

Expert and Government Review Comments on the IPCC WGIII AR5 Second Order Draft – Chapter 3

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23570	3					This chapter is unwieldy and highly uneven. First, its structure is confusing. I wish that a better sense of the large parts of the survey would be marked out. We have ethics, economics and then a set of issues toward the end that hang on and concern implementation. There is a lot of discontinuity between hard core quantitative passages and qualitative considerations. It's an odd chapter. I also find that its overriding utilitarian or calculative approach is objectionable. You could keep many of the calculative things if you focused on objective things. But focusing on well-being and reducing a life's quality to well-being is objectionable and ineliminably subjective in part. The chapter works best when it identifies concepts without entering into academic debate about them and instead mentions in a sentence where such debate can be followed out, or when it lists the problems with a view, again in single lines with references for those interested in reading more. The chapter does not work when it tries to advance a novel or contested argument in some conceptual area. Finally, the chapter should be cut in half, and anything that is not immediately practical in giving people a sense of the concepts involved should be cut.	Noted. This comment nicely balances 35926.
26068	3					I think this figure should be removed. It is stated in the text that the figure is reproduced without an assessment of the reliability. However, by including it, it will signal that it is useful information.	Taken into account. Will be considered in revision.
19437	3					This FAQ seems unnecessary and is redundant with material elsewhere in the chapter--suggest deleting.	Noted--redundancy will be removed, but this is the intro
19465	3					Is this an exhaustive list of all studies in the climate literature that use Ramsey discounting? If not, please specify the criteria for choosing studies to highlight in the table.	Taken into account. The selection rule was the prominence of the paper in the literature. Added: "Different prominent authors and committees have taken different positions on the values of δ , ρ and g , making different recommendations for the social discount rate δ . We summarize them in Table 3.6.2" to clarify
19484	3					I don't find this table to be that helpful. First, it makes more sense to me to think of one instrument per market failure rather than one instrument per policy goal. Also it is not clear how the different policy types listed map to the evaluation criteria. For instance, none of the policy types seems particularly geared towards distributional equity. However you could improve equity by distributing the revenues from an economic instrument to low-income households--but this would still be a single policy instrument.	Accepted. Earlier comments suggested removing this table anyway. Also, the commenter is correct in the sense that the RHS of this table has nothing to do with the LHS. The policy types do not correspond in any way to the evaluation criteria. At least say so, if not remove the table.
19440	3					Should there be an arrow pointing from "Cultural and Social Value" to "Aggregate Well-being"?	Rejected. So many links could be added. We concentrate on the most important ones.
19442	3					The figure on aggregation of wellbeing is confusing and doesn't add much to the discussion. I suggest deleting.	Accepted
19491	3					Please note the model (DICE, FUND, PAGE) used in each citation included in the figure.	Accepted

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24332	3					The answer to FAQ 1 could be made more concise: Part of the IPCC's task is to summarize existing economic analyses of climate change impacts and potential policy responses. Different ways of analyzing and evaluating those impacts rely on different ethical assumptions, many of which are controversial. One goal of this chapter is to make those assumptions explicit. (At the risk of making the answer longer, you might cite Gardiner's work on moral corruption here: We must guard against economic analyses that enable us to shirk our moral responsibilities.)	Taken into account. FAQ made more concise.
19578	3					I miss a logical flow in this chapter. By streamlining the presentation, text can be shortened. Further, parts of the chapter are echoing discussions undertaken elsewhere. By relaxing the treatment of overlapping issues, constraints on the amount of pages will be less pressing. Also, there is a lot of repetition of content in other chapters, especially to the one on uncertainty.	Noted
19579	3					Given the advances made on discounting since AR4, I am surprised that it is not allocated more space.	Noted
19580	3					In a Resources for the Future discussion paper by Arrow et al. (2012), interesting statements are done with respect to discounting by a panel of 12 economics experts. The paper summarizes the view of the panel on the use of the Ramsey formula as an organizing principle for determining discount rates over long horizons, whether the discount rate should decline over time, and how intra- and intergenerational discounting practices can be made compatible. I am not sure, however, if the working paper will be published in a peer-reviewed journal before this chapter is completed. Reference: Arrow K.J., M.L. Cropper, C. Gollier, B. Groom, G.M. Heal, R. Newell, W.D. Nordhaus, R.S. Pindyck, W.A. Pizer, P.R. Portney, T. Sterner, R.S.J. Tol, and M. Weitzman (2012). How Should Benefits and Costs Be Discounted in an Intergenerational Context?, Resources for the Future Discussion Paper 53.	Taken into account
32158	3					make more concise	Taken into account. We will work on making the chapter more concise in the final draft.
34434	3					A box highlighting key issues for LDCs as included in almost all other chapters should be added to the chapter.	Accepted. Box 3.8.2 "Different conditions in developed and developing countries and implications for suitability of policy instruments" was added.
19439	3					Section 2 has a lot of repetition and highly technical content that seems of marginal usefulness for policymakers. In particular, I recommend shortening or eliminating the sections 3.2.2.1 (non-human values), 3.2.2.4 (aggregation of well-being), and 3.2.2.5 (lifetime wellbeing functions).	Noted. We will work on shortening these sections but all of the subsections are necessary: 3.2.2.1 was expanded in response to previous comments. 3.2.2.4 contains core theory, on which the rest depends. 3.2.2.5 is directly relevant for policy, since it provides the theoretical basis for value of life.
20574	3					Cut by 33%.	Noted. It will be condensed.
29344	3					A reference to the controversial Lomborg may be added here. He also argues that investments in technological developments are highly important.	Taken into account - Reference considered
19503	3					Offsets are a potential mechanism for technology transfer.	Taken into account

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19504	3					I suggest reframing #1 to emphasize the need for more research on the appropriate distributional weights and intergenerational discount rate to use in policy analysis (both positive and normative approaches) instead of focusing on the value of changes in population. It's not clear to me that the population issue will have as big of an impact on conclusions as equity weights and the discount rate, and there is still little consensus about these latter two issues.	Noted. We are not suggesting that population is the only issue.
22456	3					Can be shortened, especially however 3.2.1 and even more 3.2.2 (by about 50% each)	Noted. It will be condensed.
20566	3					Cut by 33%.	Noted. It will be condensed.
23076	3					The limiting of ethical criteria to only "justice" and "value," both of which start from a individualist point of view, omits the important criterion of a positive responsibility for care based on interdependence. Relevant citations include: Jonas, Hans., 1984. The Imperative of Responsibility: In Search of Ethics for the Technological Age. University of Chicago Press, Chicago; Plumwood, Val, 1993. Feminism and the Mastery of Nature. Routledge, London; Nelson, Julie A. "Ethics and the Economist: What Climate Change Demands of Us." Ecological Economics 85, January 2013, pp. 145–154; Warren, Karen J., 2000. Ecofeminist Philosophy: A Western Perspective on What It Is and Why It Matters. Rowman & Littlefield Lanham, Maryland.	Taken into account: Text will be revised to include alternatives to individualist perspectives in the literature. References examined for inclusion.
23555	3					The absence of mentioning the Capabilities Approach here is puzzling (yes, it's addressed later, but you might include it here). The IPCC interacts with the UN strongly and the UN produces the World Human Development Reports. In addition, the most sophisticated metric around the area commonly address through "well-being" today is the WHDR notwithstanding the distinction between capabilities and functionings.	Rejected. We start with value in general, and then go on to specific values and specific claims about values. There's no reason to mention the capabilities approach until we get to specific values.
19441	3					If the section on non-human values is kept in the final draft, I think it's important to note that it is not only economic techniques that pose difficulties for measuring value. Any kind of quantification of damage to natural systems (e.g., physical damage) as a result of climate change is extremely difficult.	Noted.
19443	3					This section could probably be deleted and any essential points incorporated into section 3.2.2.6 on aggregation of wellbeing.	Noted. Will be taken into account in redrafting.
23077	3					The approach to well-being used in this section is radically individualistic and assumes numeric measurability, extreme commensurability of all aspects of well-being, and the need for a mechanistic aggregate method. Cutting out these discussions and staying with more qualitative descriptions and discussions of particular aspects of well-being would be more intellectually honest.	Noted
19444	3					I recommend deteling this section, and if needed, making a brief point about lifetime wellbeing functions in a footnote to section 3.2.2.6. The info seems tangential to the thrust of the chapter and not useful for policymakers.	Noted. It is vital for policymakers, who regularly make assumptions about the value of life. Perhaps the right thing is to add material making that clear.
23560	3					I believe this section could be cut. It raises more confusions than it clear up and it is very one-sided. I find the very idea of a life-time wellbeing function to be incoherent. This has to do with conceptual problems lodged inside the notion of wellbeing itself (an ineliminable subjective dimension) and also with the idea of quantifying a life, which not only is impossible in my view but may be immoral (a form of banal evil). One advantage of the capability approach is that it does not take on the subjective dimension but looks at objective potentials for action. Similarly, it does not reduce a life to a function but understands that a pluralistic map is about the best we can do. something that still does give us a picture to read when considering the opportunities for flourishing in a given society or over a given stretch of time.	Rejected. Discussion of capability approach in the text seems sufficient

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23078	3					The approach to well-being used in this section is radically individualistic and assumes numeric measurability, extreme commensurability of all aspects of well-being, and the need for a mechanistic aggregate method. Cutting out these discussions and staying with more qualitative descriptions and discussions of particular aspects of well-being would be more intellectually honest.	Noted
23561	3					This section can also be cut, for much the same reason as I gave in comment 25 for the previous section.	Taken into account - see comment 23560
19445	3					The section on valuing population seems tangential and not useful for policymakers. Predicting the effect of climate change on populations seems so speculative as to not have much policy relevance. I suggest deleting the section and making any essential points in the text or a footnote in section 3.2.2.6.	Rejected. The chapter is a framing chapter and is not meant to be directly action-guiding., The issue is central and deserves to be pointed out as central.
23079	3					The issue of "valuing population" is a necessary conundrum only if one begins with a radically individualist perspective of what well-being is about. Since the latter is unnecessary, this section is unnecessary. The health and well-being of a society, a species, or a planet, while profoundly interconnected with the health of individuals, need not be narrowly viewed as simply the health of isolated individuals, aggregated up. Genocide, for example, is not just the sum of a bunch of individual homicides.	Rejected - far too strong to say that since the individualist perspective is unnecessary, this is unnecessary. It is an important candidate in the literature. And the view expressed in the comment is by no means a consensus view, so it can't be used as the basis for rejecting the relevance of the issue of "valuing population." Furthermore, many of the same issues recur even when you move to bigger and bigger collective levels - for e.g., take the planet - is 'more' or 'less' planet a good thing in itself? What is more or less planet? If you manage to define what ought to exist in terms of 'planet,' you still have the problem of figuring out how many humans, for e.g., is necessary. And so on and so forth. I do think, though, that it would be useful to state somewhere that the discussion presupposes something - not individualism, but person-affecting-ism.
23562	3					And this section should be cut too, although a section on population is important for the ethics of climate change. The problem again is the utilitarian perspective of this section, which covers over the insurmountable conceptual and moral problems of quantifying people's wellbeing. See comments 25 and 26, too. I personally will find it a failing of the WGIII AR 5 if it continues to maintain an outmoded utilitarian perspective which is inconsistent with the deepest moral commitments of the United Nations.	Taken into account - Will try to include additional perspectives and tone down any emphasis on utilitarian perspectives.
19446	3					Section 3.3 could be shortened substantially without losing any information useful to policymakers.	Noted. All sections will be shortened.

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22457	3					Ch 3.3 still puts far too much emphasis on historic responsibility and compensation. It is even the first topic there. This is still a clear bias towards topics which the authors regard as most pressing. The sections on historical responsibility (e.g. 3.3.5 and 3.3.6) could be shortened by about 75%.	Rejected: the sections 3.3.5 and 3.3.6 comprise 4pgs; they address what very many states consider a major issue and what has proved to be a stumbling block for making progress in the negotiations. And: 3.3.5 stresses the limits of compensatory justice in the context of climate change, and by doing so stresses the importance of distributive issues.
24334	3					I'm not quite sure how to work this in, but I feel like the idea of rights as side-constraints gets short shrift in this section. The idea that "luxury emissions" amount to a violation of others' rights might not be a non-starter in international negotiations, but it is a prominent idea in discussions of climate justice.	Taken into account: sec. 3.4.1; the idea of luxury emissions is implicit.
20567	3					Cut by 33%.	Rejected as stated: too unspecific
22455	3					You could possibly take into account: Knopf, B./Kowarsch, M./Lüken, M./Edenhofer, O./Luderer, G.: Chapter 26: A Global Carbon Market and the Allocation of Emission Rights, in Edenhofer, O./Wallacher, J./Lotze-Campen, H./Reder, M./Knopf, B./Müller, J. (eds.): Climate Change, Justice and Sustainability: Linking Climate and Development Policy, Dordrecht: Springer 2012, pp. 269-286. There you can find both a systematic overview of ethical proposals for allocation of emission permits.	Taken into account: Covered in Ch. 4
23565	3					The title here is good. Adopt its format for the previous section on rights, 3.3.2. The section itself is too academic. I don't find it helpful. This chapter has the problem of neither being a scholarly work on the ethics of climate change nor being an action guiding policy document. But since it is meant to be the latter, all of these academic discussions should be condensed much more. Set out the concepts and indicate with one line the objections. And that's it.	Rejected: the text is meant to review and assess the relevant literature; the chapter is meant to be a framing chapter
23566	3					This section and the previous could be combined.	Accepted
24335	3					The ethics of geoengineering is one of my main research areas. This section is well done. It communicates the important ideas clearly, accurately, and concisely.	Noted. Thank you for your comment.
24337	3					In a forthcoming paper (D. R. Morrow, "Starting a Flood To Stop a Fire: Some Moral Constraints on Solar Radiation Management," Ethics, Policy & Environment [forthcoming]), I present a type of argument against geoengineering that is not covered by the categories given in this section, but is highly relevant to this chapter's concern about the ethical assumptions behind economic analyses. Briefly, the point of the paper is that certain widely held moral principles entail that damages caused by geoengineering are morally worse than equivalent damages caused by climate change. I will submit the final draft of that paper via email for your consideration.	Accepted and addressed in another comment: #29629
29335	3					The section on geoengineering may be cut down - other concrete policies are not examined in this way.	Rejected--all sections will be edited.
23567	3					This section is excellent, because practical. It gives a survey briefly so that policy makers are aware of the range of problems with geo-engineering. It does not enter into academic details. I would use this section as a model for others.	Noted. Thank you for your comment.
19481	3					The beginning of the economics section of the report is missing an overview of market failures relevant to climate change (most notably, public goods/externalities, but others like asymmetric information and knowledge spillovers also come into play). These are mentioned throughout the text, but a concise overview summary upfront would be a good addition.	Take into account: will check that overview of market failures is provided in a suitable place in the chapter.
20568	3					Cut by 33%.	Take into account: consider cuts where possible.

