Agriculture and Technology, Institute of Symbiotic Science and Technology) | Noted. This information cannot be used without a suitable reference. RM contact the reviewer and ask for a suitable reference. |
| 7-261 | A | 32 | 41 | 32 | 43 | There are various opinions whether paper recycling reduces life cycle emissions of | Noted. This comment appears to be a |

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| | | | | | | GHG compared to other means of managing waste paper, because many paper mills also uses evaporated black liquor of kraft cooking as a biomass fuel for paper-making. As the result, more fossil fuel is spent for paper recycling in the pulp and paper production, compared with kraft pulping. However, it is still insufficient to estimate life cycle emissions of GHG for utilizing biomass resources such as forest products. We have to think about sustainability of forest, consumption of fossil fuel for importing forest resources, reduction of landfill and so on. (Takayuki Okayama, Tokyo University of Agriculture and Technology, Institute of Symbiotic Science and Technology) | reiteration of the statement made in the text. |
| 7-262 | A | 33 | 17 | 33 | 18 | Tanaka et al. (2005) do not analyse economics in their paper, and the factors mentioned in the paragraph before (lines 10-15) are all of technical nature. How would this influence the ECONOMIC potential? Suggest to delete the word ECONOMIC. (Government of European Community / European Commission) | Rejected. Text clearly states difference between technical and economic potential according to the definitions used by WG III. |
| 7-263 | A | 33 | 21 | 0 | 0 | Page 33, table 7.7, instead of the pluses, I would put the values in the table, less confusing. Please decide throughout the document to use Mt C or Mt CO2, the mix is very confusing. (Dolf Gielen, International Energy Agency) | Noted. LB will convert to MtCO2. The ranges are meant to indicate uncertainty. |
| 7-264 | A | 33 | 25 | 35 | 35 | Given the complexity and variety of this sector, the food industry is a hard industry to analyse and discuss. Still, the discussion should be better organized to give policymakers a better understanding of the opportunities in this sector. What are the most important sectors from a climate or energy perspective? What are the most important mitigation opportunities? (Government of European Community / European Commission) | Noted. FY will add discussion to extent allowed by space limitations. |
| 7-265 | A | 34 | 5 | 0 | 0 | Page 34, top: May be worthwhile to note that all new ethanol plants under construction in the US use dry milling technology. (Dolf Gielen, International Energy Agency) | Rejected. The plants are for ethanol for fuel and should be covered in Chapter 4. |
| 7-266 | A | 35 | 8 | 35 | 8 | Delete for use (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will change in editing. |
| 7-267 | A | 35 | 37 | 0 | 0 | I miss in this section an overview table with present global emission estimates | Rejected. Information is in Table 7.3b. |

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| | | | | | | broken down into the largest sources, e.g. as in Olivier et al. (2005) for 2000: HFC-23 from HCFC-22 prod., HFC from its uses; PFC from alumin., PFCs from its uses, SF6 for electrical equipment, Sf6 for other uses. This could also be broken down into Annex I and non-Annex I cf. data in EDGA 3.2 FT2000. (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | |
| 7-268 | A | 35 | 39 | 0 | 0 | ".. of other industries.." (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Accepted. LB will add in editing. |
| 7-269 | A | 35 | 53 | 36 | 12 | Par. not well structured: SF6 emissions during the use of the HV equipment (e.g. Gas Insulated Switchgear, GIS,and circuit breakers) is not mentioned. This is a large source in the USA. Als mention other SF6 uses/sources, e.g. in double glazing and in soles of sport shoes, which are expected to be phased out, for semi-conductor manufacture, scientific and medical applications, and, possibly, military applications (such as radars). (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Noted. JH will add additional uses of SF6. Other comments not appropriate for chapter. |
| 7-270 | A | 35 | 54 | 35 | 54 | modify after at about 15 Mt CO2-eq.( CIGRE Study Committee 23 2001: SF6 in the Electric Industry,Status 2000), e.g.published in Electra, No.200, Febr.2002 (Friedrich Plöger, Siemens AG) | Noted. JH will evaluate. |
| 7-271 | A | 36 | 5 | 36 | 5 | add after declined by about 70%, despite…. (Friedrich Plöger, Siemens AG) | Noted. JH will evaluate. |
| 7-272 | A | 36 | 5 | 36 | 8 | "Comment: This sentence i.e.'These emissions, mainly located in Europe and Japan, are estimated to have declined, despite a 60% growth in production,1995-2003, ,,,,, at production sites.' is not clear. I would suggest better expression 'The emissions from semiconductor and liquid crystal manufacturing, mainly located in Europe and (East) Asia, are estimated to have declined, despite a 60% growth in production,1995-2003, ,,,,, at production sites.' The reasons are: (1) 'These emissions' is not clear in contrast to L8 of the same page, 'Emissions of SF6 at the end-of-life of electrical equipment,,,,' (2) In 2003 survey, DRAM manufacture share were Samsung (Korea: 24%), Micron Technology (US: 20%), Infineon Technologies (Germany: 19%), Hynix Semiconductor (Korea: 15%), Nanya Technology (Taiwan: 5%), Elpida Memory (Japan: 4%), although present share | Noted. JH will take into account in rewrite. |

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| | | | | | | may have changed. Regarding liquid crystal manufacturing, based on 2006 data, Phillips (The Netherlands) is No. 1 in the TV production, and Samsung (Korea) is No.2, followed by Japanese Sony and Sharp. Thus, Japanese companies as well as Korean and Taiwanese companies are using PFCs, SF6 and HFCs in these electric industry. I think 'Asia' or 'East Asia' instead of Japan is clearer."<br>(Koichi Mizuno, National Institute of Advanced Industrial Science and Technology) | |
| 7-273 | A | 36 | 5 | 0 | 0 | "located in Europe, USA and Japan.."<br>(Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Rejected. Production is not located in US. |
| 7-274 | A | 36 | 7 | 36 | 12 | suggest to modify as follows after production sites. Banked quantities are growing and emissions of SF6 at end -of -life will gain in relevance from 2010 onwards. State of art equipment supplied from the mid 1990-ties is extremely tight with leakage rates below 0,5% for high voltage and below 0,1% per year for medium voltage equipment requiring no or maximum one gas handling action during its entire lifetime of 40 to 50 years. Same time equipment is getting more and more compact with steadily reduced gas charges. Altogether bearing the potential to further reduce or at least keep global emissions from use and decommissioning at present level. In a pessimistic scenario ( no mitigation actions taken and assuming proportionality between electricity consumption and emissions) to US EPA (2006c) estimates that emissions from use and disposal of electrical equipment will rise from 27 MtCO2 in 2000 to 66 MtCo2 in 2020. The emissions reduction potential could be exhausted outside Europe and Japan by consequently applying known measures as the implementation of state of art techniques and systems for recovery at end of life and gas handling and replacing older leaky equipment by new extremely tight and compact equipment.<br>(Friedrich Plöger, Siemens AG) | Rejected. More detail than can be used in view of space limitation. |
| 7-275 | A | 36 | 14 | 36 | 29 | This is a sound, succinct and accurate summary of SROC<br>(Archie McCulloch, Marbury Technical Consulting) | Noted – with thanks. |
| 7-276 | A | 36 | 23 | 36 | 29 | The IPCC/TEAP Report provides an analysis of the use and emissions of HFCs and PFCs from solvent application. While this paragraph contains a qualifying | Rejected. Appropriate to have range in literature. |

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| | | | | | | sentence, it gives too much prominence to the IEA 2001 projections.<br>(Nick Campbell, ARKEMA SA) | |
| 7-277 | A | 36 | 31 | 36 | 50 | Integration options should include industrial park planning which enables easier cascading of energy and waste. Given the knowledge that is now available this option can prove to be significant for developing countries.<br>(Norbert Nziramasanga, Southern centre for Energy and Environment) | Noted. Cannot use unless reference on GHG mitigation potential is available. Chapter team does not know of any and reviewer did not provide. |
| 7-278 | A | 36 | 31 | 36 | 50 | Cross-Industry normally refers to cross-cutting technologies suchs as motors and boilers. Should this be labelled as Inter-industry Options?<br>(Government of European Community / European Commission) | Accepted. LB will change in editing. |
| 7-279 | A | 36 | 35 | 36 | 42 | Still too long to describe "slag" in the steel industry. I think this section should mention more various examples for industrial ecology such as □□□□□ or the other industry and waste management sector. The following would be one of suggested alternatives: For example, the granulated slag in Portland cement may increase energy use in the steel industry, but it can reduce net energy consumption and CO2 emissions from cement production by about 40%. The appropriate slag content varies depending on concrete application but can be as high as 60% of the cement, replacing an equivalent amount of clinker (Cornish and Kerkhoff, 2004). Light weight materials (high tensile steel, aluminium, magnesium, plastics, composites) often require more energy to produce than the heavier materials they replace, but their use in 40 vehicles will reduce transportation sector energy use, leading to an overall reduction in global energy consumption.<br>In addition,the cement industry is utilizing industrial waste such as tires and plastics as alternative thermal energies.(E.Onuma et al.,2004)<br>(Yoshito Izumi, Taiheiyo Cement Corporation) | Noted. The reviewer is discussing cross-sectoral options which are beyond the scope of this chapter. However, his suggested wording is does suggest ways of shortening the text. LB will consider in editing. |
| 7-280 | A | 36 | 35 | 36 | 42 | For example, the use of granulated slag in Portland cement may increase energy use in the steel industry, but it can reduce both energy consumption and CO2 emissions during cement production by about 40%. Slag production is approximately 300 kg/t iron. Slag content depends on concrete application, ranging from tens to as high as 60% of the cement, replacing an equivalent amount of clinker (Cornish and Kerkhoff, 2004). Light weight materials (high tensile steel, aluminium, magnesium, | Noted. The reviewer's comments suggest ways of condensing the text. LB will consider in editing. |

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| | | | | | | plastics, composites) often require more energy to produce than the heavier materials they replace, but their use in 40 vehicles will reduce transportation sector energy use, leading to an overall reduction in global energy consumption.<br>In addition,the cement industry is utilizing industrial waste such as tires and plastics as alternative thermal energies.(E.Onuma et al.,2004)<br>(Eiichi Onuma, 0) | |
| 7-281 | A | 36 | 35 | 36 | 42 | Comments:We think this section should mention more various examples for industrial ecology such as power or the other industry and waste management sector.<br>For example, the use of granulated slag in Portland cement may increase energy use in the steel industry, but it can reduce both energy consumption and CO2 emissions during cement production by about 40%. Slag production is approximately 300 kg/t iron. Slag content depends on concrete application as high as 60% of the cement, replacing an equivalent amount of clinker (Cornish and Kerkhoff, 2004). Light weight materials (high tensile steel, aluminium, magnesium, plastics, composites) often require more energy to produce than the heavier materials they replace, but their use in 40 vehicles will reduce transportation sector energy use, leading to an overall reduction in global energy consumption.<br>In addition,the cement industry is utilizing industrial waste such as tires and plastics as alternative thermal energies.(E.Onuma et al.,2004)<br>(Government of Japan) | Taken into account. Same as comment 7-279. |
| 7-282 | A | 36 | 42 | 36 | 44 | The IAI Global Aluminium Mass Flow Model shows that the GHG emissions avoided through increasing use of aluminium in vehicle lightweighting together with increased recycling will, by 2020, be greater than than all GHG emissions (direct and indirect) resulting from the production of aluminium.<br>(Robert Chase, International Aluminium Institute) | Noted. The IAI assessment assumes maximum use of Al in vehicles. However, a more realistic scenario is competition between lightweight materials, with uncertain net mitigation benefit. |
| 7-283 | A | 36 | 44 | 0 | 0 | It should be added that recent IAI modeling shows that the current trend of increasing use of aluminium in autos and light trucks, along with the inherent high recycling rates for transportation, will produce savings in GHG emissions by 2020 that totally offset all GHG emissions from producing aluminium. | Taken into account. Same as comment 7-282. |

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| | | | | | | (Jerry Marks, International Aluminium Institute) | |
| 7-284 | A | 36 | 44 | 0 | 0 | It should be added that recent IAI modeling shows that the current trend of increasing use of aluminium in autos and light trucks, along with the inherent high recycling rates for transportation, will produce savings in GHG emissions by 2020 that totally offset all GHG emissions from producing aluminium.<br>(,) | Taken into account. Same as comment 7-282. |
| 7-285 | A | 36 | 46 | 36 | 50 | The large difference in the savings (60% vs. 5%) are probably due to the different systems studied by the authors. Is it possible to address this, or remark that the practical potential will depend on site-specific conditions.<br>(Government of European Community / European Commission) | Accepted. LB will add in editing. |
| 7-286 | A | 36 | 46 | 36 | 50 | The authors do not refer to the Kalundborg Industrial Eco-Park in Denmark; one of the few examples of industrial ecological integration fo various industries. It is well described in the literature.<br>(Government of European Community / European Commission) | Noted. This information can be used only if supported by an appropriate reference. LB will ask the TSU to seek such a reference from the reviewer. |
| 7-287 | A | 37 | 5 | 41 | 50 | In earlier editions of Assessment Reports (and perhaps this one too - I have not read all the chapters), we see definitions of costs and what is included in costs. This has great bearing on estimates here. These appear to be strict financial costs but I'm not sure. Using strict finacial costs is not very representative of the percieved costs to society associated with emissions reduction. I suspect that you don't want to get into a whole discussion of the various cost definitions at this point (as I mentioned, it probably appears earlier and I just haven't read it) but you should at least define what these costs represent here. Strict financial? Risk and hurdle rates included? Producer and/or consumer welfare costs included?<br>(John Nyboer, Simon Fraser University) | Accepted. LB will add cross-reference to section in Chapter 2 defining cost basis. |
| 7-288 | A | 37 | 28 | 37 | 30 | We understand the lack of data to estimate the potentials in these sectors. Still, similar to the analysis of the potential of motor systems for other industries, there may be an opportunity to use the cited literature to make estimates for steam systems and cogeneration (as examples). This would improve the estimate of the analysis of the costs and potentials further.<br>(Government of European Community / European Commission) | Taken into account. Same as comment 7-124. |