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23083	3					The statements about how economics can be used to come to conclusions about value, even at the large scale of "the world's economy," rests on very dubious grounds, as is immediately explained in Sec. 3.4.2. Standard economic methods do NOT deal well with true uncertainty (as contrasted to measureable risk), nor with non-marginal changes. Assuming the intent of this report is to summarize scientific findings, the references to integrated assessment models should be eliminated.	Accepted (see also accepted comment 19448)
22458	3					Ch. 3.5.1 and 3.5.2 can be massively shortened	Noted.
23087	3					This entire section should be cut. The unexamined assumptions of equating human well-being with individual consumption (as if issues of relations among people and relations with the natural world, to name a couple issues, are irrelevant), of continued economic growth (requiring strong assumptions about the substitutability of manufactured and natural capital), and that CBA can be rigorously applied to non-marginal changes are all highly challengeable. Analysis based on such shaky assumptions has no place in a summary of scientific findings. Currently, only a brief passage on p. 43 (lines 21-22) about how individuals might have "different preferences when...in the voting booth" hints at the problems with the market- and self-interest based assumptions of standard CBA.	Noted.
20569	3					Cut by 33%.	Noted.
23568	3					Again, the notion of aggregating well-being makes no sense to me. See comments above.	Noted
19461	3					The discussion of the Pareto criterion seems overly technical and of limited relevance to policymakers. Also, the final full paragraph on p. 42 is really reductive. The whole point of the potential Pareto criterion is that it assesses a policy only on the grounds of economic efficiency, which is an important input--but shouldn't be the only input--into policymaking. I suggest instead rephrasing to say that because the potential Pareto criterion does not assess equity considerations, it is important that it not be the only criterion used in policymaking and must be considered alongside information about equity or other non-economic considerations instead of calling it "not credible."	Taken into account - Section removed.
19463	3					It is not clear why the discussion of discounting should be limited to the literature on normative discounting and ignore the extensive work on positive approaches to determining the discount rate. Both may be relevant for climate policy. I do not see a discussion of positive discounting in section 3.8.4, as is stated on p. 44, line 24. There is also an internal contradiction, since the US government discount rates, which are based on positive arguments, are discussed in the text. I suggest reframing the section to cover both positive and normative arguments.	Taken into account: Will be discussed
19464	3					The discussion of Ramsey discounting should make more explicit the connection between eta (the relative inequality aversion coefficient) and distributional weights. It is important to be clear that a distributional weighting scheme that puts more weight on those with low income/consumption also implies a higher discount rate under the Ramsey and other similar discounting frameworks.	Taken into account - will be addressed in revision of section
19467	3					The section on discounting assumes a constant discount rate over time and is missing a discussion of the effect of uncertainty allowing for the discount rate to change over time. Key references include Newell, R.G. and W.A. Pizer, Uncertain Discount Rates in Climate Policy Analysis, Energy Policy, vol. 32 no. 4 (2004), pp. 519-529, and R.G. Newell and W.A. Pizer, Discounting the Distant Future: How Much Do Uncertain Rates Increase Valuations?, Journal of Environmental Economics and Management, vol. 46 no. 1 (2003), pp. 52-71.	Taken into account.
23091	3					The attention paid to "discounting" based on assumptions that market interest rates reflect anything about human concern for the future and that economic growth will continue are inappropriate for a scientific report. This section and the economic IAM analysis that is based on it, should be eliminated from this report.	Taken into account. We will say even more explicitly that the Ramsey formula here is not using anything related to the market interest rate. It uses two different ethical concepts (rho and eta) plus a growth rate.

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32614	3					<p>This section on co-benefits could be of considerable practical importance, but as it stands, it misses this opportunity. First, the reliance on the mathematical formulation may well deter readers. Second, it offers a theoretical construct that seems to bear little relationship to reality because it assumes that decisions on mitigation and co-benefits are separable at the margin, independent, and appropriate to value on a common metric. None of these assumptions would seem to hold. Consider a highly pertinent example, where China is grappling with huge levels of local and regional air pollution from coal combustion. It could choose to invest in pollution control (eg FGD), or to close stations. It cannot do a bit of one, and a bit of another. FGD is a big sunk investment which would then be rendered irrelevant if the station were closed later to cut CO2. There is no such thing as a low carbon plant which maintains sulphur emissions. They are quite properly decisions which are unavoidably intertwined, and should reflect conjoined judgements. Similarly, moving away from local biomass involves a discrete and quite possibly enduring decision as to the alternative - kerosene, grid electricity, or local PV, for example, each of which has radically different but enduring GHG benefits. Third, there is an implicit assumption that the levels of pollution control can (and should) independently be targeted to optimal levels. This again fundamentally seems to misunderstand the nature of the decision making processes and their dynamics. As explained in my comment on co-benefits to Technical Summary Box TS-4, the process of development is in part a process of slowly getting to grips with externalities, which rarely reaches the optimum - US control of coal-based pollutants, one of the most advanced, being a clear example. Brief discussion, data and references on these points may be found in our book Planetary Economics (Grubb et al, 2013); Chapter 1 for fundamental points about the evolutionary character of internalisation and Chapter 6 with some data. It would help enormously if this box could be more clearly cross-linked to the empirical data in the SOD including Chapter 5, section 5.7, and Chapter 6, section 6.6.1.</p>	Rejected: while the argument that corner solutions may arise in policy-making is correct, it does not controvert the key conclusion of this section, given on page 52, lines 16-17.
19470	3					<p>Ancillary or indirect effects of climate policy can be both positive (co-benefits) and negative (co-costs). For instance, many forms of renewable energy have adverse effects on wildlife. Why are only co-benefits emphasized? I suggest renaming this section something more neutral like "Ancillary Effects."</p>	Taken into account. Will add 'adverse side-effects' to the section title and making sure that the negative effects of mitigation measures and policies are also covered semantically throughout the section.
19471	3					<p>Valuation of benefits and costs more generally should be discussed before getting into valuation of co-benefits.</p>	Noted.
19474	3					<p>Consider deleting, condensing, and/or reframing this example. First it seems out of place in a section on aggregation. Should it be moved to section 3.6 on policy instruments? Second, equation 3.5.6 doesn't actually illustrate anything about multiple taxes and externalities. It's a standard treatment of a single tax and externality. I suggest removing the equation if it's not going to be used to illustrate the key concept.</p>	Noted: Typo in SOD, rest of comment will be considered. Co-benefits/Double dividend they are aggregate concepts which is why they are in this section
19475	3					<p>Should the double dividend hypothesis be discussed in section 3.6 on policy instruments?</p>	Taken into account - Section 3.6.3.3
23569	3					<p>I would cut this section.</p>	Taken into account, section will be carefully revised.
20570	3					<p>Cut by 33%.</p>	Noted.

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19476	3					I suggest adding a brief paragraph (stand-alone or part of 3.6.1.2 on tradable allowances) on offsets. They are an important policy mechanism for achieving mitigation in traditionally "non-covered" sectors (agriculture, avoided deforestation or REDD- Reduced Emissions from Deforestation and Forest Degradation) or countries, especially low-income countries. The Clean Development Mechanism of the Kyoto Protocol is a key example, though many have proposed reforms and alternate offsets mechanisms.	Accepted
19479	3					It is worth noting that there are many hybrid policy approaches that combine some elements of standards with market mechanisms (e.g., tradable fuel economy performance standards, tradable renewable portfolio standards). "Prescriptive" technology-based regulatory approaches are becoming less and less common. Also, I'd categorize labelling as an information program, not a prescriptive regulatory approach.	Taken into account - examples will be refined and more details about "labelling" will be given to be more consistent with the taxonomy
19477	3					This section is missing a discussion of leakage--i.e., the shifting of emissions from one sector or geographic location to another due to incomplete coverage of the climate policy. Leakage can reduce the effectiveness of the climate policy.	Accepted
19480	3					A key point missing in this section is that there may be extensive opportunities for low-cost abatement in developing countries. This means that if developing countries can build the capacity to link with developed country tradable permit systems, they could gain substantial economic benefits by selling offsets. This would allow them to fund mitigation and likely gain additional profits/rents as well. In particular, Reduced Emissions from Deforestation and forest Degradation (REDD) bears mentioning in a section on developing country mitigation opportunities. Removal of fossil fuel subsidies is another key policy action in the developing country context (as well as many developed countries).	Accepted
30184	3					3.7 Assessing methods of policy choice - increasingly policymakers are looking for policies to move investment, it is now too late I imagine to include a section on this however it may be useful to indicate that you have not created a separate section on this, perhaps because you sought to deal with it through Ch 16. However, in subsequent IPCCs it may merit specific attention. The reason is that some options that are economically efficient theoretically, add risk from the perspective of financiers/investors, and therefore understanding whether metrics always work for both is very important. There is a written example for this vis a vis RE targets with trading across Europe - and the fact that, at the time (2007) financiers provided a set of reasons why this would have added to risk - even if it was theoretically the least cost option. I'm using that example as a concrete one to illustrate the point. In Hamilton, K. (2009). Unlocking Finance for Clean Energy: the need for 'Investment Grade' Policy. Chatham House Programme Paper, Chatham House, London, UK (available from URL: http://www.chathamhouse.org/research/current-projects/renewable-energy-finance-project).	Noted
22459	3					Ch. 3.7 is great (as a question!), but a little bit confusing. Should be major part of research gaps at the end: needs much more research on methodology (policy appraisal)	Accepted - identification of research needs is under continuous development
22461	3					3.7-3.11 can be massively shortened (>50%). Too technical partly.	Noted. Will be shortened.
20571	3					Cut by 33%.	Noted. Will be pared down.
22460	3					Where do these multiple objectives come from? Better rationale required (is there a survey etc.?)	Taken into account: See, e.g.. 4th IPCC assessment report

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19482	3					It seems important to note that economic efficiency supercedes cost-effectiveness as an economic objective in an ideal world, but in the case of climate policy where measures of mitigation benefits are highly uncertain and may not be the basis for setting mitigation targets, cost-effectiveness analysis may be more relevant. A limitation of cost-effectiveness analysis is that it can only compare costs relative to a single metric (e.g., \$/ton CO2), so it is difficult to incorporate non-monetized co-benefits/co-costs into the analysis.	Rejected - supersedes is not the best word in this context. And I the next point is covered already.
19483	3					I suggest rephrasing the "co-benefits" heading as "ancillary costs"--the objective may be to both promote co-benefits and also minimize environmental harms (e.g., loss of biodiversity due to biofuels expansion).	Reject. Subtitles need consolidating.
26066	3					Life Cycle Assessment could be mentioned as an example of a quantitative method for assessing environmental effectiveness.	Taken into account - see response to comment 36105.
23105	3					The presentation of standard utility-theoretical economic measures of the costs of climate change and mitigation is misleading, in ways spelled out in detailed comments on specific sections of the report. Because of the weakness of this theoretical framework for addressing issues of human well-being over vast spans of time, vast true uncertainties, and thorny ethical issues that remain unaddressed, the use of global economic IAMS and estimates of "macroeconomic costs" should be avoided in this Report. While economic analysis can play a role in evaluation of specific short-term projects, this Report would do better to avoid falling into the fallacy of misplaced concreteness by assigning unscientific macroeconomic numbers to mitigation "costs."	Rejected: This Report does make use of macroeconomic costs in chapter 6 and elsewhere. Section 3.8 provides an explanation of the assumptions embedded in those models.
20572	3					Cut by 33%.	Noted. Will work on shortening, but this section mostly contains material not addressed since the 2nd Assessment Report.
19488	3					I suggest renaming the section on "Aggregate climate damages" and cutting the first two paragraphs. The general topic of aggregation is already extensively discussed in section 3.5. Instead, I'd rename it as "Integrated Assessment Models," since that is the unique contribution of the section.	Rejected: The section is so titled because it deals with the empirical estimates of aggregate damages added across sectors of the economy, as well as across people (see response to #36115). This aggregation is different from the aggregation in 3.5. The first two paragraphs introduce the key concept of a damage function.
19494	3					This section should be renamed "Costs of Mitigation"--the section seems broader than just aggregation, and it seems strange to talk about aggregation before talking about measurement of costs more broadly.	Rejected. This section focuses on the aggregate costs of mitigation, aggregated across economic sectors as well as across people.
26069	3					There are quite a number of publications that could be cited here. For example Ackerman and Stanton (2012), http://dx.doi.org/10.5018/economics-ejournal.ja.2012-10 and 15. Botzen, W.J.W. and van der Bergh, J. (2012): How sensitive is Nordhaus to Weitzman? Climate policy in DICE with an alternative damage function. Economic Letters, 117, 372-374. I think it would good to mention their results and conclude with the range of results published in the literature. This is important to get the earlier results in perspective.	Accepted. The references will be considered.
19492	3					I suggest combining sections 3.8.2 (on IAMS) and 3.8.4 (on Social Cost of Carbon), e.g., making the section on IAMS a subsection of the Social Cost of Carbon discussion. It's confusing to have them separated by a section on mitigation costs.	Taken into account. Will be considered in revision.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19498	3					The critiques of the IAMs should be consolidated with the discussion of IAMs in section 3.8.4.	Taken into account. Will be considered in revision.
26929	3					GWP is based on integrated radiative forcing. Could you please reword from "radiative forcing" to "integrated radiative forcing?"	Accepted
19499	3					I suggest citing Marten & Newbold, 2012. "Estimating the social cost of non-CO2 GHG emissions: Methane and nitrous oxide," Energy Policy, vol. 51. They find that the GWP approach tends to underestimate the social value of methane and nitrous oxide emissions.	Taken into account. The reference will be considered.
19500	3					I do not agree that the Global Cost Potential approach is an appropriate way to aggregate across GHGs. It seems to confuse the issues of abatement costs and emissions damages, and it could lead to distortions if used in the wrong policy context (e.g., in a cap-and-trade program covering multiple GHGs). Consider deleting or moving this point to a footnote.	Rejected: the Global Cost Potential is a metric in the literature. Mentioning it here does not constitute an endorsement
34458	3					Please contact Elke Weber (chapter 2) because section 2.2 covers similar ground. Section leaders could clarify their division of labour.	Noted
20573	3					Cut by 33%.	Noted
19502	3					I'm not sure I understand the applicability of gender-specific concerns to climate policy. An example would be helpful. Maybe something about improved cookstoves in developing countries reducing emissions of CO2 and black carbon, as well as reducing labor burden for women. Consider deleting if a good example isn't apparent	Accepted - an example will be provided
34450	3					Overall, the content of this chapter is presented in a way that makes it difficult to identify policy-relevant insights. The character of the Executive Summary well reflects this tendency. For whom are you assessing the scientific literature? For governments or for fellow theorists? Complicated concepts too can be presented in an accessible and policy-relevant way. Please try harder to link your assessment to decision problems of policymakers.	Noted
34456	3					Please please please respect the page budget that governments had allocated to your issue area. You are 50% over limit.	Noted
34473	3					If one main purpose of your chapter is to "define and discuss key concepts and methods that are used in other chapters of this volume" it would be helpful to tell the reader consistently (e.g. at the beginning of each sub-section) where in later chapters these key concepts are used and how the insights you provide help the reader to better understand and contextualise ('frame') the evidence there.	Noted. Don't have the resources to do a full cross-referencing.
34475	3					At the beginning of each section (or in another prominent place), please tell the reader if, where and how the evidence you assess in this section has been treated in previous Assessment Reports, in particular in the AR4 (nice example: intro of 3.7.2). Moreover, for key findings please state how the state of knowledge evolved in comparison to the equivalent AR4 finding.	Taken into account: Will include example reference to AR4 in section 3.7. Where possible, references to ARs will be made throughout the text, but a comprehensive cross reference is not possible
34478	3					Overall, your draft improved a lot when compared to the first order draft. Thank you for your efforts. Well done!	Noted. Thank you for your comment.
34489	3					Please try to visualize key findings through the use of more tables and figures. Your draft improved in this respect but visualization remains very important and deserves continued attention.	Taken into account. More tables have been included and we have focused on the most effective figures.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34446	3					This 'Executive' Summary reads more like an Introduction. What are your key findings? Every paragraph should state one key finding in the first sentence, qualified with an uncertainty statement, and then substantiated/qualified with relevant evidence in the paragraph body and referenced to sections where more details can be found. 'Executive' readers (the targeted audience according to the section title) have very limited time. Introductory remarks (chapter purpose, outline, etc.) should be left for the Introduction.	Noted. We recognize that ES and intro overlap and will work to make them distinct in FD.
34482	3					If you feel that there is a trade-off between providing details for key findings and respecting space constraints in your Summary, please focus on a small set of key findings and their details rather than providing a paragraph on every topic that is covered in your chapter. The latter approach tends to produce assertions that are so 'comprehensive' and general that they are almost meaningless. Hence, selection seems warranted.	Noted.
19434	3					The ES jumps from topic to topic without transitions, which makes it hard to follow.	Noted.
40954	3	0				Chap 3 on social, economic and ethical concepts and methods generally is written textbook-style rather than being an assessment of the relevant academic/scientific literature on these areas. The chapter should strive to make government officials and policymakers aware that many policy assessment approaches in the current literature are based on very strong simplified assumptions that could render them useless or incoherent for policymaking purposes.	Noted. I think "textbook style" is meant to be pejorative. But textbooks do try to convey difficult material to a broad audience. Which is precisely our purpose.
32103	3	0				The aspects related to values, justice and ethics are poorly represented the report. It gives an unbalanced view of the importance of these aspects. To provide a more balanced view, it might be better to assign a whole chapter to them.	Noted. This is up to IPCC, not the chapter team.
29941	3	0				I think a discussion of alternatives to the current use of metrics and single basket approach is needed in this chapter. There are several papers in the literature discussing other approaches that could function as alternatives to the approach. (See short paragraph on this in WG1, chapter 8.) RELEVANT REFERENCES: Daniel et al., 2012: Limitations of single-basket trading: lessons from the Montreal Protocol for climate policy. Climatic Change 111(2): 241-248, Parallel Pursuit of Near-Term and Long-Term Climate Mitigation. Science, 326(5952): 526-527. Smith et al. 2012. Equivalence of greenhouse-gas emissions for peak temperature limits. Nature Clim. Change, 2(7): 535-538, Lauder et al. 2013. Offsetting methane emissions — An alternative to emission equivalence metrics. International Journal of Greenhouse Gas Control, 12(0): 419-429.	Accepted -- this will be dealt with in the new section on Emission Metrics
33513	3	0				As a general comment, I wish to emphasize that economic impacts on tourism are difficult to calculate, as demand responses of tourists are not sufficiently understood.	Noted.
24570	3	0				References to individuals are not treated consistently throughout this chapter (e.g. her or himself, he and she). The chapter would be more consistent if references are all gender neutral (e.g. they, one's, their)	Editorial -- will consult editor
33221	3	0				There is an inconsistent usage of the term 'objective' across chapters. Please liaise with the relevant chapters (such as Chapter 4) and clarify what the term 'objective' is intended to describe in the AR5 context (policy objectives, societal objectives etc.). A box in Chapter 4 could possibly explain this in a prominent manner.	Noted. Will refer comment to chapter 4
19438	3	0				Ch. 3 could be significantly shortened by reducing repetition.	Noted. Thank you for your comment. We will work on making the chapter more concise in the final draft.
19455	3	0				Overarching comment -- I suggest reorganizing the chapter to bring up section 3.8 (Metrics of costs and benefits) to come before section 3.5 (Aggregation of costs and benefits). It seems strange to talk about aggregating costs and benefits before defining and discussing them more broadly.	Noted.
19489	3	0				General comment -- consider putting all monetary values mentioned throughout the text in constant-year dollars (e.g., \$300 per household value mentioned on p. 72 line 12).	Noted--don't have the resources for this.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20297	3	0				I appreciate the chapter on "Social, Economic and Ethical Methods" very much. It is very valuable to reflect on the different concepts and methods. However with respect to economic modelling and evaluation (CBA, IAM, GEM) I am missing a more extensive discussion on the limitations and uncertainty. As the model results rely heavily on the theoretical framework and assumptions taken, highlighting the implications of the neoclassical assumptions would be valuable - e.g. the role of prices in GEM. How reliable are in the long term assumptions on growth, and especially prices, etc. There is a lack of pointing at these uncertainties in economic modelling as well as how the neoclassical assumptions determine the outcomes. The chapter would profit if these aspects would be addressed.	Accepted
22687	3	0				Space can be saved by joining paragraphs. Some are quite short.	Noted
24331	3	0				I will restrict my comments to the sections on ethics and justice. Overall, I think those sections are very good: With some exceptions, they accurately describe most of the major issues relevant to the chapter's objectives and the balance of coverage is reasonable. One general comment on balance in these sections is that the Non-Identify Problem gets more coverage than I think it deserves, relative to other issues. One major topic that that should be mentioned, in my opinion, is the distinction between ideal and non-ideal theory in discussions of justice. (See, e.g., Amartya Sen, The Idea of Justice, Cambridge, MA: Belknap, 2009.) Important moves in the climate justice literature, such as Posner & Weisbach's push for International Paretianism, only make sense in the context of non-ideal theory.	Taken into account - see Ch. 4 and response to comment 23565

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20868	3	0				<p>While this chapter covers a large field, so that it is hardly possible to mention everything, I believe an important strand of the literature in welfare economics pertaining to optimal public good provision in the presence of relative consumption effects has been neglected. This is highly relevant to measures of the cost of climate mitigation and its omission leads to biased conclusions. If private good consumption has negative externalities due to relative consumption being a component of utility, then private goods are over-valued relative to public goods, so that the cost of climate mitigation is overstated in welfare terms. The most thoughtful and comprehensive discussion of this issue in the climate context is the book by Brekke and Howarth (I provide a partial list of references below). More generally, the idea that well-being is affected by one's consumption relative to others is an old idea in economics, going back to Smith's Theory of Moral Sentiments (cited in Luttmer), through Veblen, Galbraith, and Scitovsky to the modern literature. Of these, Galbraith, after describing the endogeneity of preferences for private goods in his chapter "The Dependence Effect" explicitly draws the implication that public goods will be under-valued and under-provided in the chapter entitled "The theory of social balance". Scitovsky suggests that tax policy may have long-run effects by affecting tastes, and if properly applied these could reduce environmental externalities beyond their conventional effects. The modern literature on subjective well-being provides strong evidence of large relative consumption effects on self-reported life satisfaction. See for example, the survey paper by Clarke et al (Journal of Economic Literature, 2008) and Luttmer (Quarterly Journal of Economics, 2005). The modern literature on the implications for public good provision in general and environmental quality in particular is also quite extensive. The implication is clear: conventional measures of the cost of climate mitigation are overstated if they ignore these effects. This is the case even if one thinks that subjective well-being is only one component of well-being. The report goes on in Chapter 6 to provide costs of mitigation calculated under "market prices" under various scenarios. It is nowhere noted that these costs may overstate welfare costs substantially, although it is acknowledged that understatement of costs due to assumed optimal mitigation policy is likely. References: ---Brekke, K. and R. Howarth (2002). Status, growth and the environment: goods as symbols in applied welfare economics, Edward Elgar Publishing. ----- Clark, A.E., Frijters, P. and Michael A. Shields (2008). "Relative income, happiness, and utility: An explanation for the Easterlin Paradox and other puzzles" Journal of Economic Literature 46 (1): 95-144. -----Galbraith, J. K. (1958) The affluent society, Houghton Mifflin. -----Howarth, R. (1996). "Status effects and environmental externalities." Ecological Economics 16(1): 25--34. -----Howarth, R. (2006). "Optimal environmental taxes under relative consumption effects." Ecological Economics 58: 209--219. -----Luttmer, E. F. P. (2005) "Neighbors as negatives: Relative earnings and well-being." Quarterly Journal of Economics, 120: 963-1002. -----Ng, Yew-Kwang (1987). "Relative-Income effects and the appropriate level of public expenditure." Oxford Economic Papers, 39(2):293-300.----- Scitovsky, T. (1986). "Can changing consumer tastes save resources?" Chapter 9 in Human desire and economic satisfaction: essays on the frontiers of economics, Wheatsheaf Books.-----Wendner, R., and L. Goulder (2008). "Status effects, public goods provision, and excess burden." Journal of Public Economics, 92:1968-1985.</p>	<p>Taken into account, will be discussed in the context of behavioural economics by CA, implications for CBA will be discussed, and references will be considered.</p>
35914	3	0				<p>General comment: The word "value" is used in multiple ways (e.g., cultural values vs. monetary value) and as a noun and a verb, which creates confusion. We suggest providing a concise definition of the term value and using it consistently throughout the text; find alternate terms to represent other concepts when possible.</p>	<p>Taken into account. May add clarifying language in his initial "Synonyms for 'value'..." statement in 3.2.1</p>
35915	3	0				<p>Distributional weights and aggregation are discussed in several sections - this discussion should be consolidated</p>	<p>Noted.</p>
35916	3	0				<p>Chapter should follow gender neutral protocols that most academic journals require. This applies in many places, so must correct this throughout the chapter.</p>	<p>Editorial -- will consult editor</p>
35917	3	0				<p>Choose one way to spell judgment --- judgment or judgement --- and stick with it throughout the msc. Likewise program or programme, behavioral or behavioural, favor or favour.</p>	<p>Editorial -- will consult editor</p>