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| 7-289 | A | 37 | 39 | 38 | 0 | Table 7.8 and the related descriptions: The definition of "mitigation potential" is uncleaer. The definitions of "potential" are described in TS, p. 16. Which potential do you mean by the "mitigation potential"?<br>(Keigo Akimoto, Research Institute of Innovative Technology for the Earth (RITE)) | Accepted. LB will clarify in editing. |
| 7-290 | A | 39 | 0 | 39 | 0 | Table 7.8: the assessment of the potential would improve if the authors would not only evaluate the potential for electric motor systems but also of other cross-cutting technologies (e.g. steam systems) using the cited literature in the chapter.<br>(Government of European Community / European Commission) | Taken into account. Same as comment 7-124. |
| 7-291 | A | 39 | 0 | 39 | 0 | CCS is only included for ammonia and hydrogen manufacture. However, in the text of the chapter CCS is also mentioned for other sectors (e.g. iron and steel). Why are these not included in the potentials estimate?<br>(Government of European Community / European Commission) | Accepted. LB/EW will consider how to add to table. |
| 7-305 | A | 42 | 0 | 43 | 0 | Should try to refer back to the discount factor<br>(Philippine de T'Serclaes, International Energy Agency) | Rejected. The reviewer's intent is unclear. |
| 7-292 | A | 42 | 1 | 42 | 11 | The statement by DuPont Chairman and CEO, Chad Holliday, as presented at the Clinton Global Initiative Panel on Climate Change in New York City on September 17, 2005 and to be found under http://www2.dupont.com/Media_Center/en_US/speeches/holliday_09_17_05.html demonstrates that even in areas where GHG mitigation is not mandated, companies do invest in GHG mitigation for benefits other than just lower raw material and energy cost or driven by consumer preferences, cost, competitiveness and government regulations. While DuPont has actively addressed climate change for more than 10 years, its approach towards this issue has evolved over the years based on a deeper and better understanding of the underlying science that has been devoped and improved over time. However, already in 2001, in a speech delivered for the WBCSD at the UN and to be found under http://www2.dupont.com/Media_Center/en_US/speeches/holliday_04_18_01.html Chad Holliday provided examples that for DuPont the driver for addressing Climate Change is more than just economic considerations or policy mandates. | Noted. LP will consider including non-economic benefits of voluntary GHG mitigation. CEO speech not a valid reference. |

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| | | | | | | (Sabine Klages-Buechner, E.I. du Pont de Nemours and Company) | |
| 7-293 | A | 42 | 1 | 43 | 2 | The section focuses on barriers but there is no section in the chapter that specifically discusses ways to overcome the barriers defined. Möllersten and Sandberg (2004) analyse perspectives on companies core competencies and conclude that co-operation between industry sector companies and "energy service companies" (ESCOs), for example outsourcing, can provide opportunities for a more rational distribution of competences and efforts to access and absorb information between companies. These aspects related to competence and inter-firm partnering could add to the existing theory surrounding barriers and opportunities for sustainable industrial energy management in manufacturing industries.<br>Other relevant studies concerning industrial outsourcing and ESCOs include<br>- Brown and Minett, Market study on industrial energy outsourcing, Delta Energy and Environment, Edinburgh, 2003<br>- Möllersten K and Westermark M. Outsourcing of energy facilities in the pulp and paper industry – Motives for outsourcing partnerships between energy companies and pulp and paper manufacturers. Proceedings 18th World Energy Congress, Buenos Aires, 2001.<br>Möllersten K, Sandberg P. Collaborative energy partnerships in relation to development of core business focus and competence - A study of Swedish pulp and paper companies and energy service companies. Business Strategy and the Environment 2004; 13(2):78-95.<br><br>(Kenneth Möllersten, Swedish Energy Agency) | Noted. ESCOs have limited record of success in industry. However, LB will add sentence at end of barrier section indicating that polices discussed in Section 7.9 are ways of overcoming these barriers. |
| 7-294 | A | 42 | 1 | 0 | 0 | Page 42 barriers: a key barrier is missing. Please add: (Perceived) carbon leakage is often quoted as a major obstacle for substantial emissions reduction. If, for example, only Europe and Japan were to introduce an incentive of USD 25/tonne of CO2 in the iron and steel industry, 30% of "carbon leakage" would result. This means that each tonne of emissions reduction is balanced by 0.3 tonnes of emissions increase elsewhere, as industry moves to regions without CO2 policies. | Rejected. Carbon leakage is a problem at the global level, but it does not impact on the decisions made at the sectoral level. |

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| | | | | | | The higher the incentive, the higher the leakage rate. International policy co-ordination is thus necessarily an integral part of effective emissions reduction (Gielen and Moriguchi, 2002). The same applies to other energy and CO2 intensive commodities. Gielen, D.J. and Y. Moriguchi, (2002) CO2 in the Iron and Steel Industry: an Analysis of Japanese Emission Reduction Potentials, Energy Policy 30, pp. 849-863. (Dolf Gielen, International Energy Agency) | |
| 7-295 | A | 42 | 1 | 43 | 3 | A paragraph on slow progress of technology transfer is recommended to add in this section. It is agreed that one of important barrier to industrial GHG mitigation in developing countries is lack of affordable advanced technologies. (Government of China Meteorological Administration) | Accepted. LB to draft text. All to review. |
| 7-296 | A | 42 | 3 | 42 | 11 | Mitigation options effectively reduce wear and tear as they reduce either run time or temperature, mechanical or process stress. The benefits are comlex and most industrialists are not able to quantify these without employing consultancy services. This is why benefical measures remain undone. (Norbert Nziramasanga, Southern centre for Energy and Environment) | Rejected. The statement is not correct for many mitigation options. |
| 7-297 | A | 42 | 9 | 42 | 11 | It is claimed that there is no doubt many instances when companies have implemented energy efficiency …they haven't been aware of the GHG mitigtion benefits (page 42, line 9-11). If this was the case CEOs, board members and shareholders would seem to have little idea of how to run a profitable and sound business. Of course, this is not the case. This is an example of a general attitude through out this chapter of saying that profitable energy saving investments within industry can easily be found but is not applied as a generale rule. Surely it is possible to find examples, and this is what this chapter contains, many examples of how to deal with energy saving etc. However, there is no facts to support a general conclusion that cost-efficient investments in energy-efficient technologies do not take place. (Helle Juhler-Kristoffersen, Confederation of Danish Industries) | Noted. It was not the intent of the chapter to say that investment in energy efficiency was not happening, but rather to demonstrate that there was a large additional potential. Chapter team will reconsider draft from this perspective. |
| 7-298 | A | 42 | 9 | 42 | 11 | At this point in the chapter, it needs to state the fact that when cost-efficient investments are not made, this might very well be because they do not meet the | Noted. This point is made on Pg. 42, lines 29-32. |

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| | | | | | | internal hurdle rate of the company. If these investments in cost-efficient energy savings etc. were made, they would push aside better, more profitable and more innovative investments made by the company. The risk would be a distortionary impact on the company with less innovation taking place in the company. (Helle Juhler-Kristoffersen, Confederation of Danish Industries) | |
| 7-299 | A | 42 | 9 | 42 | 11 | It is claimed that there is no doubt many instances when companies have implemented energy efficiency …they haven't been aware of the GHG mitigation benefits. If this was the case CEOs, board members and shareholders would seem to have little idea of how to run a profitable and sound business. Of course, this is not the case. This is an example of a general attitude through out this chapter of saying that profitable energy saving investments within industry can easily be found but is not applied as a general rule. Surely it is possible to find examples, and this is what this chapter contains, many examples of how to deal with energy saving etc. However, there is no facts to support a general conclusion that cost-efficient investments in energy-efficient technologies do not take place. (Nick Campbell, ARKEMA SA) | Noted. It was not the intent of the chapter to say that investment in energy efficiency was not happening, but rather to demonstrate that there was a large additional potential. Chapter team will reconsider draft from this perspective. |
| 7-300 | A | 42 | 20 | 42 | 20 | Excess capacity is aalso a barrier to capital turnover rates, especially in the steel industry. According to estimates of World Steel Dynamics, the effective crude steel making capacity worldwide increased from about 841 million tons in 1997 to 907 million tons in 2001; increase of effective excess capacity from 42 million tons in 1997 to 66 million tons in 2001. (Francisco Aguayo, El Colegio de México) | Accepted. LB will add thought in editing. |
| 7-301 | A | 42 | 20 | 0 | 0 | Add to the list of references "A study of the U.S. pulp and paper industry found that 'an increase in the rate of capital turnover is the most important factor in permanently changing carbon emission profiles and energy efficiency' ". Source: Davidsdottir, B. and M. Ruth, "Capital vintage and climate change policies: the case of the US pulp and paper industry," Environmental Science & Policy 7 (2004) 221-233, Elsevier, 2004 (Reid Miner, NCASI) | Rejected. There appears to be no need to add a reference that is specific only to one industry. |
| 7-302 | A | 42 | 29 | 42 | 38 | The fact that when cost-efficient investments are not made, this might very well be | Noted. The text, lines 29-31 indicates that. |

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| | | | | | | because they do not meet the internal hurdle rate of the company should be noted. If these investments in cost-efficient energy savings etc. were made, they would push aside better, more profitable and more innovative investments made by the company. The risk would be a distortion impact on the company with less innovation taking place in the company. (Nick Campbell, ARKEMA SA) | |
| 7-303 | A | 42 | 29 | 42 | 35 | Are comparing invsetments that are not comparable. Why? Because there are numerous ancillary benefits that are not quantifiable (Philippine de T'Serclaes, International Energy Agency) | Rejected. Organizations that make investments compare alternatives on whatever basis they can. Outsiders cannot decide for them how to make these decisions. |
| 7-304 | A | 42 | 47 | 42 | 49 | This sentence should be deleted as the conclusion and statement of the literature cited here is not true. It is well known that a series of policies aiming to promote energy efficiency and conservation has been launched by Chinese government. It can be confirmed by the fact that during 1999 and 2001 hundreds of small, illegal cement plants were closed by the governmant due to violation of energy and/or environmental standards. (Government of China Meteorological Administration) | Accepted. LB will delete whole paragraph. |
| 7-306 | A | 43 | 1 | 45 | 18 | Table 7.9 seems to hold key information, but is insufficiently explained/discussed in §7.7. (Government of Belgium) | Noted. JR will consider replacing table with text. |
| 7-307 | A | 43 | 11 | 43 | 11 | Delete second that (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will change in editing. |
| 7-308 | A | 43 | 12 | 43 | 12 | The authors may consider to add to this list “Mexico (Aguayo and Gallagher, 2005).” Reference: Aguayo, F. and K. Gallagher, 2005: Economic Reform, Energy and Development: the Case of Mexican Manufacturing. Energy Policy 33, no. 7, pp. 829-837. (Francisco Aguayo, El Colegio de México) | Accepted. Should be Pg. 45, line 12. LB will add in editing. |
| 7-309 | A | 43 | 14 | 43 | 14 | The authors may consider to add: “ … fuel switching. In the case of Mexico, both technical improvement as de-industrialization coupled to improve energy efficiency (Aguayo and Gallagher, 2005). Structural change in China, on the contrary, may | Noted. JR will evaluate references and include as appropriate. |

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| | | | | | | have actually increased energy use, an effect countervailed due to faster technical change (Garbaccio et al., 1999). For OECD countries …". References: Aguayo, F. and K. Gallagher, 2005: Economic Reform, Energy and Development: the Case of Mexican Manufacturing. Energy Policy 33, no. 7, pp. 829-837. Garbaccio, R. F., M. S. Ho, and D. Jorgenson, 1999: Why has the energy-output fallen in china? The Energy Journal 20, no. 3, pp. 63-91. (Francisco Aguayo, El Colegio de México) | |
| 7-310 | A | 45 | 20 | 46 | 10 | I'm not sure about the value of putting this section on adaptation in the mitigation volume. I think it would be better placed in the adaptation volume. I realize the section isn't long but it does seem a bit out of place - just my opinion. (John Nyboer, Simon Fraser University) | Rejected. The WG III Outline specifically calls for discussion of this topic. |
| 7-311 | A | 45 | 22 | 45 | 36 | The discussion on adaptation focuses on extreme weather events. Is there not more literature on other impacts of climate change (e.g. agricultural resources availability, biomass supply)? (Government of European Community / European Commission) | Noted. These topics should be discussed by other chapters. |
| 7-312 | A | 45 | 38 | 45 | 45 | Mitigation through energy efficiency can assist national grids to optimise use of limited resources during droughts or such extreme events especially where hydro power is dominant. GHG mitigation in industry has a major adaptation role especially when optimum resource use, water conservation, waste heat recovery, and waste minimization are considered inlight of risk to energy supply, pollution and limited water availability. (Norbert Nziramasanga, Southern centre for Energy and Environment) | Accepted. LB will add in editing. |
| 7-313 | A | 46 | 15 | 0 | 0 | In this section, you do not deal with the regulatory policy route as you do the others. In most cases, you simply refer to regulation as something to be met rather than as a purposed policy tool like volunteerism or financial instruments are treated. There is also a special branch of such regulation known as "market oriented" or "sector specific" regulations where the sector or the market is to act as a driver for GHG reductions (e.g., a Carbon Management Standard, similar in structure to sector specific regulations like Vehicle Emissions Standards or Renewable Portfolio Standards). Jaccard, 2005, summarizes a number of these approaches in | Accepted. Section 7.9 will be restructured to show categories of policies (international, national GHG polices, and other policies that effect GHG emissions). The category on GHG polices will include a subsection on regulation. LB/JH/JR responsible. |

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| | | | | | | chapter 8, if you feel that something dealing with regulation should be included in the critique under this section. (John Nyboer, Simon Fraser University) | |
| 7-314 | A | 46 | 15 | 0 | 0 | I find it remarkable – but rather symptomatic – that nothing at all is said about environmental taxes / internalisation of externalities in Section 7.9 on "Effectiveness of and Experiences With Policies". Such instruments would have been the prime focus of the section, if the perspective had been on recommending 'optimal' approaches for society as a whole.<br><br>(Nils-Axel BRAATHEN, OECD) | Partially accepted. JH will include GHG taxes in rewrite of section 7.9.3. Choice of optimum approaches is beyond scope of IPCC. |
| 7-315 | A | 46 | 15 | 0 | 0 | As an example of a climate-related tax levied on industry, the UK Climate Change Levy could be highlighted. It is far from perfect – but it is much better than the absence of taxes on industry in most other countries. I attach a (very good!) paper on the political economy surrounding its introduction. [I have later seen that this study is summarised in Box 13.6.] (It is also freely available at www.oecd.org/env/taxes. I also attach an in-depth evaluation of the first impacts of this tax, prepared by Cambridge Econometrics – which clearly indicate that it has contributed to change firms' behaviour. In our own tax report, we summarised the study as follows:<br>Cambridge Econometrics (2005) presents an in-depth analysis of the impacts of the Climate Change Levy in the United Kingdom, comparing actual emission developments to a counterfactual reference case with no levy in place and estimating developments up to<br>2010 under various assumptions. The study inter alia found that total CO2 emissions were reduced by 3.1 mtC (million tonnes carbon) – or 2.0% – in 2002 and by 3.6 mtC in 2003 compared to the reference case. The reduction is estimated to grow to 3.7 mtC – or 2.3% – in 2010. Most of the reduction (1.8 mtC in 2010) was found to take place among "other final users", i.e. in commerce and the public sector, but "other industry" – i.e. industry other than basic metals, mineral products and chemicals – was also found to reduce emissions around 0.8 mtC in 2010. | Accepted. JH will discuss in rewrite in of section 7.9.3. |

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| | | | | | | Emissions from power generation were also found to decrease, due to lower demand for electricity. When interpreting these results it should be kept in mind that households are exempted from the Climate Change Levy, and that energy-intensive industries can benefit from an 80% tax rate reduction if they fulfil negotiated energy efficiency targets.<br><br>(Nils-Axel BRAATHEN, OECD) | |
| 7-316 | A | 46 | 15 | 0 | 0 | A discussion of taxes / internalisation of externalities could draw much on our new book on “The political economy of environmentally related taxes” and on the many references given there, cf. attachment. There we also discuss in-depth the obstacles to a wider use of such taxes, e.g. due to fair of sectoral competitiveness losses, and how these obstacles could be overcome.<br>(Nils-Axel BRAATHEN, OECD) | Rejected. More detail than appropriate for Chapter. |
| 7-317 | A | 46 | 23 | 46 | 29 | Update the CDM information here with the information "UNEP Risoe CDM/JI Pipeline" published monthly on the www.cd4cdm.org web site at the address: www.cd4cdm.org/Publications/CDMpipeline.xls. This pipeline gives the most comprehensive overview of the develpment of the CDM and JI flexible mechanisms, and is the mostly used reference in this field. The latest update was published 14 September 2006 :Table 2 in the "Analysis" sheet show that 15 of the 1151 CDM projects in the CDM Pipeline. The HFC23 projects is expected to reduce GHG emissions by 67 MtCO2eq. per year. In the same table you can find information on the distribution of the number of proejct , expected CERs, and issued CERs for all thr CDM projects types.<br>(Jørgen Fenhann, Risø) | Accepted. LB will update just prior to submitting the chapter to the TSU. |
| 7-318 | A | 46 | 25 | 0 | 0 | Suggest to add a para on voluntary actions and commitments taken by the electrical industry.The intention is to provide global publicity and attention and thus to initiate and foster implementation of mitigation measures. The following text is proposed to be added somewhere below line no.43." The European electrical industry reduced SF6 emissions from electrical equipment by 50% between 1995 and 2003 ( J.Harnisch and S.Wartmann, 2005) comparing to the European | Noted. LB will add information to the extent that page limitations allow. |

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| | | | | | | Commission's target for EU 15 on fluorinated GHG for 2010 which is to keep the 1995's level. This was achieved to early voluntary industry actions and various national voluntary commitments of the relevant industry associations of equipment manufacturers and utilities providing specific targets and transparency to stakeholders through verification by reporting systems. As an example the negotiated renewed German voluntary commitment is attached. A similar voluntary commitment exists in Japan (Yasutake and Meguro, 2002)--attached. Further inn the US the government formed a partnership with 62 electric power generators and utilities (representing about 35% of the US power grid) to voluntarily reduce emissionsfrom electrical equipment. The release rate dropped from 17% of stocks to 9% between 1999 and 2002." Suggest to consider this also for the TS and SPM (Friedrich Plöger, Siemens AG) | |
| 7-319 | A | 46 | 26 | 46 | 26 | insert the to read as projects are in the energy sector (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will correct in editing. |
| 7-320 | A | 46 | 28 | 0 | 0 | Add: In particular, HFC-23 destruction in HCFC-22 manufacturing is one of them. (Jos Olivier, Netherlands Environmental Assessment Agency (MNP)) | Rejected. This point is irrelevant in the context of the text. |
| 7-321 | A | 46 | 31 | 46 | 31 | insert to as to read concerns to its complexity (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will correct in editing. |
| 7-322 | A | 46 | 43 | 46 | 43 | There is no section 13.2.2.3.4 (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will correct in editing. |
| 7-323 | A | 46 | 46 | 46 | 53 | Table 4 in the "Analysy" sheet in the UNEP Risoe CDM/JI Pipeline shows the rgional distribution of the 1151 projects in the Pipeline. By number of projects 36% in Latin America, 60% in Asia, and only 1,5% in Sub-Sahara Africa, and 1,3% in North Africa & Middle East. The table also shows the distribution of expected annual CERs, CERs until the end of 2012, and CERs/capita. (Jørgen Fenhann, Risø) | Accepted. LB will update just prior to submitting the chapter to the TSU. |
| 7-324 | A | 47 | 15 | 47 | 15 | Capital letter for China (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will correct in editing. |
| 7-325 | A | 47 | 20 | 49 | 46 | I have attached a quote from a recent publication (refereed, and well documented) | Noted. LP/LB will evaluate document. |

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| | | | | | | that discusses the effectiveness of volunarism in reducing emissions. I think, based on the literature, that one can state more emphatically that voluntaristic policy approaches have limited impact. See attached doc: CH7 Voluntarism, Jaccard.doc. (John Nyboer, Simon Fraser University) | |
| 7-326 | A | 47 | 20 | 51 | 5 | Sections 7.9.2 and 7.9.3 on "voluntary agreements" (all agreements are supposed to be voluntary!!) and voluntary actions should be much more critical – in line with the discussion in section 10.5 of our new tax book that I attached above. For example, while section 7.9.2 says that the UK Climate Change Agreements "have provided significant energy savings", our tax report states:<br>There has been considerable debate as regards the impacts of the agreements. De Muizon and Glachant (2004) provided a theoretical discussion of the combination of the Climate Change Levy, the Climate Change Levy Agreements and the UK emissions trading system. They concluded that the performance of this instrument mix would not have been affected by an absence of the agreements.<br>Cambridge Econometrics (2005) wrote inter alia:<br>"A combination of technological change and relative decline in UK energy-intensive subsectors of manufacturing (ie bulk chemicals as opposed to specialty chemicals), implies that the energy (and therefore carbon) saving and energy-efficiency targets would have been met without the CCAs. This result is uncertain because the historical technical and structural-change trends may not continue as in the past, … Moreover, the CCA targets are set in terms of improvements in energy efficiency, whereas the model projections have used energy intensity which means that the comparison is distorted with any structural change within the sectors. Only for one sector (other<br>industry in 2008) did we find that the CCA target would have been missed had no CCL ever existed. We also found that the price effect of the reduced-rate CCL was sufficient, on its own, for the target to be met …"<br>To the extent it is correct that the targets set under the Climate Change Agreements would have been met in any case, the environmental effectiveness of adding a voluntary approach to a tax – even if reduced rates were applied for some sectors – | Noted. LP/LB will evaluate references. |

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| | | | | | | would be very modest, largely limited to any "awareness-raising" effects and similar they might have.<br><br>(Nils-Axel BRAATHEN, OECD) | |
| 7-327 | A | 47 | 20 | 0 | 0 | Also the Danish Agreements on Industrial Energy Efficiency have been less successful than the draft indicates<br>(Nils-Axel BRAATHEN, OECD) | Noted. Cannot use this comment without a reference. LB will ask the TSU to contact the reviewer asking for a suitable reference. |
| 7-328 | A | 47 | 45 | 47 | 49 | The generalisation that the French system is poorly designed is incorrect - there is considerable literature within AERES demonstrating the clear design and operation of the system. The positioning of the references indicates that they are all of the same opinion - I do not believe that this is truly the case and that the dates on ALL these references indicate that they actually pre-date the adoption and implementation of the French AERES system. Please delete these lines.<br>(Nick Campbell, ARKEMA SA) | Noted. Literature supports conclusion that early agreements were poorly designed. Will seek literature on more recent AERES agreement. |
| 7-329 | A | 47 | 45 | 47 | 49 | The impression which is given that the French system is poorly designed is incorrect - there is litterature within AERES demonstrating the clear design and operation of the system.<br>(Jean-Yves CANEILL, EDF) | Noted. Literature supports conclusion that early agreements were poorly designed. Will seek literature on more recent AERES agreement. |
| 7-330 | A | 47 | 45 | 47 | 48 | Reference to Finland should be deleted, or the text should be changed to correspond to the real situation of energy efficiency agreements: Finland has a Voluntary Agreement for Energy Efficiency in Industry signed in November 1997 and in force until end of 2007. International Energy Agency of OECD has reviewed Finnish energy policy in 2004. Reference on p. 46 of the review report: " Voluntary energy conservation agreements are the government's primary tool in encouraging energy efficiency. These agreements are an internationally accepted means of reducing energy use and are favoured by companies over stricter regulations or higher taxes. An impressive 55% of Finland's Total Fuel Consumption (TFC) is covered by such agreements. The savings achieved thus far in conjunction with the agreements are significant, nearly 1% of Finnish TFC. While companies may have pursued some energy efficiency improvements independently, a great deal of these | Noted. Literature supports conclusion that early agreements were poorly designed. Will seek literature on more recent agreement. |

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| | | | | | | savings can in any case be attributed directly to the agreements." p.47:" Finland's TFC for 2001 was 25.2 Mtoe, or 293.1 TWh. Measures implemented that year by companies having signed voluntary agreements resulted in energy savings of approximately 3.03 TWh per year, of which 0.56 TWh was electricity and 2.47 TWh was heating or fuels. More than 90% of these savings were realised in the industrial sector, 7% in the energy sector, slightly over 1% in the municipal sector and a negligible amount in the property and building sector. Further measures that have been decided but not yet implemented would produce 1.22 TWh per year additional energy savings. By the end of 2005, Motiva estimates that the overall saving potential for sectors covered by the voluntary agreements is 11 TWh, and that the savings effect of the agreements will exceed the estimated 5 TWh to 5.5 TWh per year by 2010, that is an energy use reduction of approximately 1.6% of the projected Finnish TFC in 2010." The reported energy savings are confirmed after the IEA`s review on the basis of monitoring reports done by Finnish Energy Efficiency and renewable Energy Sources Agency Motiva Ltd. References: IEA. Energy policies of IEA Countries. FINLAND 2003 review, ISBN 92-64-01482-9, OECD/IEA 2004, Paris. Motiva. Energy conservation agreements – progress review 2005. Motiva Oy, Copyright Motiva Oy, Helsinki, March 2006.<br><br>(Government of Finland) | |
| 7-331 | A | 48 | 2 | 0 | 0 | Delivery from policy may have changed in latest estimate - most recent numbers are published in the climate change programme http://www.defra.gov.uk/environment/climatechange/uk/ukccp/index.htm<br>(Ann Gardiner, AEA Technology) | Accepted. LP will check website for latest information. |
| 7-332 | A | 48 | 20 | 0 | 0 | Regarding the many examples of "successful" agreements and voluntary actions that are given, a very relevant question is to what extent the developments described represent anything different from what most likely would have happened in any case – and if not further environmental improvements could have been achieved if other policy instruments had been used instead. | Noted. Text includes available evaluations of these programs. |

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| | | | | | | (Nils-Axel BRAATHEN, OECD) | |
| 7-333 | A | 48 | 20 | 0 | 0 | On page 48, line 20, it is stated that<br>“The most effective agreements are those that set realistic targets, include sufficient government support, ….<br>10. This statement first of all is based on a presumption that there are some “effective agreements”. Further, “government support” would not enhance the effectiveness of the agreement as such – and proper analysis raise serious doubts about the effectiveness of public support for environmental purposes. In general it is much better for the environment and for the economy to tax / price negative externalities than to “reward” “good behaviour“.<br><br>(Nils-Axel BRAATHEN, OECD) | Rejected. Reviewer is stating option not supported by references. |
| 7-334 | A | 48 | 38 | 48 | 42 | German industries' climate protection agreement with the German government should not be referred to in such a negative way. New wording proposed after ...(OECD, 2002): Real emissions reductions, however, are being delivered e. g. by the Agreement between German Business and the Federal German Government on Climate Protection (November 9, 2000) which had been negotiated starting from the earlier agreements of 1995 and 1996. The Agreement pledges a reduction of the reletive Kyoto gas emissions of 35 % till 2012 and is monitored by a neutral third party. The latest report on the years 2000 - 2002 published by RWI gives further evidence of the substantial reductions achieved so far. [www.rwi-essen.de] Delete: "Early programs ... However"; continue with "More recent efforts appear to have also yielded positive results."<br>(Joachim Hein, BDI - Federation of German Industries) | Rejected. Literature supports conclusion that early programs were ineffective. |
| 7-335 | A | 49 | 6 | 49 | 6 | Can you provide some examples of the more stringent targets<br>(John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB to add in editing. |
| 7-336 | A | 49 | 23 | 49 | 24 | If "Chinese Taipei" remains in this sentence, the word "national" must be deleted from the phrase of "national semiconductor industry associations of". If "national" remains, delete "Chinese Taipei" | Accepted. LB will delete “national.” |