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35918	3	0				Current organization of the chapter leads to lots of repetition. Specifically, internal references to different parts of the chapter take up too much space and interrupt the flow of the narrative.	Noted
35919	3	0				All figures should include a citation (to original paper) below the figure. Consistency across figures would be helpful, to the extent possible.	Noted
35920	3	0				In addition to economics and ethics, anthropology and sociology (as well as other social sciences) have much to say about these issues. Experts should be found, familiar with this literature, to provide input on this chapter.	Noted. Outside the scope of the chapter.
35921	3	0				In general, the chapter does not provide enough empirical evidence regarding the efficacy of particular policy types. In many cases these findings do exist, even if they are in other domains than climate change.	Rejected. This is because Ch3 is about conceptual and methodological aspects. For empirical issues, see sectoral chapters, and Ch. 15: National and Sub-national policies.
35922	3	0				The connection between this chapter and the sandwiching chapters on Risk & Sustainability has not been provided. A brief synopsis at the close of the chapter would be appreciated.	Taken into account. Context about relationship with 2 and 4 will be added to Executive Summary. Additional cross references to Ch. 2 and Ch. 4 will be added throughout chapter.
35923	3	0				The discussions of economics and costs and benefits (Section 3.5) has a lot of jargon and are highly theoretical, with a number of equations. They can be difficult for non-economists to follow. The authors should evaluate the usefulness and relevance of theoretical discussions and mathematical expressions, and whether a simpler narrative approach can achieve the same goal.	I think we have to present the theory accurately, and it's a mathematical theory. I suggest rejecting this comment.
35924	3	0				The discussion of ethics should be revised to reflect the fact that all considerations and decisions are socially and culturally embedded.	Taken into account - covered in Section 3.4.1-2.
35925	3	0				The structure of this chapter is complex, and sections cover overlapping material. Authors should review the chapter for repetition, which will help reduce the length.	Noted
35926	3	0				The tension between economics and ethics is overstated. It is clear that ethicists and economists have different perspectives and use different tools to analyze a single problem. But the notion that ethicists reject economic thinking, or that economic analysis somehow precludes ethical considerations is inaccurate, but the current draft leaves this impression.	Noted. It's nice to see this comment, in view of the others that say the ethics is too much geared towards supporting the economics. Perhaps we have got the message right.
35927	3	0				There are a number of concepts that are in both this chapter and in chapter 4, perhaps some coordination would be beneficial to shorten both chapters.	Noted
35928	3	0				Too many words are wasted in the chapter on "previewing." For example: "In making these interventions, governments will need to measure values, and make decisions that have wide-ranging ethical dimensions." (p. 35, line 24) If this is not an appropriate place to say what the ethical dimensions of those interventions are, we don't need this line. This is only an example--this type of previewing appears throughout the text, frequently takes up whole paragraphs, and adds very little value. Instead of focusing on what economics or ethics can do, focus on what economics or ethics has done.	Noted

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27452	3	0				<p>Overall, the content of this chapter is presented in a way that is too theoretic and inconclusive to offer policy-relevant insights. Keep your intended reader in mind when writing your texts. If one main purpose of your chapter is to "define and discuss key concepts and methods that are used in other chapters of this volume" it would be helpful to tell the reader where exactly this or that key concept is actually used in later chapters and how the insights you provide help the reader to better understand subsequent material.</p> <p>Moreover, please respect the page budget that governments had allocated to your issue area. You are 50% over limit. Cutting back the deficit might hopefully help you to get more focused on policy-relevant insights.</p>	Noted. We will meet the page limit.
27453	3	0				<p>The ethical considerations in this chapter are quite one-sided as they are focused mainly on a fair burden sharing between generations and within the present generation. Due to the prisoner's dilemma an ethical debate which merely focuses on burden sharing will only lead to a positive outcome if all relevant actors support it. There are other moral aspects of equal importance. Their inclusion is likely to bring more constructive moral debates.</p> <ul style="list-style-type: none"> - What is a fair benefit sharing within the context of the necessary transformation? Who should benefit from technology development, value creation, jobs and economic dynamics created by this transformation? And who should receive the money? - Due to Rawl's second basic principle, an outcome should be fair in a sense that goods are to be equally distributed or, if unequally distributed, this unequal distribution must be agreed to be to the advantage of all as measured primarily by the desires of the least advantaged member of society. This would mean that a solution could only be considered as fair if all states see it as fair, in particular vulnerable states. "Do considerations of justice provide guidance in determining the appropriate (1) level of present emissions on a global scale" (Chapter 3.3.1.(1)). - Potential tipping points of the climate system with catastrophic relevance for large regions should be considered as a threshold, where acceptance of the affected states and people is very unlikely. - It should also be taken notice of the need that framework setting does not only have to be fair at the moment, but should also create an incentive framework (for risk reduction by mitigation and adaption) to prevent additional inequities in the future. 	Rejected. The possibility of a Pareto improvement is mentioned in box 3.5.2, and we do give attention to Rawls. Also see Ch. 4. Commentator seems to ask for a prescriptive treatise which the assessment report is not meant to be.
26678	3	0	0	0	0	No discussion on GDP, employment effects, No justification for the discount rate of 5% used in chapter 6 - page 45 lines 6-9 seem to suggest a lower discount rate than 5%. No discussion on impossibility of finding social cost of carbon due to high uncertainties in damage costs (see also Weitzman, M. L., 2010. Climate change: Insurance for a warming planet, Nature, 467, 784–785. doi:10.1038/467784a). There is discussion of shortcomings of different model types but not of their strenghts.	Rejected: Weitzman's analysis of uncertainty is already noted in section 3.8
26692	3	0	0	0	0	This chapter could be condensed throughout by shortening the extensive text-book type discussions on various concepts that are not really relevant to policymaker and do not reflect the advances in literature since the 4AR. If needed references to text-books and theoretical papers could be made.	Noted.
19177	3	1				There is no evidence that greenhouse gases harm the climate so economics should ignire the subject. Not todo so is unethical	Noted.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22453	3	1				In general, ch. 03 has improved compared to FOD. Particularly valuable is the framing at the beginning of chapter 03 (introduction and executive summary). Unfortunately, ch 3 is still not well integrated in other chapters. And ch 3 does not often refer to other chapters. Could be improved. Less than before, but still: many passages read like textbooks. - Even though the framing of ch 03 is great, and the idea to refrain from pointing out the "right" ethic as well, it would nonetheless be interesting to be much more informed about the consensus/ majority in the ethics literature. Of course this does not tell us what is true. But it could make AR5 more trustworthy because it is also unclear whether the ch 3 authors "objectively" assess the validity and quality of the arguments discussed in the literature	Noted.
23535	3	1		149		I have no substantive comments to add, further to my responses to the first draft. I was pleased that John Broome took the initiative to contact me for clarification on some of my earlier suggestions. I hope that the exchange was useful. Congratulations on a wonderful document.	Noted. Thank you for your comment.
19150	3	1	1	53	20	I found this whole chapter, especially up to page 53 very theoretical. It should be considerably condensed.	Noted. The chapter has been condensed.
25058	3	1	2	1	4	TSU asked reviewers to indicate where the chapter could be shortened. My suggestion is to shorten 3.3 "Justice, equity and responsibility" substantially, as equity is discussed in Chapter 4 as well.	Taken into account: Chapter is shortened in revision.
30827	3	10	13	10	13	"mitigating GHG emissions is a public good" - this is not clear. Is the act of mitigating a public good or are the GHGs themselves the public good?	Noted. Could adjust language.
24442	3	10	20			This paragraph makes it seem as though there is no need for global coordination for adaptation which fails to acknowledge a crucial aspect of the global debate. At the crux of the climate issue for developing countries is that they cannot afford adaptation which means there is a coordination - and pure funding - problem. Economics can be helpful, if treated with extreme care, in identifying the extent of adaptation finance potentially required through assessment of impacts (for instance which some people are trying to do as in the PAGE 2002 IAM. See Hope 2002? 2003?)	Noted. Paragraph sufficiently qualified.
21262	3	10	22			Change "soot" to "sulphate particles." It is sulphate that is the technique being studied. Kravitz et al. (2012) showed that soot would be a terrible idea. Kravitz, Ben, Alan Robock, Drew T. Shindell, and Mark A. Miller, 2012: Sensitivity of stratospheric geoengineering with black carbon to aerosol size and altitude of injection. J. Geophys. Res., 117, D09203, doi:10.1029/2011JD017341.	Accept--references to soot removed.
27470	3	10	24	10	26	At this point in time, any statements on the costs of geo-engineering options are very speculative. What is "low cost" supposed to mean? Compared to which alternatives? I suggest deleting "relatively low cost".	Reject. Text is sufficiently qualified.
24094	3	10	26			The "side-effects" of geoengineering that are being discussed are not only environmental, they are also likely to be political, with issues of international security and distributive justice, as the next sentence rightly implies without saying so. cf. Bodle, Ralph, " Geoengineering and International Law: The search for common legal ground", Tulsa Law Review Geoengineering Symposium issue, 46 Tulsa L. Rev. 2 (2010) p. 305-322	taken into account - removed word "environmental"
23989	3	10	26		28	Please change as follows: It may SEEM rational for an individual country to undertake climate engineering unilaterally without taking into account the consequences for other countries, BUT THE POSSIBILITIES FOR INTERNATIONAL DISAGREEMENTS AND THE implications for global governance are significant (Von Neumann, 1955). von Neumann, John (1955). "Can We Survive Technology?" Fortune, June, 106–108.	Noted
21261	3	10	26			It is not just environmental side effects that are of concern. There could be additional side effects, including on agriculture, water resources, development of weapons, no more blue sky, degradation of remote sensing and land-based astronomy, international conflict, production of electricity with solar energy, control of the climate by multinational corporations, and enhanced skin cancer.	Same as 24094

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27471	3	10	26	10	26	A more cautious wording would be more appropriate when talking about the possibility of unilateral deployment, e.g.: "It may be e c o m e rational...".	Noted
22454	3	10	29	10	40	Here and elsewhere ch 03 does not take into account that there is a lot of literature questioning the fact/value dichotomy. This is not mentioned in ch 3 - which is therefore strongly biased in this regard. Examples for literature: Putnam, H.: The Collapse of the Fact/Value Dichotomy and Other Essays. Cambridge Mass.: Harvard University Press, 2002. Or: Douglas, H.: Science, policy, and the value-free ideal. Pittsburgh: Univ. of Pittsburgh Press, 2009. Or: Caldwell, Bruce J.: Beyond Positivism. Economic Methodology in the Twentieth Century. Revised Edition. London: Routledge, 1994.	Noted. Not clear what is being requested. The ethics part is clearly not value-free.
24443	3	10	36			Again, future funding of adaptation is a central ethical issue and has been discussed in the literature and in ongoing global negotiations (see ADP reports from UNFCCC; academic example includes Grasso, M. Global Environmental Change; Volume 20, Issue 1, February 2010, Pages 74–81	Noted
35961	3	10	41	10	45	Consider moving this material to the very beginning. This is the clearest statement of goals in the chapter.	Noted
35962	3	10	47	10	47	What section is being referred to here? Two sections are referenced in the previous sentence.	Taken into account. This paragraph removed.
19588	3	10	6	10	30	Can be shortened.	Noted
24444	3	10	general			It might be useful to link this whole chapter to chapter 13, particularly the discussion on the principles of climate policy. It is abundantly clear that the central principles being discussed are equity, CBDR, precaution, protection of least vulnerable, provision of sustainable development and cost effectiveness. See pg 12, ch 3. Highlighting this linkage would help readers see the importance of a solid discussion of and integration between ethics and economics.	Taken into account: Will try to incorporate as many cross-references as possible throughout the chapter.
24218	3	10	16	10	21	These arguments on the comparison of importance between climate change adaption and mitigation from public goods' perspective lack supporting evidence and are arbitrary and subjective. Ethical principles, such as the consequentialist and nonconsequentialist justifications, indicate necessities to design a fair international burden-sharing scheme of climate change adaptation costs (R. Dellink, et.al, 2009). In parallel with the discussion on mitigation, the adaptation financing and technology transfer issues should also be considered in global context, and it's highly recommended to delete the whole paragraph or add the following sentence: "The adaptation issues are as crucial as mitigation, but such considerations would be mostly discussed in WG II report". Reference: R. Dellink, et.al, 2009, Sharing the burden of financing adaptation to climate change, Global Environmental Change	Noted. No action will be taken since this goes beyond the scope of the chapter.
35960	3	10	16	10	16	This sentence seems like an overstatement. Adaptation measures that are taken by individuals that weigh what are largely private costs against private benefits of adapting are not subject to free-rider problems, but institutional adaptation - such as building public infrastructure to withstand higher winds - is, though as the paragraph states it is likely more local and contemporaneous.	Noted. Could adjust wording.
27326	3	10	20	10	21	It is not only a matter of importance, but also the feasibility and suitability of the scales: adaptation may require actions on very large scales (this is local), which hardly articulates with a global level of decision.	Noted
32397	3	10	22	10	24	Please refer to WGI Ch06, section 6.5, for more details on geonengineering.	Noted. Not sure what action the reviewer wishes us to take.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19670	3	10	9	10	11	The logic of real individual costs versus collective mitigation benefits does not necessarily apply at the national / country level. For example, there have been studies showing that unilateral climate change mitigation action on behalf of a nation (particularly developed country) may lead to increased competitiveness, boost exports and output (i.e. mitigation benefits) via innovation and export leader effects particularly if it involves systemic transformations. Examples of such studies are: Barker, T. and S. Scrieciu (2009) "Unilateral Climate Change Mitigation, Carbon Leakage and Competitiveness: an Application to the European Union", International Journal of Global Warming 1(4): 405-417	Disagree--not the consensus of the literature.
29699	3	10 of 14	22		24	REPLACE: "The potential for geoengineering (also known as climate engineering) for example by injecting soot into the stratosphere to reduce incoming solar radiation raises its own ethical dilemmas and issues for international cooperation." WITH: The potential for geoengineering (also known as climate engineering) for example by injecting soot into the stratosphere to reduce incoming solar radiation raises its own ethical dilemmas and equity considerations, and issues for international cooperation as well as increases the likelihood of coming into conflict with international treaties/agreements.	Noted
29700	3	10 of 14	24		28	REPLACE: "Although much remains to be learned about geoengineering..." WITH: "While geoengineering proposals are speculative currently, some have argued that it could provide a relatively low cost backstop option though the long-term costs are unknown and environmental, social and economic side effects could be severe." A citation for the "low cost backstop option" must be provided here.	Noted
35967	3	11	28	33	15	Besides being too abstract, the ethics section seems to omit thinking from after 1900 or perhaps 1950. Experimental Philosophy is a relatively recent area of study that bases morality in findings about how people actually behave, what they take into account in moral decisions, and what questions they actually consider to be open. This is the philosophical equivalent to behavioral economics, and likewise cannot reasonably be left out of this discussion of practical ethics.	Rejected - Experimental Philosophy does not as such base morality in these findings. Experimental philosophy can be used by people who want to base morality on these findings, and this is a very old tradition in philosophy. It is less than clear why experimental philosophy is so crucial that it must be mentioned.
35968	3	11	29	11	34	Elinor Ostrom, cited elsewhere in the chapter, should be cited here as her work on collective decision-making institutions is very relevant to handling "prisoner's dilemma" situations.	Noted. A suggestion worth pursuing, if she has written on climate change.
35969	3	11	29	11	34	Would be worth noting here that not only will a particular country suffer only part of the harm from its emissions, its emissions only cause part of the harm. This reinforces the prisoner's dilemma because not only does the country not suffer the full costs of its actions, changing its behavior will not necessarily reduce harm unless others act as well.	Rejected. This isn't the point.
30828	3	11	33			Suggest changing "needs to be" to "can only be". 'Needs' veers toward being policy prescriptive, while 'can only be' provides an assessment of what the evidence points to as the only possible solution.	Accepted. Text revised.
22694	3	11	footnote 1			I realize the term 'defect' is used in discussions of PD. But I'm not sure it's helpful in a very brief introduction of the problem like the one here. Why not just say that non-cooperative behavior is dominant for each (non-cooperating) individual?	Taken into account. Text revised.
21606	3	11				Although these are very well written and informative sections, it would be useful to have a conclusion that connects all the different elements together. In a sense a recap of figure 3.2.1 at the end would be useful.	Noted