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| | | | | | | (Government of China Meteorological Administration) | |
| 7-337 | A | 49 | 40 | 0 | 0 | For example, in relation to the Japanese case described in line 40 ff. on page 49, it would be of interest to know how much of the 6.4% improvement since 1990 had already been achieved (or the industry new for sure would soon take place) at the time when the commitment was made.<br><br>(Nils-Axel BRAATHEN, OECD) | Noted. There is no way to answer the reviewer's question. |
| 7-338 | A | 49 | 50 | 51 | 6 | In the previous comment, I provide a source for information on other aspects of policy that are not at all introduced in this chapter, issues related to rebound effects. While the attached quote from Jaccard 2005 explains and supports the concept, it is not particularly focussed on industry and rebound may be less evinced there than in commercial or residential sectors. Nevertheless, it still exists there as well. Again, see attached doc: Subsidies, Jaccard.doc.<br>(John Nyboer, Simon Fraser University) | Rejected. Chapter is not carrying out an in depth assessment of these polices. Reviewer is offering only indirect evidence. |
| 7-339 | A | 49 | 50 | 51 | 6 | Again, I have attached a rather lengthy quote from the same book as above that reviews some of the issues related to the degree to which finacial incentives in industry as well as other sectors may NOT be as advantages as first thought. Again, I think we may be misleading decision makers if we portray such incentives in a better light than they deserve. See attached doc: Ch7 Subsidies, Jaccard.doc.<br>(John Nyboer, Simon Fraser University) | Rejected. Chapter is not carrying out an in depth assessment of these polices. Reviewer is offering only indirect evidence. |
| 7-340 | A | 49 | 50 | 51 | 7 | The focus of this section on GHG financial instruments is on subsidies or government incentive programs. I think this leaves out some important trends in the flows of private capital toward GHG mitigation particularly in clean energy technologies<br>(Jacob Park, Green Mountain College) | Noted. The reviewer seems to be referring to the energy sector, which is covered in Chapter 4. |
| 7-341 | A | 49 | 50 | 0 | 0 | The discussion in section 7.9.3 of "Financial Instruments" is plagued with terminology confusion and a lack of critical analysis. All the instruments described are subsidies – and they should be named as such. To talk about "grants and subsidies" is like saying "fruits and apples". To 'conclude' (in line 50 on page 50) that "fiscal incentives for industry may lead to energy savings" is hardly | Partially accepted. JH will improve the text in rewrite. Reject trying to do analysis of societal costs. |

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| | | | | | | revolutionary. A more relevant issue is whether the costs to society of providing these subsidies are higher or lower than the benefits obtained – and whether similar improvements could have been achieved at a lower cost using other instruments.<br><br>(Nils-Axel BRAATHEN, OECD) | |
| 7-342 | A | 50 | 8 | 50 | 8 | delete some form and replace with a form of grant….<br>(John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will correct in editing. |
| 7-343 | A | 50 | 17 | 0 | 0 | It is also hardly surprising that “soft loans are less popular than subsidies” [ Line 17, page 50 -– Here subsidies means ‘grants’]. Loans are to be repaid whereas grants are yours forever. Again, the relevant point is which option provides most ‘bang for the buck’ for society as a whole, not whether industry prefers to get a large present rather than a smaller one.<br><br>(Nils-Axel BRAATHEN, OECD) | Partially accepted. JH will improve the text in rewrite. Reject trying to do analysis of societal costs. |
| 7-344 | A | 51 | 10 | 0 | 0 | In the discussion of trading schemes in section 7.9.4, it should be made clear that industry receives a gift – not a burden – when a trading scheme based on grandfathered permits is introduced (because they obtain the whole ‘scarcity rent’ that the policy triggers.)<br><br>(Nils-Axel BRAATHEN, OECD) | Rejected. Empirical evidence shows a massive redistribution of resources, with winners and losers. Not necessarily a gift to industry. |
| 7-345 | A | 51 | 24 | 51 | 48 | The discussion on EU ETS is very general, suing only a few resources. The European Commission hs in the meanwhile evaluated the first experiences (after 1 year of trading). It may be good to update this section based on the latest literature available (e.g. summer 2006).<br>(Government of European Community / European Commission) | Accepted. JH will update this discussion with newer references. |
| 7-346 | A | 51 | 39 | 51 | 42 | "...many industrial products are globally traded commodities, "constrained only by transportation costs"."<br>Although this holds true for inter-european transports, it is less relevant for global | Noted. The comment is correct, but misses the point. Emission from transportation are not covered by the EU ETS. |

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| | | | | | | transports. But a more important item in this context is the additional emissions seagoing transport adds to the specific emissions for the concerned product. It is therefore suggested the following addition following the last sentence in line 42: "Another factor to be considered related to global trade is the additional emissions caused by transport. As an example, transporting cement from China to Europe adds 10.9% to the $CO_2$ emitted by the production of imported tonnages under the European production standards".<br>(Claude LOREA, CEMBUREAU, The European Cement Industry) | |
| 7-347 | A | 51 | 43 | 51 | 45 | Provide reference to this statement what few industrial enterprises?<br>(John Kessels, Energy Research Centre of the Netherlands) | Noted. JH will replace this statement with information based on analysis of the first year's trading in the EU ETS. |
| 7-348 | A | 51 | 43 | 0 | 0 | Please add a paragraph on the impact on energy-intensive industries:<br>RELATIONSHIP OF THE EU ETS WITH energy-intensive INDUSTRY:<br>Energy intensive industries are critical concernign the impact of the ETS on their competitiveness and the environmental efficiency of the scheme. Energy-intensive industry sectors like aluminium state that early closure of existing plants may take place resulting in carbon leakage. The ETS has generated costs directly and indirectly, namely through the pass-through of carbon value as opportunity costs in the power price. The resulting transfer of wealth from power consumers to power producers is estimated as €7 billion per year in Germany alone. The International Energy Agency (IEA) has analysed the impact of a price of €20/t$CO_2$ on iron and steel (both basic oxygen furnace and electric arc), cement, paper and aluminium. Assuming that these sectors would receive 10% less allowances than in their business-as-usual case, IEA estimated that cement sector would incur a 7% production cost increase and aluminium sector – while facing only the indirect costs – would see its production costs increase by 8%. As an example calculated by cement industry experts, assuming industry would have to<br>buy all allowances with €27/t$CO_2$ – $CO_2$ prices reched €30/t in the first trading period -– there would be a 30% cost increase for a tonne of cement produced (i.e. by €20 €/t of cement at 65€/t average) instead of the current free allocation of the | Accepted. JH will mention windfall profits to electricity sector but not in detail proposed by reviewer. |

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| | | | | | | ETS Directive. The freight rates to import cement to the EU are between €11.5 and 13 €/t of cement from Mediterranean area and 20 €/t of cement from the Far East. At the moment 14% of EU consumption is imported. According to a study commissioned by UNICE, carbon leakage for energy intensive sectors was estimated at 19%. (See also the European Commission websit, DG Industry High Level Group on Competitiveness, Energy and Environment; Ad hoc Group 2 EU Emissions Trading Scheme; Chairman Issues Paper: http://ec.europa.eu/enterprise/environment/hlg/docs/c_i_p_2.pdf). Industry demand urgent action from policy makers to fix the damaging, unintended impacts on power prices: "More work needs to be done on the Emissions Trading Scheme (ETS)", Theo Walthie says in a Cefic press release on 6 June 2006."Lessons learnt from the first trading period now need to be taken into account for the second phase (2008-2012). We must reduce the complexity (e.g. by excluding SMEs) and limit the impact on power prices. These electricity price increases damage the chemical industry and we cannot wait until 2013 for a solution".<br><br>(Peter Botschek, European Chemical Industry Council (Cefic)) | |
| 7-349 | A | 51 | 50 | 0 | 0 | There is a consistency problem with the first sentence in section 7.9.5 on Energy and Technology Policies: "Some of the energy technologies needed by energy-intensive industries require enormous amount of investment … ". If the investments required are really 'enormous', most likely these technologies ought not to be developed. The subsequent discussion of governments' roles is also rather useless. For example, instead of using "regulation to suppress unsustainable technologies", the text ought to argue for a proper internalisation of the relevant negative externalities.<br><br>(Nils-Axel BRAATHEN, OECD) | Rejected. Even enormous investment can be justified on life cycle cost and benefit analysis. Second part of comment is an opinion unsupported by references. |
| 7-350 | A | 51 | 50 | 52 | 9 | Section 7.9.5 seems to be weakly presented. There are several policies in India | Noted. LB/JR will rewrite based on latest |

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| | | | | | | which directly and indirectly effects GHG emissions which ranges from market instruments like pricing of fossil fuels to technology development support to industries especially SME s by the Pollution Control Boards.<br>(Government of India) | references. |
| 7-351 | A | 52 | 10 | 0 | 0 | Section 7.9.6 on Sustainable Development Policies is hardly convincing either. For example, rather than telling us that India has mandated a Bureau for Energy Efficiency to ensure "efficient use of energy", it would be of more interest to be told how the Bureau is to ensure this. Will the benefits of their measures be larger than the costs?<br><br>(Nils-Axel BRAATHEN, OECD) | Noted. JR will provide appropriate examples from literature. |
| 7-352 | A | 52 | 44 | 52 | 44 | Replace thought with through<br>(John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will change in editing. |
| 7-353 | A | 52 | 48 | 52 | 48 | In the revised SOD for Chapter 4 there is no section 4.7.2.2<br>(John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will correct in editing. |
| 7-354 | A | 53 | 12 | 0 | 0 | Page 53 Waste management. Not only can waste policy have CO2 benefits, also the reverse can be true: A benefit of a CO2 reduction incentive, compared to sector-specific measures, is that it can have positive effects throughout the materials life cycle, including the waste management stage. Model analysis suggests that a 50% CO2 emissions reduction in the petrochemical sector of Japan would simultaneously reduce the amount of plastic waste by 18%. CO2 benefits and waste benefits would be of equal importance in policy terms (Gielen and Moriguchi, 2002). Waste benefits of CO2 policies in Japan. Gielen, D.J., Moriguchi, Y.: Waste Management & Research 20 (2002): 2-15.<br>(Dolf Gielen, International Energy Agency) | Rejected. Aspect has been addressed in Section 7.4. |
| 7-355 | A | 53 | 34 | 0 | 0 | The discussion of Waste Management Policies in section 7.9.8 accepts to easily the arguments given for EU's limits on landfilling. For society as a whole, landfilling seems to be much cheaper than e.g. incineration. Hence, it is on such a background rather strange to talk about "inexpensive disposal routes" in line 34 on page 53. | Rejected. Quote is taken out of context. |

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| | | | | | | (Nils-Axel BRAATHEN, OECD) | |
| 7-356 | A | 55 | 22 | 0 | 0 | Section 7.11 The section barely refers to the specificities of innovative activity in energy-intensive industries. It is true that there is not much about the issue in the literature. Two features seem to me relevant to consider. First, together with in-house engineering and design, innovation in energy intensive industries is also highly dependent on product innovations made outside the sector, more precisely, in the capital-goods sector. Second, as is evident from R&D expenditure statisctics (OECD, 2005), energy intensive industries tend to have relatively smaller R&D to GDP ratios, compared to other industries, with the notable exception of the chemical industries. This feature confirms that much innovation in energy intensive industries is capital embodied, and developed somewhere else. Third, Hagedoorn (2003) shows that in basic chemicals, food and beverages, and metal products, joint ventures in R&D have had a disproportionate (lower) importance throughout most of the past decades. These insights suggest that technology policy directed to mitigation in energy-intensive industries should have a strong inter-sectoral content. References: Pavitt, K. :1984. Sectoral patterns of technical change: Towards a taxonomy and a theory. Research Policy 13 (6), pp. 343-373; Hagedoorn, J. :2003. Inter-firm R&D partnerships: an overview of major trends and patterns since 1960. Research Policy, 31(4), pp. 477-492. OECD: 2005. Science, Technology and Industry Scoreboard. OECD, Paris. (Francisco Aguayo, El Colegio de México) | Noted. LB will evaluate during rewrite. |
| 7-357 | A | 55 | 42 | 55 | 53 | This paragraph addresses RDD&D and the roles of public and private sectors. It refers case studies in the literature. It should be noticed that there are a lot of studies on the same topic. One example may include a series of reports published by OECD on the topic of national innovation systems and technology policy. In particular, OECD (2006) presents a synthesis of case studies on the innovation of energy technologies across several countries. These studies examine the drivers of energy innovation; the processes of knowledge creation, diffusion and exploitation; and the roles of public/private partnerships, intellectual property rights and globalization in the innovation process. This report and related OECD studies are | Noted. LB will evaluate during rewrite. |

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| | | | | | | worth being referred.<br>OECD (2006). Innovation in Energy Technology: Comparing National Innovation Systems at the Sectoral Level. OECD Publishing.<br><br>(Akira Maeda, Kyoto University) | |
| 7-358 | A | 56 | 23 | 0 | 0 | It should be added that the implementation of inert anodes will also eliminate CO2 emissions. As further progress is made in PFC emissions reduction through work practices, process control and capital turnover, the CO2 emissions from electrolysis carried out on carbon anodes becomes the predominate GHG emission.<br>(Jerry Marks, International Aluminium Institute) | Accepted. LB will add in editing. |
| 7-359 | A | 57 | 22 | 57 | 27 | Aguayo (2005) shows that R&D intensity (as a share of GDP), and business enterprise share of R&D in Latin America is systematically lower than their North American counterparts. This asymmetry between developed and developing countries has been confirmed in other R&D statistics (UNESCO, web site). Aguayo (2005) argues that fragile macroeconomic environments and weak innovation efforts tend to reinforce themselves, calling for coordination between macroeconomic, sectoral, and mitigation policies. Reference: Aguayo, F., 2005: Stepping off the Hydrocarbons Regime: the Challenge of Technological Transition for Latin America. Proceedings from IPCC Expert Meeting on Industrial Technology Development, Transfer And Diffusion IPCC Working Group III Technical Support Unit. IPCC. Bilthoven, The Netherlands. UNESCO Institute for Statistics, Montreal, web site: www.uis.unesco.org.<br>(Francisco Aguayo, El Colegio de México) | Rejected. The section is not a general discussion of the importance of RDD&D, but its role in GHG mitigation. The reviewer does not indicate how his study related to GHG mitigation. |
| 7-360 | A | 57 | 29 | 0 | 0 | Section 7.11.1.2. There is no mention of the Asia Pacific Partnership agreement here. A major focus of this agreement is additional energy efficiency and GHG emissions reduction. The aluminium sector is one focus of the Asia Pacific agreement.<br>(Jerry Marks, International Aluminium Institute) | Rejected. Program has just started. Assessment is premature. |
| 7-361 | A | 57 | 37 | 0 | 0 | While I know of no specific data published on energy consumption of Chinese aluminium production facilities it is clear that there has been a major transition that | Noted. Additional information has been supplied on energy efficiency in China. If that |