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35963	3	11	22	33	15	Sections 3.2 and 3.3 should be substantially shortened and reworked to remove normative assertions about the usefulness of different concepts of value and justice for climate policy. Instead we suggest briefly defining each concept of value and justice and characterizing the applicable findings from the literature in a neutral way. This could be accomplished in a table or bulleted list. An extensive text discussion of each concept is not necessary.	Taken into account, we are always removing normative assertions during the revision process. However, in reviewing these ethical concepts we discuss the normative analysis without choosing among them.
35964	3	11	28	22	34	Section 3.2 should incorporate a discussion of non-Western philosophy and value systems and what they have to say about decisionmaking in reference to climate change. For example, much text is devoted to the question of whether collective obligations exist, yet the bulk of non-European philosophy takes such obligations for granted. That philosophy has much to say, more relevant in this context, about what such obligations consist of and how they may be fulfilled.	Taken into consideration. May add a sentence on collective obligations when discussing the community pays principle.
35965	3	11	28	33	15	Sections 3.2 and 3.3 are too abstract and technical and should be reframed to emphasize applied findings relevant to climate change (mitigation, adaptation, geoengineering). Lots of terms are defined in textbook style but do not seem germane to what comes after. These sections should be cut and revised to focus on concrete empirical findings that offer useful information for the decisions that governments, institutions, and individuals need to make with regard to climate change. A key point is that decisions about how to respond to climate change do not follow directly from a solid understanding of the source of GHGs and their impacts. There will never be one, single best decision.	Rejected: While it might be debatable whether everything in the text as we have is relevant for climate change -- see for example the discussion from 3.2.2.5 - 3.2.2.6 -- it is made absolutely clear that the judgment of which is the "best" outcome depends on judgments of value and their weight, and that this latter is highly contestable. It is clear that what you consider best depends on your value judgments, and that your value judgments may be reasonably denied.
35966	3	11	28	33	15	Sections 3.2 and 3.3 are too long and could be shortened substantially by leaving out most of the abstract theoretical discussion. It seems like these sections could more effectively make the main points and be far more accessible to a non technical audience if streamlined. Removal of about 7- 10 pages seems feasible.	Noted - addressed by comment 35965
23049	3	11	35	11	39	The paragraph seems to completely ignore the "the polluter pays principle" as provided for in the UNFCCC Convention. Hence this paragraph needs to be reworded to capture the spirit of the convention	Rejected. The PPP is covered in the text and reviewing the UNFCCC is not a goal of the chapter.
25679	3	12	2	12	4	This part should be changed from "commonly adopted" to "widely discussed" because this target is not agreed but only politically mentioned. In addition, the 2C target is extremely difficult to attain, as described in (Höhne, 2011, conclusion) and (Rogelj, 2011, abstract). These literatures are listed in the No4 line of this table.	Taken into account. See #24503
24503	3	12	3	12	4	"this target is commonly adopted in international politics", although The Cancun Agreements explicitly recognise „the need to consider strengthening the long-term global goal on the basis of the best available scientific knowledge, including in relation to a global average temperature rise of 1.5 °C" (Decision 1/CP.16). The Durban decisions also refer to an increase below the 2°C OR 1,5°C.	Accepted. Wording will be relaxed and changed to be compatible with SPM.
22696	3	12	31	12	39	Possibly a paragraph that could be sacrificed to save space.	Noted--will be reducing length of text.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35975	3	12	31	12	33	This example suggests a causal chain that is inaccurate: it is nearly impossible to ascertain a specific harm done by one country towards another as a result of GHG emissions. Consider rewording the phrase, "...a transfer of wealth made by a rich country to a poor one," to "...a transfer of wealth from one country to another."	Noted. Wording will be examined.
35976	3	12	41	12	41	Consider replacing "justice" with "rights."	Rejected. This paragraph compares justice and value, so justice has to be mentioned here.
27472	3	12	47	12	48	It is confusing that section 3.2 is dubbed as covering "value" when the headline of section 3.2 is "Ethical and socio-economic concepts and principles" and therefore a headline for much more than values. "Values" are really covered by section 3.2.2. Therefore, this should be changed accordingly.	Taken into account. (Introduce new section 3.4 on Value ("Values and Wellbeing"), move 3.2.2 into it.
22695	3	12	5	12	9	These sentences could be cut to save space, as the claim has already been made in the introduction to the chapter.	Taken into account. They should be kept here, but we may be able to shorten the overlapping material in the introduction.
35970	3	12	1	12	9	This paragraph could be restructured to make the ethical component a bit more obvious - why is how much we should mitigate a normative question? The items listed - the effects of climate change, how bad they might be, the costs - none of these seem to support the statement that its normative. The item missing from this list is how much it matters to people to avoid the damages associated with climate change, relative to other competing priorities.	Reject - this is already addressed in lines 5-8. But we will try to add something to sentence on 7-8, beginning "This balancing of values, to reflect that these are values for people and there are competing ones.
35972	3	12	16	12	17	The 2nd question is worded awkwardly.	Accept. Text revised.
35973	3	12	18	12	20	The use of the term "right" seems problematic here, as in, "even when a process of decision-making is right," and "need to judge what outcome is the right one." If these are normative judgments then using the word right in this way is problematic. Also, it introduces confusion by using the word in two somewhat different ways: The notion that access to a clean environment is a right; and the value judgement that something is right, appropriate, proper vs. wrong. Strike it in its second usage throughout.	Taken into account. It's true we use 'right' in two senses. However, in one sense it is a noun and in the other an adjective, so there is little chance of confusion. Still, we will check for specific places where confusion may occur. In general, we cannot discuss ethics without using ethical terms.
35974	3	12	28	12	30	Consider deleting the list of synonyms. How people think about making the world a better place is much broader than these terms imply. And introducing the terms cost and benefit in this value laden context also seems simplistic, confusing, and possibly incorrect.	Taken into account - suggestion seems good, criticism is not convincing.
35971	3	12	6	12	7	Replace the costs of emission reduction with something a bit broader so that readers understand that this is the broader concept of costs, inclusive of opportunity costs (trade-offs), for example. It isn't just limited to the cost of abatement, which is what the sentence makes it sound like.	Taken into account. We will try to find broader wording
23512	3	13				This figure and the discussion about justice in section 3.3.2-3.3.6 has some overlaps with the discussion about equity in chapter 4. Whilst chapter 4 discusses ability to pay in addition to historical responsibility for emissions, this does not seem to be mentioned in chapter 3 - make this coherent?	We should coordinate the justice section with chapter 4 on equity (Section 3.2 coordinate with Chapter 4 CLA)
35977	3	13	1			Delete figure 3.2.1. It adds little value to the text, and the implied chain of causality between several of the concepts is debatable.	Rejected. We think this diagram is useful. The links do not show 'causality' but conceptual relations. Indeed, they are debatable, but so is everything in ethics.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35978	3	13	5	14	3	Delete in the interest of space. This is mostly discussion of issues handled elsewhere.	Noted.
26087	3	131	30			*Correction to citation, should read: Nakashima DK, Galloway McLean K, Thulstrup, HD, Ramos Castillo, A and Rubis, JT. 2012. Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation. UNESCO/UNU-IAS, Paris/Darwin. ISBN: 9789230010683/9780980708486.. Downloadable from: http://www.ipmpcc.org/wp-content/uploads/2012/06/Weathering-Uncertainty_FINAL_12-6-2012.pdf	Noted - reference not included in final draft.
21607	3	14				Consider changing the label of scenario B	Rejected. Comment is not clear - provides no suggestion
23513	3	14	11	14	12	To equate voluntary carbon reduction with making a sacrifice is assuming from the start that emissions are related to enhanced wellbeing. Chapter 4 provides a more nuanced discussion of this by pointing out that it might be possible to decouple emissions and wellbeing - refer to this discussion here, too?	Taken into account. A reference could be useful.
24333	3	14	18	14	19	I'm not sure that this figure is very helpful, but it takes up a lot of space. I think it could be cut.	Rejected - we disagree. The figure is a response to previous comments. We expect readers to refer back to it.
35979	3	14	18			Provide additional explanation here. Which philosophers? Why? A basic Jamieson citation leaves the discussion devoid of impact in this context. This is a strong statement that would benefit from some elaboration.	Noted. Will try to add more references.
24504	3	14	21	14	23	I wonder if reference could be made to Kant's categorical imperative here? As relevant as ever...	Noted.
35980	3	14	27	14	34	The discussion of values and wellbeing, and specifically the example beginning on line 31, seems to suggest that all the benefits of a nation's GHG emissions are acquired by the nation itself and all the harm is imposed on other countries. In reality, some of both the benefits and losses of any countries GHG emissions are acquired by all countries. It is a question of proportionality, not category. This suggests a discussion of the distribution of marginal benefit and loss, however disproportionate it may be.	Taken into account - will change line 32 to say "they may harm people in other nations." This is not meant to be a statement of fact, it's only a way to illustrate a thought. And putting "may" in will help avoid the charge of suggesting something in particular.
23554	3	14	22	14	23	This is one of the few indications of the duty to act collectively -or the problem of collective action apart from international action- in the WGIII AR 5 so far. Good to see! We need more of it, or more strongly emphasized.	Noted.
26048	3	15		16		These new lines about non-human value are critical to the chapter. They should not be omitted	Noted.
19566	3	15	16	15	20	An excellent description of Indigenous memory and capacity to remember and offer new views on the value discussion, see Sheridan, J., and R. D. Longboat. The Haudenosaunee Imagination and the Ecology of the Sacred. <i>Space and Culture</i> 9 (4): 365–381, 2006 and Mustonen, Tero. Rebirth of Indigenous Arctic Nations and polar resource management: critical perspectives from Siberia and Sámi areas of Finland, <i>Biodiversity</i> , DOI:10.1080/14888386.2012.725652, 2012.	Noted. Reference considered.
35984	3	15	26	15	28	If the section on non-human values is retained, consider alternative citations than Singer. There are many comparative psychology findings on consciousness, cognition, emotion, & pain in other species. We should make a particular effort, where relevant, to cite empirical findings related to philosophical claims, rather than merely citing someone who states the claim in question.	Rejected - The relevant claim is not the psychological one. It's the normative one, that pain etc. matters.
22697	3	15	38	15	38	The word 'special' should presumably be replaced with 'species'.	Editorial
35985	3	15	38	15	38	Sentence beginning "Some have argued that a special..." is unclear. There appears to be a typo or omission.	Editorial
35981	3	15	6	15	7	This sentence is circular and not particularly meaningful. Please revise or delete it.	Accepted. Text revised

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35982	3	15	9	16	4	The non-human values section is less relevant to climate policy than other sections. This chapter could be shortened by removing this section.	Rejected. This is a statement of a point of view, the type of thing this person has previously objected to. Our expert assessment of relevance differs from his or hers.
35983	3	15	21	15	43	If this section is retained, these paragraphs could be cut, with references for the interested reader included in a brief footnote. The basic point is already made in the first 2 paragraphs of section 3.2.2.1. It doesn't need to be delineated in such detail. Instead, a brief discussion of ecosystem services that are valuable to people but difficult to quantify and monetize for inclusion in cost-benefit analysis should be included.	Noted.
29776	3	15	40	15	40	Incomplete sentence	Editorial
19567	3	16	15	16	17	Crate (2008) is not reviewing Indigenous communities as understood by the Russian and International law. The Yakut-Sakha communities in her research have the legal status of "local" communities. A proper discussion on the impacts of climate change for Indigenous societies in the Arctic, please refer for example to Chapter 3. Indigenous perspectives. Arctic Climate Impact Assessment, Arctic Council, 2005 or Mustonen, Tero. Rebirth of Indigenous Arctic Nations and polar resource management: critical perspectives from Siberia and Sámi areas of Finland, Biodiversity, DOI:10.1080/14888386.2012.725652, 2012 to name a few. Several monograph sources exist also on this topic for Russian Indigenous communities, including: Mustonen, Tero and Mustonen, Kaisu. Eastern Sámi Atlas. Kontiolahti: Snowchange Cooperative, 2011.	Taken into account. The Arctic Climate Impact Assessment is not peer-reviewed, but it would be good if we could cite it all the same. The other references may be useful.
35986	3	16	15	16	17	For both culture-related and nature-related values, citations should be more cross-culture in scope. While many of these ideas are recent in western philosophy, they were developed earlier or in parallel elsewhere. Historical and anthropological citations would be appropriate along with direct cites of philosophers, since writing down one's philosophy & values is not universal.	Taken into account: If possible, references will be added.
22700	3	16	35	16	38	The text implies that the meaning of 'utility' as preference satisfaction is *not* the meaning used in the chapter. But this is potentially confusing, given that the opening para of this section explicitly acknowledges this meaning.	Accepted - will just delete this sentence
35987	3	16	19	16	20	It is jarring to come across something prescriptive in a chapter that purports to only be laying building blocks for later chapters. The sentence could be restructured so it doesn't use the word "needs." One could just say: Human wellbeing is one important value to account for in decision-making.	Taken into account - will change the wording
35988	3	16	25	16	26	There appear to be typos in these two sentences.	Editorial
35989	3	16	29	16	32	Delete this paragraph. It adds little in additional value and uses very simplistic language to describe what is good or bad.	Taken into account - will improve paragraph
22698	3	16	4			I found the discussion of non-human values useful, though it's unfortunate that it does not end on a more constructive note. Can the authors point to some way in which these values may still be taken into account in decisions about climate change?	Rejected. This would be very contentious and would take lots of space. We can emphasize that non-human values should be taken seriously.
22699	3	16	6			I wonder if this section couldn't be cut, given that the substantive discussion of cultural and social values actually appears in 3.9.2.	Noted. The section will be condensed.
23556	3	16	6	16	6	I don't believe it is simply a "benefit" to humans to live in a flourishing culture, it is a precondition of flourishing for anyone but an exceptional human being. The same goes for society.	Accepted. Wording has been changed.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23557	3	16	25	16	26	There is a disagreement between Sen and Nussbaum around functionings, with Sen admitting the them as part of the capability approach. But this move has been fairly clearly criticized in the capabilities tradition (of the HDCA). Really, the capability approach addresses capabilities -- what people are ABLE to do and to be. See Nussbaum (2000) Women and Human Development (Cambridge). If the capability approach concerned possessing the goods it would be called the FUNCTIONINGS approach. Some indication of this might be worthwhile.	Noted.
27474	3	17	14	17	29	If these lines are supposed to be a box, the legend is missing. If these lines are not supposed to be a box, the line between line 13 and 14 is out of place and to be erased.	Editorial
35994	3	17	22	17	22	Reword: inspired other measures or inspired other metrics.	Accepted
21609	3	17	26	17	29	Reference to Schneider et al. (2000) is out of context. Paragraph is discussing wellbeing but this reference relates to valuation and trade-offs more generally.	Taken into account. May delete reference.
21608	3	17	8	17	9	Diagram doesn't add more than is described in the text. Not necessary, given space constraint.	Accepted. Diagram will be deleted in revision.
35990	3	17	8	17	9	Delete diagram between lines 8 and 9. The figure adds very little that cannot be said quickly and easily in the text, and the figure cannot be understood without reading the text anyway.	Accepted
27473	3	17	9	17	9	The legend for the figure is missing as well as an explanation of the figure.	Reject. There is an explanation of the figure just above it.
35991	3	17	10	17	10	Instead of using terms like narrow, which seem to imply a judgement, restate to say that neoclassical economics makes specific assumptions with regard to how preferences behave and then briefly list what they are.	Accepted
35992	3	17	10	17	13	This would be a good opportunity to add a citation such as the 2008 REEP review article by Shogren and Taylor.	Accepted.
35993	3	17	14	17	29	This seems to overlap with paragraphs on the previous page. Suggest eliminating repetition and consolidating any unique points into the previous section.	Accepted - text is revised.
23558	3	17	19	17	19	Calling a functioning or a capability a "good thing" is confusing. From a metaphysical and linguistic perspective, certainly each is a kind of thing. But in the normative discourse of each "things" usually connotes goods, and this is reinforced by saying "good things." Yet the approach is meant, following Rawls, to concern the space of freedom understood as capabilities, with the question of the provision of goods left as a question of means to enable people's capabilities. Also, focusing on the good here obscures the distinction between the right and the good that is central to this tradition of political and administrative thought.	Accepted - May add "One measure assumes that wellbeing consists in capabilities ... this approach has inspired etc." - the sentence after 'good things' is explicitly and solely about the capabilities approach, and I agree that 'thing' is misleading.
21610	3	18	1	21	24	Content is good but seems poorly structured. Opening line of 3.2.2.6 is contradicted by section 3.2.2.4 which explicitly considered valuation across the whole of a society. Content of 3.2.2.4 and 3.2.2.5 substantially overlap.	Noted.
22701	3	18	19	18	19	Perhaps it should be added that the non-identity problem is discussed later in 3.3.2.	Accepted. However, 3.2.2.4 was changed to 3.4, so a reference has been added in 3.3.2 to 3.4.
35995	3	18	2	18	2	Typo: "in" should be "of."	Editorial
35996	3	18	8			Delete figure. It is difficult to read and adds very little to what is said in the text, and the figure cannot be understood without reading the text anyway.	Accept.
22702	3	19	12	19	13	This is a vague comment. Does it mean that the choice affects the number of people living in the future? Their identities?	Noted. Both. But it could be more explicit
35998	3	19	14	19	44	We recommend deleting section 3.2.2.5 on Lifetime Wellbeing Functions. This section seems overly technical - using lots of jargon - and is not particularly enlightening. It seems in the weeds in a way that is not essential to understanding climate change issues. If some material is retained, perhaps include a small textbox with an example of how qalys or dalys are an alternative way of quantifying wellbeing.	Reject. But the section's relevance could/should be shown