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| | | | | | | has occurred there over the past several years in which all the less energy efficient Soderberg technology has been converted to the more energy efficient point feed prebake technology as of the end of 2005. I don't think it's any longer accurate to include aluminium production as "much less energy efficient" unless there is specific post 2005 data indicating so. (Jerry Marks, International Aluminium Institute) | information supports the reviewer's comment, LB will make the change. |
| 7-362 | A | 58 | 9 | 0 | 0 | Section 7.11.2 The issue of intelectual property rights and patents is discussed at several point in this section and in other chapters of the report. It is reasonable to deduce from the literature that a strong patent system can harm diffusion of relevant technologies and subsequent technological learning, thereby hindering mitigation objectives. Detailed patent design can, on the contrary, foster mitigation policies. See attached file IPRs_SOD.doc for the complete argument and references. (Francisco Aguayo, El Colegio de México) | Noted. LB will evaluate reference. |
| 7-363 | A | 58 | 12 | 58 | 12 | Suggest rewrite which had as one of its objectives of identifying to read as diffusion, one of the objectives of the meeting was to identify…. (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will change in editing. |
| 7-364 | A | 58 | 28 | 58 | 28 | Delete second that (John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will change in editing. |
| 7-365 | A | 58 | 32 | 59 | 11 | In the paragraph, only technology potentials for a few industries are described and no policy option. This weakens the paragraph for policymakers or leave the impression that no public policy has influence here. There should be at least an allusion (and reference to chapters 11 or 13), for example at line 37 add : "Such radical change may not happen and industries could face a lock-in in traditional technologies in the absence of policies such as sectoral cooperation, research or tax policies such as developed in chapter 13". (ANTOINE BONDUELLE, Université Lille II) | Noted. The purpose of this section is to describe longer term technical options. The reviewer's comments will be taken into account elsewhere in the chapter. |
| 7-366 | A | 58 | 32 | 59 | 11 | Note only four longer term mitigation options exist, as written in the paragraph line 35 and they are not only based on new techniques but may also stem from radical change in flux systems of an industries in the absence of switch of process. Most industries do have such advanced processes in the labs or on paper. Also, other | Accepted. LB will change in editing. |

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| | | | | | | advances could deserve to be listed here included for example the plasma physics, supraconductivity among others. The idea in this paragraph could be summed by "Many advanced technologies or radical system changes offer the potential for significant further reduction in the longer run..."<br>(ANTOINE BONDUELLE, Université Lille II) | |
| 7-367 | A | 58 | 35 | 0 | 0 | Examples of four options<br>(Ann Gardiner, AEA Technology) | Rejected. The comment incomplete. |
| 7-368 | A | 59 | 11 | 59 | 11 | In the revised SOD for Chapter 4 there is no section 4.4.2.2<br>(John Kessels, Energy Research Centre of the Netherlands) | Accepted. LB will correct in editing. |
| 7-369 | A | 60 | 0 | 60 | 0 | References:<br>Jirí Klemeš, Igor Bulatov, Tim Cockerill (2006). Techno-economic modelling and cost functions of CO2 capture processes. Computers Chemical Engineering.<br>Petar Varbanov1, Jirí Klemeš, Ramesh K. Shah, Harmanjeet Shihn (2006). Power Cycle Integration and Efficiency Increase of Molten Carbonate Fuel Cell Systems. Journal of Fuel Cell Science and Technology NOVEMBER 2006, Vol. 3/3.<br>J. Klemeš, V. R. Dhole, K. Raissi, S. J. Perry and L. Puigjanerl (1997). TARGETING AND DESIGN METHODOLOGY FOR REDUCTION OF FUEL, POWER AND CO, ON TOTAL<br>SITES. Applied Thermal Engineering Vol. 17, Nos. 8-10, pp. 993-1003, 1997 ‘C European Communities 1997. Published bv Elsevier Science Ltd.<br>Petar Varbanov, Simon Perry, Jiri Klemesˇ, Robin Smith (2004). Synthesis of industrial utility systems: cost-effective de-carbonisation. Applied Thermal Engineering 25 (2005) 985–1001.<br>Möllersten K., Yan J., Moreira J.R. Potential market niches for biomass energy with CO2 capture<br>and storage – Opportunities for energy supply with negative CO2 emissions. Biomass and<br>Bioenergy 2003;25:273-285<br>Möllersten K., Yan J., Westermark M. Potential and cost-effectiveness of CO2 reductions through | Noted. Authors will consider in rewrite of section. References on pulp and paper already taken into account. |

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| | | | | | | energy measures in Swedish pulp and paper mills. Energy 2003;28(7):691-710<br>Möllersten K., Gao L., Yan J., Obersteiner M. Efficient energy systems with CO2 capture and<br>storage from renewable biomass in pulp and paper mills. Renewable Energy 2004;29(9):1583-<br>1598.<br>Grönkvist S., Bryngelsson M., Westermark M. Oxygen effiency with regard to carbon capture.<br>Energy 2006;31(15):3220-3226.<br>Hektor E., Berntsson T. Future CO2 Removal From Pulp Mills - Process Integration<br>Consequences. Proceedings of ECOS 2006, Aghia Pelagia, Crete, Greece, 12-14 July 2006, 3 pp.<br>1629-1636. ISBN/ISSN: 960-87584-1-6.<br>Hektor E., Berntsson T. CO2 capture from recovery boiler flue gases with biomass energy or<br>heatpump. Proceedings of the 8th International Conference on Greenhouse Gas Control<br>Technologies.<br>Axelsson E., Olsson M.R., Berntsson T. (2006): Heat integration opportunities in average Scandinavian kraft pulp mills: a pinch analysis of model mills. Nordic Pulp and Paper Research Journal, 21(4).<br>Olsson M.R., Axelsson E., Berntsson T. (2006): Exporting lignin or power from heat-integrated kraft pulp mills: a techno-economic comparison using model mills. Nordic Pulp and Paper Research Journal, 21(4).<br>Axelsson E., Olsson M.R., Berntsson T. (2006): Increased capacity in kraft pulp mills: lignin separation and reduced steam demand compared with recovery boiler upgrade. Nordic Pulp and Paper Research Journal, 21(4).<br>Ulrika-artiklar:<br>Wising, U. (2005): The potential for energy savings when reducing the water | |

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| | | | | | | consumption in a Kraft Pulp Mill, PRES'03, Applied Thermal Engineering 25 (7 SPEC. ISS.), pp. 1057-1066<br>Wising, U. (2005): Energy efficient evaporation in future pulp and paper mills , 7th International conference on new available technologies, Stockholm, Sweden, 4-6 June 2002, pp 112-116 [Stockholm, Sweden: SPCI Swedish Association of Pulp and Paper Engineers, 2002, 218pp] (K, S)<br>(Thore Berntsson, Chalmers) | |
| 7-370 | A | 60 | 5 | 60 | 5 | it is suggested that some words be added at the end of this paragraph to emphasize again the role of techonology transfer to developing countries in industrial mitigation, given the "technology lock-in" effects and the huge capital stock in developing countries in the near future.<br>(Government of China Meteorological Administration) | Taken into account. See comment 7-295. |
| 7-371 | A | 60 | 13 | 0 | 0 | References: Kindly make sure that the above cited references are included<br>(Friedrich Plöger, Siemens AG) | Noted. Reviewer's earlier comments addressed above. |
| 7-372 | A | 68 | 9 | 0 | 0 | "Comment on reference title: Firstly, the reference names in these chapters are different, i.e.' IPCC' in Chapter 5, 'Metz, B., L. Kuipers, et al' in Chapter 6, and 'IPCC/TEAP' in Chapter 7. These three names are the same literature. I think 'IPCC/TEAP' described in Chapter 7 is better. Secondly, reference titles in the text should also be identical. Thirdly, please check other reference titles which might have the same confusion.<br>(Koichi Mizuno, National Institute of Advanced Industrial Science and Technology) | Noted. LB will discuss with the TSU. |
| 7-373 | A | 69 | 15 | 69 | 25 | "Comment: Although I am not an expert, my personal opinion is the importance of power electronics. In contrast to clear expression of superconducting cables, power electronic devices did not seem emphasized in the section 4.3.7. Recent R&D of SiC and GaN semiconductors may indicate a promising advance in energy supply in the fields of industrial uses such as electric motors, decentralized energy, hybrid cars, CPU power and cell phone stations. The energy saving is estimated to be about 10 million tons-COs/yr in Japan. The technology development is competing in US, Germany and Japan. If the above opinion is already expressed in, for | Noted. LB will check whether this topic is adequately covered by Chapter 4 and add cross-reference if appropriate. |

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| | | | | | | example, p.69, L15-L25 in Chapter 4, I could withdraw my comment." (Koichi Mizuno, National Institute of Advanced Industrial Science and Technology) | |

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| 7-1 | B | 0 | 0 | 0 | 0 | Chapter 7 generally presents a very Northern-hemisphere centric view of the industry sector. The vast majority of examples of government and industry policies in the industry sector come from either Europe or the USA. The authors should review the literature to determine whether more Southern Hemisphere examples can be provided (some examples for Australia are provided below). (Government of Australia) | Accepted. LB will review material submitted by Australia and discuss its inclusion in the Chapter with the appropriate authors. |
| 7-2 | B | 2 | 22 | 4 | 25 | The Executive Summary usefully includes certainty estimates for the findings contained in the body of the chapter and this is to be commended, however, the notation used is not the IPCC standard as used in the WG1 and WG2 reports. The authors should attempt to ensure standardisation across the AR4 in this regard. (Government of Australia) | Rejected. The certainty statement use the terminology agreed applicable for WG III. |
| 7-3 | B | 2 | 24 | 2 | 24 | Replace "is" with "remains" to highlight that the industry sectors share of emissions is not increasing. (Government of Australia) | Accepted. LB/JR will rewrite this text in response to this another comments. |
| 7-4 | B | 3 | 47 | 3 | 49 | Is it possible to clarify what "restructuring through the adoption of industrial development pathways that minimise the need for future mitigation" means? How does it relate to the discussion of small and large companies in the rest of the paragraph? (Government of Australia) | Accepted. JR will handle in rewrite. |
| 7-5 | B | 4 | 19 | 4 | 19 | The text should be amended to read "public and private sectors have important…" (Government of Australia) | Noted. LB will consider in editing. |
| 7-6 | B | 4 | 30 | 4 | 30 | The authors should provide a more detailed explanation of the chapter's coverage of the industry sector and include an explanation of the principles behind the coverage. (Government of Australia) | Noted. LB will consider in rewrite. |
| 7-7 | B | 4 | 43 | 4 | 45 | Replace dot point with "hydrofluorocarbons (HFCs) are emitted as unintended by-products of HCFC-22 production; HCFC-22 is used as a refrigerant, for foam-blowing, and also as a feedstock in the production of fluoropolymers (plastics) and HFCs' to provide a more comprehensive description of HFCs. (Government of Australia) | Accepted. LB will rewrite this text in response to this and other comments. |
| 7-8 | B | 5 | 42 | 5 | 42 | The text should be amended to read "innovative R and D is also taking place in this sector." (Government of Australia) | Accepted. LB will handle in editing. |
| 7-9 | B | 6 | 1 | 6 | 10 | Take the reference to copper out of the legend in the figure as it is not used. (Government of Australia) | Accepted. LB will handle in editing. |
| 7-10 | B | 6 | 6 | 6 | 8 | The text should read "Statistics on aluminium, cement and iron and steel production | Accepted. EW will update production data |

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| | | | | | | are provided by the USGS2004. Statistics on ammonia production are provided by IFA 2005 and statistics on paper production are provided by FAOSTAT 2006." Note there is no reference for FAO 2005; check appropriate reference for FAOSTAT 2006 closer to publication.<br>(Government of Australia) | with latest references. |
| 7-11 | B | 6 | 32 | 6 | 33 | The second part of this sentence is unclear. Could read "while at the same time are placing increasing competitive pressure on other SME's in developing country markets."<br>(Government of Australia) | Accepted. LB will handle in editing. |
| 7-12 | B | 9 | 20 | 9 | | Table 7.3.B – HFC-22 should read HCFC-22. U.S. Government<br>(Government of U.S. Department of State) | Accepted. LB will correct in editing. |
| 7-13 | B | 9 | 22 | 9 | 20 | It is unclear how the second row in Table 7.3B was generated. The footnote indicates that only emissions from refrigeration equipment used in industrial processes are included here. The referenced sources however do not show ODS substitute emissions disaggregated in this way. Although the source does analyze an end-use titled "industrial process" it is unclear whether other end-uses such as "chillers" or "cold storage" might be included in "refrigeration equipment used in industrial processes." It is also unclear whether sources other than refrigeration and air-conditioning (aerosols, solvents, foam blowing and fire protection) are included. Suggest the table either be explicit on how these numbers were derived, or simply list the total ODS Substitute emissions shown in the cited sources with a footnote indicating that only part of those emissions are discussed in this chapter while other parts are discussed in Chapters 5 and 6. U.S. Government<br>(Government of U.S. Department of State) | Noted. CD will evaluate. It seems unreasonable to assign all HFC emissions to the industrial sector, as is done is some analyses, since most of the emissions are end-use emissions from other sectors. |
| 7-14 | B | 9 | 23 | 9 | 30 | Table 7.3.B presents only one of the two scenarios developed in USEPA 2006b and c for the industrial HFC, PFC, and SF6 sectors, including production of HCFC-22, aluminum, semiconductors, and magnesium, and use of electrical equipment. The scenario presented here is the No-Action scenario, which does not reflect global and regional industry agreements to reduce emissions. EPA considers the No-Action scenario to be considerably less likely than the other scenario that EPA developed, the Technology-Adoption scenario. In addition, the difference between the two scenarios is significant: the No-Action scenario projects 2020 emissions for the above sectors that are more than two and one half times as high as the emissions in the Technology-Adoption scenario, and the differences for some sectors are even higher (e.g., the 2020 No-Action semiconductor emissions are more than eight times as large as the Technology-Adoption semiconductor emissions). In view of | Accepted. CD will provide a better explanation of baseline choice. |

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| | | | | | | this situation, EPA recommends presenting both baselines in Table 7.3. If this is not possible, the authors should consider presenting the Technology-Adoption baseline rather than the No-Action baseline in Table 7.3. At the very least, the authors should acknowledge the existence of a second scenario in the source documents and provide brief explanations of both the differences between the scenarios (qualitative and quantitative) and the reasons why the No-Action scenario was selected for presentation in the IPCC Mitigation Report. U.S. Government (Government of U.S. Department of State) | |
| 7-15 | B | 10 | 14 | 10 | 14 | Ensure Chapter 7 consistently refers to both motors AND motor systems at each mention After "motors", add "and motor systems". U.S. Government (Government of U.S. Department of State) | Accepted. LB will add in editing. |
| 7-16 | B | 11 | 1 | 11 | 30 | The Iron and Steel, Fuel Switching entry should read "Natural gas, oil or plastic injection into the BF." (Government of Australia) | Accepted. LB will add in editing. |
| 7-17 | B | 11 | 1 | 11 | | Under Table 7.4, rename the table "Greenhouse Gas Management and MitigationOpportunities". Then, add a new first row above the existing column titles entitled "Greenhouse Gas Tracking, Management and Benchmarking Systems". A row is suggested because this new heading subsumes and logically precedes the activities described in the column titles. U.S. Government (Government of U.S. Department of State) | Noted. EW will add benchmarking as a sector-wide mitigation option |
| 7-18 | B | 11 | 2 | 11 | | Table 7.4. Chapter 7 consistently refers to process heating systems in place of furnaces/ovens/kilns/etc. except where appropriate for a sector-specific process. Also, petroleum refining is missing from this table. Under chemicals, there are more separation technologies that are very obvious. U.S. Government (Government of U.S. Department of State) | Noted. EW will add petroleum refining to the table. On chemicals separation technologies, these are only examples, table cannot be comprehensive. |
| 7-19 | B | 11 | 2 | 11 | 2 | Table 7.4 should include "separation from flue gas" under CO2 sequestration column for cement. U.S. Government (Government of U.S. Department of State) | Noted. Separation from flue gas I sector-wide, not limited to cement. |
| 7-20 | B | 11 | 2 | 11 | 2 | In Table 7.4, row labeled "Sector wide", second column "Energy Efficiency"—add "optimized" before the words "motor systems" then add ",optimized steam and process heating systems". Consider also adding "energy-efficient motors" to this list. Add a pie chart to show energy end uses by sector. U.S. Government (Government of U.S. Department of State) | Noted. EW will add "efficient" Cannot develop requested pie chart. |
| 7-21 | B | 12 | 0 | 12 | 29 | There are better examples of corporate energy management systems than the | Noted. LB will add "For example" to text. |

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| | | | | | | Exxon-Mobil example cited. Add additional references. See Alliance to Save Energy http://www.ase.org/section/topic/industry/corporate/cemcases. See also USDOE/ITP http://www1.eere.energy.gov/industry/bestpractices/corporate_success.html and www.energystar.gov/industry. U.S. Government (Government of U.S. Department of State) | Rejected. Reviewer does not indicate why the examples in reference are better. |
| 7-22 | B | 12 | 28 | 13 | 50 | Note that the subheadings on these pages are not formatted or numbered as such; i.e., 7.3.1.1. Energy Audits and Monitoring Systems" (Government of Australia) | Noted. Some of the formatting was lost when the text was sent to the TSU. LB will correct in editing. |
| 7-23 | B | 12 | 28 | 12 | 35 | Add following first sentence "Energy management systems have proven benefits for companies in providing a consistent and comprehensive method for reducing energy use across all operations. US EPA's ENERGY STAR Guidelines for Energy Management provide a systems-based approach to managing energy across a corporation and were compiled based on USEPA's observations of the successful practices that U.S. companies put in place for reducing energy use." (USEPA – www.energystar.gov/industry) U.S. Government (Government of U.S. Department of State) | Noted. LB will consider in editing. |
| 7-24 | B | 12 | 28 | 12 | | "Section 7.3.1 (Management Practices). There should be some discussion of using available software tools to help identify energy saving opportunities. ITP has developed many software tools in this area that could be of interest (e.g., steam, compressed air)." Add this reference: http://www1.eere.energy.gov/industry/bestpractices/. U.S. Government (Government of U.S. Department of State) | Noted. LB will evaluate the reference and change text if appropriate. |
| 7-25 | B | 12 | 29 | 12 | 35 | "In Energy Audits and Management Systems, discussion could include ITP (and/or other government) audit programs, such as Industrial Assessment Centers and Save Energy Now audits." U.S. Government (Government of U.S. Department of State) | Noted. Space limitation preclude more than a mention of such programs. |
| 7-26 | B | 13 | 15 | 13 | 17 | Following "index", add in "known as an energy intensity index produced for a specific refinery and". Include more information on the Solomon Associates energy benchmarking. U.S. Government (Government of U.S. Department of State) | Noted. The Salomon Associates Index is proprietary. The type of information requested by this comment is not publicly available. |
| 7-27 | B | 13 | 21 | 13 | 21 | If this is the first use of "CCS", spell out the abbreviation and explain what this technology is and what promise it holds. U.S. Government (Government of U.S. Department of State) | Accepted. LB will add in editing. |
| 7-28 | B | 13 | 23 | 13 | 41 | Provide a broader elaboration on the nature of each benchmarking program. U.S. Government | Noted. Space limitation preclude more than a mention of these programs. |

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| | | | | | | (Government of U.S. Department of State) | |
| 7-29 | B | 13 | 28 | 13 | 29 | "Top of the world" is an unusual expression, could be replaced with "industry is required to achieve world's best practice in terms of energy efficiency." (Government of Australia) | Accepted. LB will change in editing. |
| 7-30 | B | 13 | 43 | 13 | 48 | Reword paragraph's front end as follows to provide clearer information on US plant benchmarking: "In the United States, the U.S. EPA, through the ENERGY STAR program, has developed a benchmarking system for certain industries (e.g. automobile assembly plants, cement plants, and wet corn mills, or corn refineries) to aid companies to compare the energy efficiency of a specific facility to that of the entire U.S. industry. (Boyd, 2005) The USEPA system provides an energy performance rating for a plant on a scale from 1 to 100 and compares it to the average and efficient plants in the U.S., enabling companies to establish goals for managing and reducing energy use. The system is used …." U.S. Government (Government of U.S. Department of State) | Accepted. LB will use input in editing. |
| 7-31 | B | 14 | 0 | 14 | 50 | The IEA has recently (July 2006) developed a policy document for the G8 "Industrial motor systems energy efficiency: Towards a plan of action", which should be cited. U.S. Government (Government of U.S. Department of State) | Accepted. EW to evaluate document and edit text as appropriate. |
| 7-32 | B | 14 | 10 | 14 | | In 7.3.2 (Energy Efficiency), there needs to be further discussion in the steam section of the opportunities for technology development in boilers, such as the "SuperBoiler" project ITP is funding that is expected to reach an efficiency of 94%. In addition, a paragraph is recommended for generic process heating technologies that cross industries. U.S. Government (Government of U.S. Department of State) | Noted. EW will evaluate. |
| 7-33 | B | 14 | 15 | 14 | 12 | Another factor that may influence energy efficiency is plant location, which includes items such as availability, cost, and temperature of air and water as well as co-location of other facilities for exchange of material and energy streams. U.S. Government (Government of U.S. Department of State) | Accepted. LB will add in editing. |
| 7-34 | B | 14 | 22 | 14 | 18 | There are numerous examples and industry consensus to support a conservative estimate of compressed air leakage of 20% of system capacity. See USDOE/ITP http://www1.eere.energy.gov/industry/bestpractices/pdfs/compressed_air3.pdf For If you are interested in more information, specific citations have been taken from Compressed Air Challenge training materials. U.S. Government (Government of U.S. Department of State) | Accepted. LB will add in editing. |

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| 7-35 | B | 14 | 26 | 14 | 31 | Add “to older or less efficient plants” (or something similar to this) after “maintenance” in line 25 to specify which type of plants the potential savings are applicable. U.S. Government (Government of U.S. Department of State) | Accepted. LB will add in editing. |
| 7-36 | B | 14 | 33 | 14 | 26 | Insert the following between “exhaust gases” and “use of high efficiency electric motors”— “matching supply with demand through maintenance and low-cost changes in operating procedures” U.S. Government (Government of U.S. Department of State) | Accepted. LB will add in editing. |
| 7-37 | B | 15 | 0 | 15 | | In Fuel Switching section, there should be some discussion of fuel and feedstock flexibility through applied R&D for industrial process integration with various synthetic fuels and material production, and integration/synergy across industries and processes. U.S. Government (Government of U.S. Department of State) | Rejected. Unclear what reviewer is suggesting. |
| 7-38 | B | 15 | 13 | 15 | 16 | Is it possible to re-express the 40 MW and 10 MW in terms of MWhrs of electricity produced? Also, the authors should insert the words "potentially saving" before 400 ktCO2/year. (Government of Australia) | Noted. LB will insert “potentially.” FY will recheck numbers. |
| 7-39 | B | 17 | 36 | 17 | 37 | The sentence is currently a little unclear. Suggest "The process typically uses 60-70% less energy than the production of steel from raw materials and the total reduction in CO2 from scrap recycling is determined by the type of fuel used to generate the electricity used in the process." (Government of Australia) | Noted. LB will consider in editing. |
| 7-40 | B | 18 | 1 | 17 | 30 | The relationship between water, waste reduction and energy consumption needs to be addressed. Regulations and policies affecting these areas can have a large impact on greenhouse gas emissions.<br>-See http://www.watergy.org/<br>-See http://industrial-energy.lbl.gov/node/4<br>-See http://water-energy.lbl.gov/index.php?about U.S. Government<br>(Government of U.S. Department of State) | Taken into account. See Batch A, comment 7 – 20. |
| 7-41 | B | 18 | 6 | 18 | 40 | Section could include further discussion on which sectors/industries will be able to incorporate CCS into commercial operations and possibly address the different challenges and opportunities facing different sectors in relation to take-up of CCS. (Government of Australia) | Taken into account. See Batch A, comment 7 - 291 |
| 7-42 | B | 18 | 6 | 18 | 8 | Paragraph misrepresents CO2 capture. The IPCC Special Report on CCS categorises four types of capture systems - post combustion, pre-combustion, | Accepted. LB will rewrite section to present four pathways. |

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| | | | | | | oxyfuel and industrial separation (rather than the two paths discussed).<br>(Government of Australia) | |
| 7-43 | B | 18 | 30 | 18 | 40 | This paragraph discusses oxyfuel combustion as a separate process rather than one of the four capture pathways (as identified in the IPCC Special Report on CCS). Section should equally address all four types of capture pathways (post combustion, pre-combustion, oxyfuel and industrial separation) and their applications to industry.<br>(Government of Australia) | Accepted. LB will rewrite section to present four pathways. |
| 7-44 | B | 18 | 46 | 36 | 50 | More discussion of CCS is needed as applied to specific industries. U.S. Government<br>(Government of U.S. Department of State) | Rejected – CCS is discussed in Section 7.3, not industry by industry. |
| 7-45 | B | 21 | 12 | 18 | 46 | Text is confusing. Suggest adding a pie chart showing usage by industry. U.S. Government<br>(Government of U.S. Department of State) | Rejected. Focusing on energy use in the U.S. is too limited for this report which is supposed to be global in scope. |
| 7-46 | B | 22 | 24 | 21 | 50 | There is no mention of mitigation strategies for steel plants involving pumping, steam, and compressed air systems- these can be significant.<br>See<br>http://www1.eere.energy.gov/industry/bestpractices/case_studies_industry.html#st U.S. Government<br>(Government of U.S. Department of State) | Rejected. These systems are discussed in Section 7.3, not industry by industry. |
| 7-47 | B | 22 | 25 | 22 | 25 | Delete "and based on calculations using the industry's mass flow model." as it is superfluous.<br>(Government of Australia) | Accepted. LB will change in editing. |
| 7-48 | B | 23 | 15 | 22 | 24 | Insert "and" between "(IAI, 2005)" and "has grown an average." U.S. Government<br>(Government of U.S. Department of State) | Accepted. LB will change in editing. |
| 7-49 | B | 23 | 16 | 23 | 15 | The maximum cost of major retrofits that is cited here is from the draft EPA report (2006b). The maximum cost included in the final report was revised to \$27/tCO2 eq (\$99/tC eq). U.S. Government<br>(Government of U.S. Department of State) | Accepted. LB will change in editing. |
| 7-50 | B | 23 | 47 | 23 | | The EPA estimate includes primary and secondary magnesium production and die-casting. Please insert ""production and" following "for." U.S. Government<br>(Government of U.S. Department of State) | Accepted. LB will change in editing. |
| 7-51 | B | 23 | 47 | 23 | 27 | Although the information presented in this paragraph is broadly comparable to that presented in the cited sources (e.g., IAI, 2005), these sources don't always present the specific values shown here. For example, IAI 2005 doesn't appear to show the overall changes (across cell technologies) in CF4 and CF6 emissions intensity. In | Noted. LB will check references and add others if need. Text was responsive to comment on FOD. |