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35997	3	19	7	19	7	Avoid use of the word need. Instead of, "We need to assess the value of distributions of wellbeing like this. Doing so involves....," suggest rephrasing as, "Assessing the value of distributions of wellbeing involves...."	Noted. Will reword.
23559	3	19	6	19	6	Adding a line here to indicate that the WHDR approaches well-being through a set of incommensurable capabilities that map an entire capability space is worth mentioning.	Rejected. It creates one index of them, so it evidently makes them commensurable.
21611	3	19				No considerations on the theory of wellbeing and remembering versus experiencing self is given here. However it would seem appropriate to cite some of the literature and discuss the topic (Kahneman, Daniel, Ed Diener, and Norbert Schwarz. Well-being: The Foundations of Hedonic Psychology. Russell Sage Foundation Publications, 2003.)	Accept. Yes, perhaps we need more of this. Will consider reference.
35999	3	20	1	22	33	Consider whether the content in these two section would make more sense in section 3.5 near the discussion on the Paretian approach. The ethical issues connected to societies and populations can be incorporated into section on Wellbeing with promissory note on relevant economic models in later sections.	Noted
36001	3	20	23	20	32	This seems far too technical for this report. Delete paragraph and perhaps just say that plausible assumptions underlie a social welfare function of the form illustrated in equation 3.2.1, though it additive separability does not allow for the direct incorporation of equity.	Taken into account - text revised.
36000	3	20	4	20	5	Grammar needs to be fixed. The sentence is unclear.	Accepted. Paragraph revised.
22703	3	20	6	20	7	Surely not most economists have *claimed* this. Perhaps most would agree.	Taken into account - May rephrase
36003	3	21	25	22	9	We suggest deleting section 3.2.2.7 on Valuation Population. The section is overly technical, the references are dated, and the relevance to climate policy is not made clear.	Taken into account. Cannot delete section, but will add more to make the relevance clearer.
36005	3	21	26	21	27	If this section is retained, it should be noted that there are multiple major impacts on the world population from climate. This suggests only one "major impact"	Rejected. In the same way, science has had a major impact on society.
36004	3	21	26	21	30	It should also be pointed out here--changes in population will have a major impact on climate change.	Noted. Worth mentioning, though not directly relevant.
36002	3	21	9	21	12	Equation 3.2.3 is identical to 3.2.1 so it doesn't need to be repeated here. Instead, one could just say: One way is through prioritarianism, which has a social welfare function identical to 3.2.1 but assumes that $v(.)$ is increasing and strictly concave. And then to more clearly explain the implications of these two assumptions for how wellbeing across individuals are weighed.	Rejected. The equations are different.
36006	3	22	14	22	33	If this section is retained, the critiques of these approaches should be more balanced and better supported by references.	Noted.
36007	3	22	25	22	26	The goal of average utilitarianism is not to limit the population. It just does not consider or value adding population as a goal in and of itself. That doesn't mean it is for the opposite.	Rejected. The text does not say that this is the goal of average utilitarianism. It says that under certain circumstances, which are described, average utilitarian views would recommend population control.
30829	3	22	30		31	The statement that "climate change policies are very likely to affect the size of the world's population" is very definitive. Suggest that this be referenced in some way, either directly to literature or to somewhere else in AR5.	Taken into account into redrafting of the section
36008	3	22	30	22	31	Is there a reference or example possible for how climate change policies are likely to affect the size of the world's population? If not, the authors should delete this.	Taken into account. We may add an example.
21612	3	22				Although these are very well written and informative sections, it would be useful to have a conclusion that connects all the different elements together. In a sense a recap of figure 3.2.1 at the end would be useful.	Noted.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24575	3	22	35	33	15	Chapter 3 has been allocated 65 pages and is 33 pages over target. A section that should be significantly shortened is 3.3 Justice, equity and responsibility. In particular, there seems to be a disjunct between 3.3.8 and those around it. Geoengineering may be better framed as a practical application/example of the concepts of ethics and justice previously established in this chapter. Suggest that this text be either 1) placed in a 'box' format as a case study (where it should be shortened AND linked more specifically to each of the ethical concepts previously defined), or 2) removed entirely from the chapter in the shortening process.	Taken into account. Chapter is shortened in revision.
36009	3	23	10	23	11	To what timeframe does the statement that developed countries are causally responsible for GHG build-up refer? It would be a good touchstone to include.	Rejected: the text says: "Even though industrialization in the developed world is causally responsible for a large part of the build-up in GHGs (Den Elzen et al., 2005; Lamarque et al., 2010; Höhne et al., 2011), developing countries will likely suffer disproportionately more from climate change (IPCC, 2007 WG II 12 AR4 SPM)."
22869	3	23	13	23	19	I believe that the this point is less true at every passing day (according the the latest data on emissison China has greater emissions that the US): I would reccommend to make this claim less bold	Rejected: the claim is a qualified one
36010	3	23	15	23	19	These sentences on the asymmetry are highly skewed and unsupported. For example, why are developed countries expected to have relatively modest physical deamages and even some benefits (line 16) but developing countries are expected to suffer significant physical damage? This ignores small developed countries that may bear little aggregate responsibility, but are in a particularly vulnerable position. This isn't to question that developing countries bear disproportionate risk, but these lines overstate the potential disparity. It also notes that "developed countries have the main causal responsibility -- in part owing to past emissions", which again offers a normative judgment about how to consider past emissions (i.e. current responsibility) without citation to literature. All such references to past emissions should be presented in a non-normative way, which would be to note that some commentators have argued/posited such responsibility.	Accepted: Text revised.
22870	3	23	19	23	26	There's a missing question in my opinion: what kinds of benefits and burdens (Emission rights, atmospheric absorptive capacity, etc.)are to be justly shared among subjects of climate justice?	Taken into account: Covered in Chapter 4.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36011	3	23	19	23	19	Countries do not have "basic rights" in a human rights context-- individuals in countries have these rights. Should clarify this rather than say "countries ...are at greater risk of violation of their basic rights." Further, the link drawn here between climate impacts and rights violations is unclear and very broad, and is therefore borderline inaccurate. Which rights might be violated due to either climate impacts (directly, causally, backed up by science?) or in the asymmetrical climate damages?	Accepted: change to: "their inhabitants' basic rights" The empirical data given by, e.g., IPCC 2007b, AR4 WII, pp. 19, 49, 297, 393, 557, 791 are in need of interpretation. The connections between such findings concerning the impacts of climate change on ecological systems and the imposition of the risk of rights violation on those who will live in the future are not straight forward. Relevant references: IPCC 2007 Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press, pp. 7-14; ICHRP (2008): Climate Change and Human Rights, Geneva; Shue, H. (1993), Subsistence Emissions and Luxury Emissions, Law and Policy 15, 39-59; Caney, S. (2010), Climate change, human rights and moral thresholds, in: Humphreys, S. (ed.), Human rights and climate change. Cambridge: Cambridge University Press, 69-90. And see references below, 23, 42.
36012	3	23	25	23	26	The question of "who owes compensation for damages that are caused by emissions" presupposes that compensation is in fact owed. Such a presupposition is a normative judgment by the authors. The question should be stated as: "whether anyone owes compensation for damages that are caused by emissions."	Accepted: change to: "whether anyone owes compensation for damages that are caused by emissions"
36013	3	23	29	25	14	Suggest deleting or slimming this section. It should spend more time on actual socioemotional & well-being consequences, not whether those consequences matter. This would also be an excellent place to bring up schools of philosophy that start with collective & intergenerational duty as a foundation (Confucianism is only the most well-known example).	Rejected; the literature and the issues reviewed here are central to an understanding of equity and climate change
36014	3	23	34	23	35	Unclear how past generations can be viewed as holding rights against present generations (at least with respect to issues such as emissions and potential causation of harms). The authors may want to note if the rights/duties to past generations is of another variety.	Taken into account
22705	3	23	35	23	38	I found this sentence opaque.	Taken into account: Sentence removed in revision.
22704	3	23	4	23	6	Sentence could be cut.	Accepted – text revised.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36015	3	23	42	24	1	Consider deleting unless reference can be included to an international agreement establishing these rights.	Rejected: we review the relevant peer-reviewed scientific and philosophical literature
23563	3	23	3	23	4	Suggesting that "correctness" is the standard for justice is misleading. As Aristotle pointed out, practical matters do not admit of mathematical precision.	Rejected: we do distinguish between correct and incorrect conclusions of ethical inferences and so did Aristotle; correct claims do not have to be mathematically precise
23080	3	24	12	24	14	The idea that future generations might be better off due to technology and investments in capital rests on implausibly extreme assumptions about the substitutability of manufactured capital for the very specific kinds of environmental capital that are currently being depleted and degraded. The sentence beginning "However, future generations..." should be struck.	Accepted. Sentence deleted.
24505	3	24	18	24	25	Can be shortened IMHO: the idea that you cannot hold a right because you cannot exercise it today seems rather 'outdated' to me... Which legal scholar still defends that today?	Rejected: Influential will-theorists include Kant, Savigny, Hart, Kelsen, Wellman, and Steiner. Add reference: Wellman, Carl (1995): Real Rights, New York and Oxford: Oxford UP, Ch. 4
22706	3	24	21	24	25	This sentence is very long and convoluted.	Accepted: Two sentences instead of one: However, some justice theorists argue that neither being able to exercise the right nor the possibility of mutual interaction is necessary to attribute rights to people. Rights, they argue, are attributed to beings whose interests are important enough to justify imposing duties on others.
23081	3	24	26	24	39	This discussion of the non-identity problem can be cut, since the extreme individualist assumptions that underlie it are not relevant for the discussion of climate change.	Taken into account. The non-identity problem is important to address. Also, for the problem to arise it is sufficient that we mean to attribute human rights claims to future individual persons. This does not seem extremely individualistic.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36017	3	24	26	24	39	Suggest deleting this paragraph because it does not add a great deal of value to the discussion.	Rejected: The non-identity problem is a central sui generis problem of relations between currently living people and people who might exist depending upon currently living people's decisions. It is also central to an interpretation of indirect victims' claims to compensation. We should not reject reviewing an argument that is central and prominently discussed in the peer-reviewed literature since we fear misuse of it.
22707	3	24	28	24	28	I suggest replacing 'on the genetic identity view of personal identity' with 'if personal identity is determined by genetic identity'.	Taken into account: Phrase removed in revision.
22708	3	24	29	24	29	Presumably 'genetic' should be replaced with 'personal'. As it stands, the sentence is true irrespective of the 'genetic identity view'.	Taken into account: Phrase removed in revision.
36016	3	24	3	24	3	The causal link of how exactly rights are violated due to temperature rise is unclear, especially since there are no agreements that speak to this (and a right in this context is internationally recognized and accepted).	Rejected. The claim made in the text is in terms of likelihood. Also, the right in this context is not about being internationally recognized and accepted, if that refers to political agreement and acceptance. The agreement and recognition here is about the peer-reviewed scientific and philosophical literature.
22709	3	24	34	24	39	Another very long sentence.	Taken into account: Sentence removed in revision.
22710	3	24	40	25	3	The discussion of possible responses to the non-identity problem might be too condense to make sense to the uninitiated reader.	Rejected. There is not enough space to do more.
23564	3	24	15	25	3	First, the section on intergenerational justice is key and should not be removed from the chapter. I would advise expanding it by starting first with the notion of intergenerational justice as a discrete section and then considering rights as a second section. But even if you do not, I would cut the text on the non-identify problem. It's a red herring. Everyday people have no problem understanding that we owe something to the future. Parfit's problem is a side-line in metaphysics that is highly misleading. It is fine to indicate it, but there is absolutely no need to go into depth around it in this kind of document. It is entirely academic and could be used by morally corrupt parties to tangle the issue of intergenerational justice by appealing to the IPCC's very own report. Delete it.	Rejected: The non-identity problem is a central sui generis problem of relations between currently living people and people who might exist depending upon currently living people's decisions. It is also central to an interpretation of indirect victims' claims to compensation. We should not reject reviewing an argument that is central and prominently discussed in the peer-reviewed literature since we fear misuse of it.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22711	3	25	10	25	10	I didn't understand the reason for restricting to 'certain or very likely' consequences.	Accepted. Change to: against other consequences of their actions, including the certain or likely violation of the rights of currently living people (Oberdiek, 2012; Temkin, 2012).
22712	3	25	16	25	16	As one example' -- of what?	Accepted: revised sentence: Suppose that a global emissions ceiling that is intergenerationally just has been determined
22713	3	25	45	25	45	An example or explanation of regulatory approaches could be useful.	Taken into account: Covered in Ch. 4
36018	3	25	15	26	6	Suggest shortening the section on intragenerational justice. Also, this section seems to miss that one could still distribute permits unequally on the basis of who caused harm versus who suffers damages (per the next section's discussion). These would have very different equity implications. How does that comport with what is discussed here?	Taken into account: see secs. 3.3.4 and 3.3.5
36019	3	25	31	25	38	An important point is missing from the discussions of distributive justice: There is a difference between improving the wellbeing of the worse off as a matter of justice generally and the question of how climate policy interacts with distributive justice. The most immediate question is whether climate policy is fair from the standpoint of avoiding further or disproportionate harm on the world's most vulnerable. That is very different from thinking about climate policy as a redistributive policy in and of itself with the aim of decreasing vulnerability that exists due to factors that have nothing to do with climate change - for example, poverty. Given that the world's institutions have not yet solved that challenge, it seems onerous to burden climate policy solving the world's larger distributive justice problem. Sometimes the text seems to imply that is the case.	Taken into account: The paragraph by stating the good whose distribution is at stake here: "benefits from emission-generating activities" or " sacrifices in reducing emissions". Explicitly taken into account: 26, 2-6 (in the SOD)
29701	3	25 of 14	11		14	AFTER: "...geoengineering measures" INSERT: "which, if deployed, are expected to 'lock-in' future generations that did not have the right to participate in the original decision to deploy. "	Rejected: the expected 'lock-in' is not the issue that defines the concern here.
22714	3	26	2	26	2	I don't see how this sentence is supposed to stand in contrast to the previous sentence, as suggested by the occurrence of 'however'.	Accepted: Text revised.
36022	3	26	20	27	20	The discussion of historical responsibility provides a very narrow view of responsibility for GHG emissions, particularly given that the consensus that GHGs are harmful didn't emerge until 1990 and that cumulative emissions since then already outweigh all emissions prior to that time.	Taken into account: 26, 34 ("Second ..."); benefits from emission-generating activities correlate with level of historical emissions
36020	3	26	20	30	35	This whole discussion of historic responsibility (Sections 3.3.4-3.3.6) needs to be re-drafted to accurately put it in the right context. As written, there is a fully inaccurate conflation of responsibility (used in non-legal sense) with "legal responsibility."	Rejected. 3.3.4 and 3.3.5 review and assess the theoretical (normative and philosophical literature). 3.3.6 reviews and assesses the legal literature

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36021	3	26	20	30	35	The discussion of historic responsibility on pp 26 to 27 is especially skewed and is (again) the authors making a normative judgment about the validity of the arguments in the sources they are citing. Example, first paragraph on page 27 does nothing but offer arguments rebutting the cited sources that had expressed objections to historical responsibility. There is only one cited source in that paragraph, and, if anything, the arguments in that source would support the contrary proposition to what it is cited for.	Reject - not a normative judgment, rather an assessment of the scope of the objections. Will add reference 27, 8: (see Meyer, Lukas H. and Dominic Roser (2010): Climate Justice and Historical Emissions, Critical Review of International Social and Political Philosophy, 13,1, 233-235; Meyer, Lukas H. (2013): Why Historical Emissions Should Count, Chicago Journal of International Law 13, 2, 603-609
36024	3	26	22	26	27	The second two sentences of this paragraph should be deleted as they are prejudicial and do not accurately reflect the range of interpretations that are commonly applied to the relevant articles in the convention.	Taken into consideration. Text revised.
36025	3	26	24	26	27	This is inaccurate to state that common but differentiated responsibility in the UNFCCC is "usually interpreted to imply that current and historical differences of causal responsibility . . . Should play a role in determining emissions reduction obligations." It implies there is a widely accepted definition of common but differentiated responsibilities. "Usually interpreted" should be replaced with "some commentators have asserted . . ." Without that change, it would be the authors of this chapter offering an interpretation of specific terms in the Convention, which would be highly inappropriate and not acceptable. For example, many would say that the concept of "responsibility" extends to decisions regarding future emissions and that the concept has dimensions (e.g., an understanding of the nature of the problem and the ability to address it) that are not directly to emissions per se.	Taken into consideration: Usually will be changed to sometimes
36026	3	26	27	26	27	The footnote on this page incorrectly simplifies articles from the UNFCCC-- the language here reflects particular interpretation of those articles, rather than agreed understandings or definitions. Please revise.	Footnote has been deleted.
36027	3	27	1	27	16	This paragraph must be deleted, because it is argumentation by the authors for a particular normative judgment about how to think about/assess historic emissions and, thus, is not in keeping with IPCC principles. There is only one citation in the paragraph (Shue, 2010), which does not actually support any of the propositions in the paragraph. If anything, the Shue article cited could be read to indicate that a current generation is not responsible for the actions of past generations because the current generation (or a future generation) takes the world it is born to as it finds it, with particular past emissions and a particular energy development path that the current/future generation had no choice over.	Taken into account. Language will be revised. "Should" changed to "Need not"
36028	3	27	14	27	16	This reference to distributing emission permits, in addition to suffering from the problem of offering normative judgements about historic emissions and how to consider them, also presupposes a contentious view of addressing the problem climate change, thinking in terms of a total carbon budget and distributing permits according to that historic responsibility.	Rejected: It is not a normative judgment about historic emissions. It is a hypothetical judgment as clearly indicated by 27, 11-13 "if in ... standards".
27475	3	27	33	27	34	To leave it at the statement that "defining 'wrongful' is a matter of normative theory and not easy" is not enough. There should be some attempt to actually give some definitions.	Taken into account: 27, 42-44

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36029	3	27	21	29	31	Section 3.3.5 contains many abstract concepts. This seems like a place for simpler, briefer exposition. Also there is a fair amount of repetition on p. 28. When a concept has already been discussed, be brief. The 4 difficulties with compensatory payments is way too detailed and the attempt to link back to them in the paragraph that begins on line 23 is confusing and unnecessary. Instead of 2 1/2 pages of text, this could be consolidated to 1 page of text. That would be about the right level of detail.	Rejected. The review of "abstract concepts" reflects the relevant literature and state of the art. Will try to be more concise in redrafting.
27327	3	27				This section has a political position which changed the result of logical and conceptual analysis, cause it adopted a questionable premise about a concept that can be seen far beyond the legal interpretation as it was placed. That is, "Defining" wrongful "is a matter of normative theory and not easy (Feinberg, 1984; Coleman, 1992; McKinnon, 2011)", the text adopts the premise that only the normative precepts that are to indicate the validity of the application the concept of polluter-pay and its congeners. Adheres arbitrarily that only actions that are intentionally assigned valid for this purpose. So there is intent or not, the physical impact occurred in the atmosphere and the impacts will be felt by others who did not participate in the causes and the benefits of using fossil fuels. That is, the approach adopted by the text of the IPCC ignores establish liability because not intend purpose or knowledge, however, to identify that from now into the future this is just for future emissions would be discussion of compensation and allocation of responsibilities.	Taken into account - covered sec. 3.3.6
35233	3	27	22			This section discusses intra-generational equity, including historical responsibility and compensatory justice. The current viewpoints presented and literatures cited provide a biased view by only covering three principles of compensatory justice mainly used in civil lawsuits-the Polluter Pays Principle (PPP), the Beneficiary Pays Principle (BPP), and the Community Pays Principle (CPP), which are only applicable to domestic lawsuits. However, the discussion on the concept of historical responsibility should be based on the principles of CBDR and equity, which have been the cornerstone of the current international framework. It is suggested to add the following at the beginning of this section: "The principle of CBDR was initially put forward at the United Nations Conference on Environment and Development in 1992, and was confirmed by the UNFCCC and its following climate change negotiations. This principle was oriented from perspectives of Corrective Justice Theory and Distribute Justice Theory. According to Corrective Justice Theory, unsustainable production and consumption leads to the deterioration of global environment from both historical and practical perspectives. As a result, the countries that are responsible for unsustainable production and consumption in history should bear the liabilities of controlling, reducing and eliminating damage on global environment, and their responsibilities should be proportional to the damage induced. On the other hand, the Distribute Justice holds that the largest share of historical and current global emissions of greenhouse gases has originated from developed countries; that per capita emissions in developing countries are still relatively low and that the share of global emissions originated from developing countries will grow to meet their social and development needs."	Rejected. CBDR and the interpretation as suggested is summarized in 26, 21-27
32105	3	27	32			The content of the section fails to communicate the true importance and potential of the public provision of public goods or services aiming to reduce GHG emissions.	Rejected. Covered elsewhere in chapter
20565	3	28	1	28	2	Please add "Disregarding transaction costs, according to the Coase-Theorem (Coase, 1960), compensatory payments lead to the same optimal emission reduction, regardless the polluter or the injured party pays". Cite: R. H. Coase (1960). The Problem of Social Cost. Journal of Law and Economics 3, 1–44.	Rejected: do not think this is relevant here
23082	3	28	19	28	22	This discussion of the non-identity problem and potential duty-bearers can be cut, since the extreme individualist assumptions that underlie the notion of justice being used are not relevant for the discussion of climate change.	Taken into account: see responses to comment 23564