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| | | | | | | addition, the latest year presented in IAI 2005 is 2003, not 2004. Is there another source for these numbers? If so, appropriate reference to the source should be included in the text. U.S. Government (Government of U.S. Department of State) | |
| 7-52 | B | 24 | 1 | 24 | 5 | The statement that the International Magnesium Association represented 44% of global magnesium production in 2002 is overly precise. The data presented in US EPA 2006b do not support such a precise calculation. Recommend saying that the IMA represented "about half" of global magnesium production in 2002. U.S. Government (Government of U.S. Department of State) | Accepted. LB will change in editing. |
| 7-53 | B | 24 | 5 | 24 | | The EDGAR estimate for 2000 SF6 emissions from magnesium die-casting and smelting appears to be very high. It is more than twice as high as EPA's estimate for the same processes for the same year and is five times as high as the total 2000 SF6 sales to the magnesium sector reported by SF6 manufacturers in the 2004 RAND survey. Although the RAND sales data do not include China and Russia, these countries are very unlikely, based on magnesium production data, to have accounted for 80% of global SF6 consumption by this sector in 2000. It is possible that the EDGAR estimate does not account for the decrease in emission factors that occurred throughout the magnesium industry during the late 1990s in response to a sharp increase in the global price of SF6. The authors should check this and reconsider their use of the EDGAR estimate for the magnesium sector. U.S. Government (Government of U.S. Department of State) | Rejected. The two references show the range of estimates in the literature. |
| 7-54 | B | 24 | 12 | 24 | | The value for electricity-related CO2 emissions provided in Table 7.6 (300 MtCO2 eq) does not match the value provided in IEA GHG 2000 (about 250 MtCO2), which appears to be the document you intended to cite (since IEA GHG 2001 covers only PFC emissions from aluminum). U.S. Government (Government of U.S. Department of State) | Noted. JH will check numbers. |
| 7-55 | B | 24 | 12 | 24 | | Recommend deleting the citation (IEA GHG 2001) from this line, because the estimate of total emissions from non-ferrous metals has multiple sources, as shown in Table 7.6. IEA GHG 2001 (Harnisch et al), which is cited, does not include estimates of either direct or indirect CO2 emissions because its focus is limited to fluorinated chemicals. U.S. Government (Government of U.S. Department of State) | Accepted. LB will delete reference in editing. |
| 7-56 | B | 24 | 18 | 24 | | Recommend updatingyou update the estimate and source for the row of Table 7.6 that currently reads "SF6--Casting." The process should be changed to "SF6-- | Noted. JH will change labeling in table, but will reflect range of values in Table |

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| | | | | | | Production and Casting;" the estimate should be changed to 9 MtCO2 eq; and the source should be changed to "US EPA 2006b and c." U.S. Government (Government of U.S. Department of State) | |
| 7-57 | B | 24 | 30 | 24 | | Throughout Table 7.6, IEA GHG 2001 appears to have been confused with IEA GHG 2000. The former covers fluorinated chemicals only (PFCs, for aluminum), while the latter covers direct and indirect CO2 emissions as well as PFC emissions. U.S. Government (Government of U.S. Department of State) | Accepted. JH will check references. |
| 7-58 | B | 25 | 5 | 24 | 32 | This sentence refers to U.S. CH4 emissions from petrochemical manufacture and SiC. Throughout this chapter every effort seems to be made to present global estimates of emissions, where available. Including U.S. only values here seems too restrictive. Recommend reviewing the national inventory submissions of Parties to the UNFCCC to, at a minimum, estimates those Parties' emissions from these sources. At least a couple of other Parties report emissions from petrochemical manufacture. U.S. Government (Government of U.S. Department of State) | Noted. LB will add "for example" to indicate that other countries have similar emissions. |
| 7-59 | B | 25 | 39 | 25 | 14 | There is no mention of mitigation strategies for chemical plants involving pumping, steam, and compressed air systems. These can be significant. See http://www1.eere.energy.gov/industry/bestpractices/case_studies_industry.html U.S. Government (Government of U.S. Department of State) | Rejected. These systems are discussed in Section 7.3, not industry by industry. |
| 7-60 | B | 26 | 24 | 26 | 24 | It would be useful if the authors provided a brief summary of the information contained in the TAR on emissions from chlorine production. (Government of Australia) | Rejected. While it would be useful, space limitation preclude such an approach. |
| 7-61 | B | 27 | 10 | 26 | 18 | Change text to indicate that CCS can be integrated with conventional technology used for ammonia production, not just in conjunction with application of new technologies. U.S. Government (Government of U.S. Department of State) | Accepted. LB will change in editing. |
| 7-62 | B | 27 | 14 | 27 | | Several values in this paragraph need to be updated to reflect the final rather than draft sources (USEPA 2006 b and c). 2020 N2O emissions from the production of nitric and adipic acid are now projected at 177 Mt CO2 eq (rather than 181 MtCO2 eq). Developed nations account for slightly more than 60% of emissions in both 2000 and 2020 (64 and 61 percent respectively). U.S. Government (Government of U.S. Department of State) | Accepted. LB and CD will check to ensure that final values are used. |
| 7-63 | B | 27 | 16 | 27 | | According to US EPA 2006b, potential mitigation at nitric acid plants can range from 70 (rather than 77) percent to almost 100 percent. U.S. Government | Accepted. CD will update with final version of EPA report. |

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| | | | | | | (Government of U.S. Department of State) | |
| 7-64 | B | 27 | 18 | 27 | | The costs cited for adipic and nitric acid appear to be too low. The least expensive option cited in US EPA 2006b is $1.99/tCO2 eq and the most expensive is $5.81/tCO2 eq. U.S. Government (Government of U.S. Department of State) | Accepted. CD will update with final version of EPA report. |
| 7-65 | B | 27 | 25 | 27 | 35 | In section 7.4.3.5 the authors should discuss the impact of fugitive emissions from the manufacture and distribution of HCFC-22. (Government of Australia) | Accepted. JH will handle. |
| 7-66 | B | 27 | 28 | 27 | | Replace "165 Mt CO2 eq" with "162 Mt CO2 eq" and make the corresponding change for Mt C eq. U.S. Government (Government of U.S. Department of State) | Noted. CD will handle with update. |
| 7-67 | B | 27 | 30 | 27 | 31 | The authors should insert "(plastics) and HFCs" after "fluoropolymers". (Government of Australia) | Accepted. LB will change in editing. |
| 7-68 | B | 27 | 35 | 27 | 29 | The statement regarding HCFC-22, "under the Montreal Protocol, this use is scheduled to end by 2020" is incorrect. First, the Montreal Protocol does not control "use" only "consumption" (defined as production plus import minus export minus destruction) of chemicals. After the chemical is produced, it may be used forever. Secondly, the Montreal Protocol sets a reduction of consumption of all HCFCs that does not reach 0 until 2030 for developed countries. Individual countries have enacted regulations that may limit or stop use or consumption for different applications or different chemicals on different schedules. For instance, the U.S. will stop consumption of HCFC-22 in 2020, but its continued use in refrigeration and air conditioning equipment is allowed after that. A simple fix would be to say "under the Montreal Protocol, production for this use is scheduled to end by 2030..." U.S. Government (Government of U.S. Department of State) | Accepted. LB will correct in editing. |
| 7-69 | B | 28 | 0 | 28 | | In the paragraphs describing petroleum refining, there should be mention of the changing crude variety available to refiners (both historical and projected) and its impact on energy efficiency in this sector. U.S. Government (Government of U.S. Department of State) | Noted. This is an extremely complex subject, since not only crude quality but product slate is changing. LB will consider in rewrite. |
| 7-70 | B | 28 | 24 | 28 | | The range "$0.20 to 0.32/tCO2 eq" should be updated to "less than $0.20 to 0.35/tCO2 eq." IPCC/TEAP 2005 simply states that abatement costs fall below $0.20/tCO2 eq, while USEPA 2006 b provides an upper-bound value of $0.35/tCO2 eq. U.S. Government (Government of U.S. Department of State) | Accepted. LB will change in editing. |
| 7-71 | B | 29 | 15 | 28 | 25 | Remove this sentence. There is insufficient data to draw this conclusion. U.S. | Rejected. There is not way to tell which |

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| | | | | | | Government<br>(Government of U.S. Department of State) | sentence the comment refers to. |
| 7-72 | B | 29 | 29 | 29 | 15 | Clarify what is meant by the notion that CO2 emissions from calcination of limestone can be reduced. Emissions from the calcination process cannot be reduced, as this is dependent on a stoichiometric relationship (CaCO3 yields CaO and CO2). The process-related emissions from calcination perhaps could be captured and sequestered, or less limestone could be used, however CO2 emissions from the calcination process cannot be reduced. U.S. Government<br>(Government of U.S. Department of State) | Noted. EW will handle in rewrite. |
| 7-73 | B | 29 | 52 | 29 | 30 | The discussion of applicability of CCS needs to be expanded beyond the reference to a previous section, which is also an incomplete discussion. CCS is applicable not only as part of the combustion process, but also for reduction of CO2 from calcinations of limestone. U.S. Government<br>(Government of U.S. Department of State) | Noted. CCS will be discussed in Section 7.3.7, not on an industry-by-industry basis. |
| 7-74 | B | 30 | 25 | 29 | 54 | Miller (2003) can be updated to Miller (2005). Considering Miller 2005, the sentence should read, "…estimated global production at 127 Mt, excluding regenerated lime. The largest producers are China, United States, Japan, Russia, Germany, Braxil and Mexico. U.S. Government<br>(Government of U.S. Department of State) | Accepted. LB will change in editing. |
| 7-75 | B | 31 | 5 | 31 | | Add a paragraph to discuss that there may be no net emissions from lime production in cases where the lime produced is used in certain industries. For example, in water softening, precipitated calcium carbonate or sugar refining the lime reacts with CO2 to reform calcium carbonate. Although there is still much research that needs to be done about the extent of this practice, it is a recognized process that results in emission reductions. U.S. Government<br>(Government of U.S. Department of State) | Accepted. EW add additional example(s), as appropriate. |
| 7-76 | B | 31 | 40 | 31 | 40 | Insert a period at the end of the sentence after "needed". U.S. Government<br>(Government of U.S. Department of State) | Accepted. LB will correct in editing. |
| 7-77 | B | 31 | 40 | 31 | | Add further discussion of waste heat recovery opportunities from industries such as lime and cement. U.S. Government<br>(Government of U.S. Department of State) | Rejected. Space limitation precludes further discussion of heat recovery. |
| 7-78 | B | 31 | 45 | 31 | 9 | Include improved compressed air system efficiency. U.S. Government<br>(Government of U.S. Department of State) | Rejected. These systems are discussed in Section 7.3, not industry by industry. |
| 7-79 | B | 32 | 11 | 31 | 45 | It is not obvious that the use of concrete as an alternative building material for ceramics (bricks) is actually a GHG mitigation strategy. As noted earlier in the paper, the production of cement (which is used to make concrete) is a very | Noted. JH will add reference to support statement. |

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| | | | | | | emissions intensive process. If the example of concrete is retained,then it is recommended that the reference to a study that has actually looked at whether the replacement of bricks with concrete actually leads to GHG emission reductions be used. U.S. Government (Government of U.S. Department of State) | |
| 7-80 | B | 32 | 46 | 32 | 46 | The authors should provide a view as to whether they consider paper recycling a legitimate GHG emissions reduction option. (Government of Australia) | Rejected. Literature does not provide a clear answer on this question. |
| 7-81 | B | 34 | 39 | 32 | 46 | Include mitigation strategies involving pump, fan, compressed air, steam, and process heating systems. See: http://www1.eere.energy.gov/industry/bestpractices/case_studies_industry.html U.S. Government (Government of U.S. Department of State) | Rejected. These systems are discussed in Section 7.3, not industry by industry. |
| 7-82 | B | 35 | 45 | 34 | 45 | This section for food processing includes language about cross-cutting systems that would apply to most of the other industrial sectors in this chapter U.S. Government (Government of U.S. Department of State) | Accepted. LB will address in editing. |
| 7-83 | B | 36 | 6 | 36 | 6 | Change "production, 1995-2003" to "production between 1995 and 2003". (Government of Australia) | Accepted. LB will change in editing. |
| 7-84 | B | 36 | 8 | 36 | | To reflect the final rather than draft EPA report, change "about 40" to "about 30" and "(11 MtC eq)" to "(7 Mt C eq)." The values in the final report were calibrated to the emissions actually reported by major emitting countries and regions (or their semiconductor trade associations). U.S. Government (Government of U.S. Department of State) | Accepted. LB will change in editing. |
| 7-85 | B | 36 | 10 | 36 | 12 | To strengthen and generalize the final sentence in the paragraph, insert "use and" after "Emissions from" and before "disposal," and add "US EPA 2006b" as a source to "Wartman and Harnisch, 2005." U.S. Government (Government of U.S. Department of State) | Rejected. Use is handled in Chapter 4. |
| 7-86 | B | 36 | 10 | 36 | 9 | Delete "production" after "SF6 emissions from" and before "use and disposal of electrical equipment." USEPA 2006 b and c did not include emissions from production of electrical equipment, which can be significant. U.S. Government (Government of U.S. Department of State) | Accepted. JH will address in rewrite. |
| 7-87 | B | 36 | 14 | 36 | | Replace the first "of" with "if." Insert "further" between "no" and "mitigation actions." The US EPA estimates cited do include mitigation actions taken to date, but not future actions. U.S. Government | Accepted. LB will change in editing. |

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| | | | | | | (Government of U.S. Department of State) | |
| 7-88 | B | 36 | 21 | 36 | 16 | HFCs are also used and emitted in hand-held and fixed fire extinguishers. Suggest "… solvents, for cleaning purposes, or for fire protection." The next few sentences discussing the Montreal Protocol phaseout, the use of HFCs in place of ODSs, general mitigation options, and coverage by the IPCC/TEAP Special Report also apply to fire protection as well as the other indicated sources of HFC emissions. U.S. Government (Government of U.S. Department of State) | Rejected. Use is handled in Chapter 6. |
| 7-89 | B | 36 | 23 | 36 | 23 | Lines 26-29 indicate how different analyses yield different results for the ODS substitute sources; therefore, suggest referencing more than just one source for the reader who wishes to explore in greater detail this complex field. Could change to "… can be found in IEA GHG (2001), the IPCC/TEAP Special Report …(IPCC/TEAP, 2005) and more recently US EPA (2006b, 2006c)." U.S. Government (Government of U.S. Department of State) | Accepted. LB will incorporate in editing. |
| 7-90 | B | 37 | 32 | 36 | 29 | It is not clear why fugitive emissions from HFC production and solvents are specifically referenced here whereas other larger sources such as refrigeration & air conditioning are not. Perhaps these sentences should be in a separate paragraph and/or include a transitional sentence explaining why they are discussed further here. Alternatively, a brief discussion of the use patterns (emissive or banked) and global projections could be included for the other sources (refrigeration and air conditioning, foam blowing, medical and non-medical aerosols and fire protection). U.S. Government (Government of U.S. Department of State) | Accepted. Other reviewers have noted the same problem. LB will add text explaining only industry applications are covered in this section and that transportation and buildings applications are covered in Chapters 5 and 6. |
| 7-91 | B | 37 | 34 | 37 | | The authors should explain how they extrapolated emissions and mitigation potential from the 2020 values provided in USEPA 2006b. U.S. Government (Government of U.S. Department of State) | Accepted. CD will address in rewrite. |
| 7-92 | B | 37 | 43 | 41 | 33 | Change references to "table 7.5.1" to "table 7.8". (Government of Australia) | Accepted. LB will correct in editing. |
| 7-93 | B | 38 | 1 | 38 | | The reduction potential provided for aluminum in Table 7.8, 100 percent, is too high. Further, it is based on assumptions that are questionable, buried in a footnote to the table, and inconsistent with the reasonable discussion of reduction options for aluminum that appears earlier in Chapter 7. Specifically, the footnote states, "Assumes use of an inert electrode and non-carbon electricity." Leaving inert anodes aside for a moment, there is no doubt that using non-carbon electricity would sharply reduce GHG emissions from many industrial sectors! However, a | Accepted. Agree that 100% mitigation potential is too large. LB/EW will reconsider. |

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| | | | | | | sector-wide switch to "non-carbon electricity" is a rather radical option to tuck into a footnote with no further explanation, particularly since the discussion of Fuel Switching in section 7.3.3 of the chapter only mentions mitigation potentials of10 to 20 percent. The emphasis on inert anodes in Table 7.8 is also inconsistent with the treatment of this option elsewhere in the Industrial chapter.<br>The discussion of mitigation options for aluminum in section 7.4.2.1 states that "the main potentials for further CO2 eq emissions reduction are a further penetration of state-of-the-art, pointfeed, prebake smelter technology and process control plus an increase of recycling rates for old scrap." That discussion also states that "IEA notes that the ultimate technical feasibility of inert anodes has yet to be proven, despite 25 years of research." Given these statements, it is not appropriate to include inert anodes as an option in what should be a summary table. If the authors genuinely believe that inert anodes are a viable option for 2030, they should revise the earlier text in section 7.4.2.1. Right now, the glaring differences between the values in Table 7.4.2.1 and the discussion elsewhere in the chapter undermines the credibility of both. U.S. Government<br>(Government of U.S. Department of State) | |
| 7-94 | B | 38 | 1 | 38 | | Based on the fact that Table 7.8 presents only one set of estimates of emissions of non-CO2 gases, the authors probably meant to insert a "not" between "do" and "include the effects of SRES scenario differences." However, although the projections in US EPA 2006b may not include the effects of SRES scenarios, per se, they do include multiple scenarios based on different assumptions regarding compliance with voluntary emission reduction goals. This should be mentioned in this paragraph. U.S. Government<br>(Government of U.S. Department of State) | Noted. “Not “ is already in footnote. CD will discuss choice of scenario in rewrite. |
| 7-95 | B | 39 | 1 | 40 | 30 | Table 7.8: the table and surrounding discussion doesn't make it clear that mitigation potential refers to the reduction in projected annual emissions at 2030. The authors should put this in the table eg "Mitigation Potential, Mt CO2e/year" in the column heading.<br>(Government of Australia) | Accepted. LB will change in editing. |
| 7-96 | B | 39 | 1 | 39 | | If the authors continue to present the reduction potential for aluminum apart from that for other sources of non-CO2 sources, it is recommendated they should take care should be taken not to count PFC emissions and reductions in both places. Right now, the table appears to double-count these emissions and reductions, as the emissions and reductions from USEPA 2006b and c include those from aluminum. U.S. Government | Accepted. LB will correct in editing. |

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| | | | | | | (Government of U.S. Department of State) | |
| 7-97 | B | 41 | 8 | 41 | 13 | The authors should change the sentence to "ABARE (Matysek et al., 2006) used its general equilibrium model of the world economy (GTEM) to estimate that widespread adoption of advanced technologies, including those for control of non-CO2 gases, could reduce industrial sector GHG emissions by an average of about 2.8 GtCO2 e/year over the 2030-2050 timeframe relative to the GTEM reference case, which assumes continuation of current or already announced future government policy."<br>(Government of Australia) | Accepted. LB will change in editing. |
| 7-98 | B | 41 | 30 | 41 | | Reference is made to a Table 7.5.1, which isn't included in the review copy U.S. Government<br>(Government of U.S. Department of State) | Accepted. LB will correct in editing. |
| 7-99 | B | 41 | 33 | 41 | | The 2030 mitigation potential for the non-CO2 gases provided in Table 7.8 is not consistent with the 2020 values provided in USEPA 2006 b and c. Specifically, the extrapolated 2030 global mitigation potential presented in the table (560 Mt CO2 eq) is lower than the total 2020 global mitigation potential presented for the same sources in USEPA 2006b, even though the extrapolated 2030 emissions are higher than the 2020 emissions. (For the No-Action scenario, 2020 reductions available under $20/tCO2 eq include approximately 401 Mt CO2 eq from aluminum, magnesium, semiconductors, electric power systems, and HCFC-22; 162 Mt CO2 eq from adipic and nitric acid, 6 Mt CO2 eq from foams, and 23 Mt CO2 eq from Non-MDI aerosols for a total of about 590 Mt CO2 eq). Since the trend in emissions is upward, the trend in reductions should also be upward. The authors need to clarify the methods used to extrapolate emissions and reductions and make them internally consistent. U.S. Government<br>(Government of U.S. Department of State) | Noted. CD will discuss choice of scenario in rewrite. |
| 7-100 | B | 45 | 20 | 46 | 14 | Section 7.8 provides a succinct discussion of how mitigation, adaptation and impacts interact in the industry sector. We suggest that this be used a as template for the discussion of this interaction in the other sectoral chapters of the WG3 report.<br>(Government of Australia) | Noted – with thanks. |
| 7-101 | B | 45 | 22 | 45 | 27 | This paragraph does not seem necessary. The authors should consider whether it should be deleted.<br>(Government of Australia) | Noted. Some introduction is needed, but LB will consider whether it can be made shorter in editing. |
| 7-102 | B | 46 | 15 | 47 | 19 | Section 7.9.1 does not provide any industry specific data on the Kyoto Mechanisms but presents a broad discussion of the successes and failures of the mechanism. | Taken into account. Will use available data to discuss type and geographic distribution of |

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| | | | | | | This section should either be re-drafted (to more clearly focus on the industry sector), or be deleted.<br>(Government of Australia) | industrial CDM projects. See Batch A, Comment 7 - 317. |
| 7-103 | B | 48 | 25 | 48 | 2 | Please add a section on the organizational barriers that exist even for relatively low-cost energy efficiency improvements to cross cutting industrial systems using proven technologies and yielding a 2 year simple payback or less. These include:<br>-Industrial markets focus on components, not systems<br>-Energy efficiency is not a core mission for most industries<br>-These are supporting systems- production practices can deeply affect their operation, but are outside of the facility engineer's control<br>-Technical skills is required to optimize motor-driven systems- a one-size-fits-all approach misses most of the savings. U.S. Government<br><br>(Government of U.S. Department of State) | Noted. This is an excellent comment, but cannot be used without a reference. LB will ask the TSU to ask reviewer for suitable reference. |
| 7-104 | B | 48 | 35 | 49 | 40 | The authors should review the literature to provide some analysis of whether company initiated voluntary action, or industry association action has been more successful at achieving emissions reductions.<br>(Government of Australia) | Noted. LP will consider in rewrite. |
| 7-105 | B | 48 | 55 | 48 | 55 | A further example from Australia that could be considered by the authors is: "CRF (Colac Otway) Pty Ltd, a lamb and veal processing company, joined Australia's Greenhouse Challenge in 2000 and has since increased production by 6.8 times and achieved a 75% improvement in their Greenhouse Performance Indicator". The reference for this statement is "Australian Greenhouse Office, The Plus Factor, issue 01, Dec 2005."<br>(Government of Australia) | Noted. LP will review reference. |
| 7-106 | B | 50 | 42 | 50 | 42 | The authors should add information about Australia's Fuel Tax Credit Scheme to provide greater Southern Hemisphere information. Suggested inclusion:<br>"- Australia now requires companies receiving in excess of $3 million of fuel tax credits to be members of its Greenhouse Challenge Plus programme to receive the credits". The reference for this statement is Australian Greenhouse Office, Fuel Tax Credits and Greenhouse Challenge Plus Membership, http://www.greenhouse.gov.au/challenge/media/fueltaxcredits.html.<br>(Government of Australia) | Accepted. JH will add text, as appropriate. |
| 7-107 | B | 50 | 54 | 50 | 54 | Delete "also are" from this sentence.<br>(Government of Australia) | Accepted. LB will change in editing. |
| 7-108 | B | 51 | 50 | 52 | 9 | The authors should provide some examples of national energy and technology | Noted. RM/LP will look for examples. |

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| | | | | | | policies that has effectively promoted investment through technology policy. (Government of Australia) | |
| 7-109 | B | 55 | 1 | 55 | 6 | Most companies smaller than the large multinationals referenced here have not developed a way to integrate energy management into their routine management practice, using whatever management system they employ (ISO, Six Sigma, TQM, adaptations of these of other systems). There is a large mitigation opportunity in developing and offering programs that focus on energy management, reinforced by mandatory or voluntary energy management standards. This is a substantial missed opportunity, particularly for developing countries with a large and growing population of medium-sized industrial facilities. U.S. Government (Government of U.S. Department of State) | Noted. LB will ask TSU to seek reference from reviewer. |
| 7-110 | B | 56 | 49 | 56 | | In Technology RDD&D, the discussion should stress the importance of the government role due to the diversity of the stakeholders and industrial processes. Government also has a unique role in stimulating the cooperation and synergy between private and public sectors. Furthermore, the level of government RD&D funding needs to grow consistently to address the growing climate problems. U.S. Government (Government of U.S. Department of State) | Rejected. Role of government in R&D already discussed. |
| 7-111 | B | 57 | 0 | 40 | | Suggest adding a reference to the IEA Industrial Energy Related Technology and Systems Agreement (IETS). This agreement is for RD&D and deployment activities and includes combustion systems, separation technologies and process integration. U.S. Government (Government of U.S. Department of State) | Noted. LB will consider in rewrite. |
| 7-112 | B | 57 | 8 | 56 | 52 | Sentence reports 42% of suggested measures are implemented. Would be better if authors did not refer to the percentage since it implies a certain level of precision and does not relate to the associated percentage of energy savings. U.S. Government (Government of U.S. Department of State) | Rejected. 42% is direct quote form reference. |
| 7-113 | B | 57 | 30 | 58 | 30 | Section 7.11.1.2 could include more examples of important international policies that are aimed at fostering RDD&D in the industry sector. The Asia-Pacific Partnership on Clean Development and Climate is clearly an example of an innovative approach to fostering RDD&D linkages between key countries, and should be included in this section. Similarly, along with the examples provided for the US, Australia has a number of bilateral partnerships (such as with China), that are targeted at technology development and transfer. (Government of Australia) | Rejected. Program has just started. Assessment is premature. |

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| 7-114 | B | 59 | 19 | 57 | 14 | "Please update the reference to 2004 data (http://www1.eere.energy.gov/industry/about/pdfs/impacts2006.pdf)." U.S. Government<br>(Government of U.S. Department of State) | Accepted. LB will update in editing. |
| 7-115 | B | 59 | 20 | 59 | | The U.S. DOE has also funded projects to advance hydrogen fueled turbines, for industrial use and power production. The Hydrogen program in 2003 to 2005 funded turbine programs. Distributed Energy Resources also funded work in 2004, 2005. Fossil Energy at the National Energy Technology Laboratory is funding work in this area as part of the Future Gen Program. U.S. Government<br>(Government of U.S. Department of State) | Rejected. Refers to Chapter 4. |
| 7-116 | B | 59 | 24 | 59 | | Or hydrogen fueled internal combustion engines. Ford has developed a hydrogen-fueled ICE gen-set to produce electricity, efficiently, with near zero emissions (including NOx) and cost effectively. U.S. Government<br>(Government of U.S. Department of State) | Rejected. Refers to Chapter. |
| 7-117 | B | 59 | 38 | 0 | | In Nanotechnology discussion, there should be additional discussion on the potential opportunities for nanotechnologies and the impact nanotechnology could have on industrial processes. The need for applied R&D in mass scale manufacturing and production technologies should be addressed. U.S. Government<br>(Government of U.S. Department of State) | Noted. LB will evaluate and add text if appropriate. |
| 7-118 | B | 69 | 44 | 69 | 46 | Citation should read "Matysek, A., M. Ford, G. Jakeman, A. Gurney and B.S. Fisher, 2006: Technology: Its role in economic development and climate change, ABARE Research Report 06.6 prepared for Australian Government Department of Industry, Tourism and Resources, Canberra, July".<br>(Government of Australia) | Accepted. LB will correct in editing. |