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29332	3	28	19	28	20	Refence to Derek Parfit, "Energy policy and the further future: the identity problem", pp. 112-121, in: S. Gardiner et al "Climate ethics: essential readings" (Oxford University Press)	Taken into account. Reference considered
29333	3	28	19	28	20	It may be added that Parfit's argument presumes that one politics causally effects conception which may be considered as highly controversial.	Taken into account: 24, 47-50
29334	3	28	21	28	22	PPP does not fail due to the death of the duty bearer. What it shows is that PPP may be a politically unfruitful strategy.	Taken into account: 28, 30-33
22715	3	28	3	28	4	This sentence seems to suggest that the following objections effect each of the three apporaches (PPP, CPP, BPP). But for example, at least the third and fourth problems do not seem to effect CPP.	Accepted: Text revised.
36030	3	28	34	28	34	Typo: a or the missing.	Editorial
22716	3	28	46	29	2	It would be useful to make explicit the implicit assumption that potential bearers of the duty cannot obviously forego the benefit.	Rejected. Assessing this is difficult.
36031	3	29	22	29	24	How are "highly industrialized rich countries" defined in this context? Are these UNFCCC categories or not?	Accepted: "duty to pay for adaptation should be allocated on the basis of people's ability to pay"
36033	3	29	33	30	35	The discussion of "legal concepts of historic responsibility" glosses over a key component of determining responsibility in both common and civil law systems -- state of mind. Whether harm was caused willfully, recklessly, negligently, or unknowingly (strict liability). Emissions pre-1990 would have been made without any knowledge of potential harm. Finding responsibility in that strict-liability (no knowledge) context is extremely limited in legal systems.	Taken into account: 28, 8-12 (SOD)
36032	3	29	32	30	35	This is another section that could be much briefer. Some of what is here seems more like an aside or textbox material. Also, the relevance of national law to climate policy is unclear. For climate, it seems more relevant to understand whether the concept of historical responsibility comes up in international law, and specifically international environmental law, which isn't even really discussed.	Noted. This section is already very brief, and the commenter does not does not suggest any specific cuts. The purpose of this section is to show how the concepts of historic responsibility have been developed in legal systems as one source of insight into the ethical issues. International law was deliberately excluded from the assignment I was given.
27328	3	29				This section also has a political position which changed the result of logical and conceptual text analysis. The text ignores the conditions of legal statutes related to "strict liability" for environmental damage already exist in various legal systems. Thus, the analysis goes almost as singular a petition stating and defending that due to lack/difficulty of assigning blame to the damage (climate change) there will be no change to be assigned the responsibility for the generation of historical GHG to the U.S. and EU.	The section is correct as written, but a small wording change is recommended in the interest of clarity. The section recognizes that the United States imposes environmental liability for hazardous waste regardless of fault. Even though the EU recognizes strict liability as well, there is an exception for situations where the harm was beyond the scope of scientific knowledge at the time, as the section points out.

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35232	3	29	32			When discussing historical responsibility (section 3.3.6) in the context of climate change, it should be clear in the first place that the UNFCCC and its Kyoto Protocol have been widely participated by all countries in the world. Therefore, the discussion on the principles and concepts in this section should base on the principles and norms established under the UNFCCC and its Kyoto Protocol. It is therefore not appropriate to discuss the concept of historical responsibilities using the legal principles and norms of civil or common law which aim at defining the liability of firms or individuals, not state (historical) responsibilities. The discussion should particularly bases on the principles of CBDR and equity, which have been the core of the current international framework as well as the responsibility and burden sharing system established by the Convention. Other principles arising from the civil law or common law, such as harmful conduct, causal link with the resulting harm, or unjust enrichment, etc. although the objective and substance of these norms are not controversial with the principles of the Convention, they are not a replacement or alternative of CBDR and equity and should not be the major basis in settling the concept of historical responsibility. This section needs to be redrafted and relevant parts of the chapter need to be modified accordingly.	Reject. The purpose of the section is to show how legal concepts can shed light on the ethical issues, not to provide a discussion of the existing international regime. We would argue in favor of adding a discussion of international law to the Sixth Assessment.
36034	3	30	10	30	14	The US EPA's Endangerment Finding could be cited here. http://www.epa.gov/climatechange/endangerment/	Rejected. It seems better not to cite particular national documents dealing with climate change.
36035	3	30	17	30	17	It's very difficult to establish a causal link between emissions and any specific impact in isolation, so the statement that a link between emissions and adaptation costs would be easier seems counterintuitive. Please revise.	Rejected. The idea is simply that an adaptation measure may be a reasonable response to increased risk, even if we cannot be sure whether any specific later event was actually caused by climate change. This seems quite intuitive.
27330	3	30	18			Repetition of the word "also".	Editorial
27329	3	30	2			Correct for <<bom père de famille>>.	Editorial
22717	3	30				I think space may be saved by unifying the first and second components mentioned in this section. I don't really see the difference between them myself.	Reject the suggestion. There is a clear distinction between the first and second components. As the section states, the first component concerns "the types of agents who should be included" (e.g. states, individuals, etc.), whereas the second component concerns which particular members of these categories (which individuals? or which states?). The distinction is thus both clear and important.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22718	3	31	20	31	21	This sentence strongly endorses a controversial position. I'm not sure this sits well with the stated aim of avoiding policy prescriptions.	Taken into account. This sentence is not endorsing a particular view and does not make any policy prescriptions at all. It is describing (but not endorsing a certain view). I would suggest rewording the sentence to make this clear: It should say "For some proponents, the decisions eventually reached are to be justified on the basis of reasons that none of the parties could reasonably reject "
36036	3	31	45	31	47	Is there empirical data to support this claim? If not, suggest deleting.	Taken into account. Text revised.
22719	3	31				I think the discussion here could be cut without loss. What does it add to the first and second components in 3.3.7.1?	Reject. Section 3.3.7.1 is quite distinct. It focuses on which types of actors should be included (e.g. individuals? NGOs?) , and then which specific members of that class (e.g. which particular individuals). Section 3.3.7.2, by contrast, is on two quite distinct issues. The first points out that procedural justice can apply in different ways at different levels of governance - global, regional, state-level, substate level. And the second concerns the implications of the principles discussed in section 3.3.7.1 given the global and intergenerational character of climate change.
22508	3	31	40		44	The Procedural justice is valued for a reasons that "political institutions should adopt inclusive decision-making processes because it is intrinsically fair, and is the only legitimate way to make political decisions".And"other modes of decision-making – ones that do not include affected parties in the ecision-making process – fail to treat them with respect." This opinion too absolute, and ignore the efficiency problem	These statements claim only that procedurally just institutions have some value. They do not claim that that value is the only relevant consideration: the passage does not deny that other consequentialist considerations should play a role or that procedural values should take priority. This was explicit in an earlier draft but has been dropped now (presumably because of word limits).

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32472	3	317				<p>The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardised by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Levasseur are missing, which are particular relevant to chapters 8 and 11. These are:</p> <ul style="list-style-type: none"> -Brandão M, Levasseur A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Levasseur A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Levasseur A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy 35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Levasseur A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy. 	Rejected. This comment is unclear and does not appear to apply to Chapter 3.
23991	3	32	10			carbon dioxide removal AND LONG-TERM STORAGE.	Rejected - CDR is not necessarily requiring long-term storage in the sense of sequestration (think of enhanced upwelling, ocean fertilization, etc.)
19040	3	32	11	32	12	A cross-reference to WGI AR5 Chapters 6 and 7 and WGIII chapter 6 would be welcomed.	Addressed in another comment: #32398

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23992	3	32	11		12	Typo here, also Keith 2000 is not a general review of moral issues (for this cite Gariner, Jamieson)	Accepted - reference to Keith should be deleted at this point, instead reference to Gardiner 2010 to be inserted
21260	3	32	11			Remove the duplicate "(for surveys see"	Editorial – copyedit to be completed prior to publication
21263	3	32	14			"preparatory research into them." Add reference to Robock (2012): Robock, Alan, 2012: Is geoengineering research ethical? Peace and Security, 4, 226-229. http://climate.envsci.rutgers.edu/pdf/GeoResearchEthics.pdf	Taken into account - addressed in another comment: #29704
27476	3	32	15	32	18	At this point in time, any statements on the costs of geo-engineering options are very speculative. What is "low cost" supposed to mean? Compared to which alternatives? I suggest deleting "relatively low cost".	Addressed in another comment: #29704
21264	3	32	16			Correct the spelling with no hyphen: "geoengineering"	Editorial – copyedit to be completed prior to publication
23993	3	32	17			17 they might have considerable adverse side-effects, INCLUDING SOCIAL DISRUPTION, or	Taken into account. Addressed in another comment: #29704
21265	3	32	17			"low cost" Include references to Robock et al. (2009) and McClellan et al. (2012) Robock, Alan, Allison B. Marquardt, Ben Kravitz, and Georgiy Stenchikov, 2009: The benefits, risks, and costs of stratospheric geoengineering. Geophys. Res. Lett., 36, L19703, doi:10.1029/2009GL039209. McClellan, Justin, David W Keith, Jay Apt. (2012). Cost analysis of stratospheric albedo modification delivery systems. Environmental Research Letters, 7, doi:10.1088/1748-9326/7/3/034019.	Taken into account. Addressed in another comment: #29704
23994	3	32	20		23	20 First, it has been argued that we might end up in a situation 21 where deploying geoengineering is a lesser evil than allowing uncompensated and catastrophic 22 climate change to happen (Crutzen, 2006; Gardiner, 2010; Keith et al., 2010; Svoboda, 2012a; Betz, 23 2012). Delete Gardiner, 2010 who does not support this position and add the following: BUT THIS POSITION MAKES THE DUBIOUS ASSUMPTION THAT CLIMATE ENGINEERS HAVE BOTH PREVISION AND MORAL AUTHORITY OVER THE PLANET (FLEMING, 2010 ; HAMILTON, 2013) Hamilton, Clive (2013). Earthmasters: The Dawn of the Age of Climate Engineering New Haven, CT: Yale University Press. ISBN:9780300186673	Rejected - We cite papers that present and analyze the arguments, citation doesn't imply that the arguments are ultimately endorsed.
19041	3	32	26	32	28	It is undisputable that RCP2.6 includes a significant amount of BECCS, which falls under the umbrella term of geoengineering according to current definitions. I think the whole section suffers from a lack of clarity of what this chapter and the studies they cite actually mean by geoengineering.	Addressed in another comment: #32398

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19039	3	32	29	32	35	Talking about geoengineering generally (ie with an umbrella term) is not particularly useful here and in the rest of the section, as the ethical implications of SRM and CDR can be pretty different.	Taken into account -- Added "The moral arguments do not apply equally to all proposed geoengineering methods and have to be assessed on a case-specific basis." This section, however, can only sketch the major types of arguments that are advanced.
24336	3	32	37	32	38	Consider adding something like 'at least as a short term measure' to the end of the paragraph and cite: T. M. L. Wigley, "A Combined Mitigation/Geoengineering Approach to Climate Stabilization," Science 314 (2006), 452–54	Rejected - not essential
23995	3	32	43		44	43 fix" objection (Scott, 2012) or the "hubris" argument (Fleming, 2010) – that rely on HISTORICAL PRECEDENTS AND a critical 44 assessment of technology and modern civilization in general.	Rejected - true, but too specific.
23996	3	32	46		47	Please delete Keith 2000 who mentions, but does not analyze moral hazard arguments.	Accepted with qualifications -- Moral hazard section has been deleted.
23997	3	32	48			The cost-effective argument was originally made by Nordhaus in the early 1990s in an NRC report if not earlier. National Academy of Sciences (1992). Policy Implications of Greenhouse Warming: Mitigation, Adaptation, and the Science Base. Washington, D.C.: National Academy Press.	Rejected - the section is concerned with the recent geoengineering debate (and not trying to uncover its historical precedents)
24095	3	32	6			The short definition of geoengineering is one of many attempts to find a short phrase that covers the essentials. There should be a reference to the fact that there are several other definitions, all with shortcomings (including previous IPCC ones that differ), of the overview in Williamson, P., Watson, R.T., Mace, G., Artaxo, P., Bodle, R., Galaz, V., Parker, A., Santillo, D., Vivian, C., Cooper, D., Webbe, J., Cung, A. and E. Woods (2012). Impacts of Climate-Related Geoengineering on Biological Diversity. Part I of: Geoengineering in Relation to the Convention on Biological Diversity: Technical and Regulatory Matters. Secretariat of the Convention on Biological Diversity. Montreal, Technical Series No. 66	Rejected - The text is not giving a formal definition of geoengineering but merely a description. See also comment #32398
24096	3	32	6			The short definition on geoengineering should be aligned and be consistent with those in other parts of the report, e.g. chapter 1 p. 16 line 38	Addressed in another comment: #32398
19038	3	32	6	32	7	It would be good to have a unified definition of geoengineering in AR5, rather than each WG and each chapter having its own. The definition of IPCC (2011) -expert meeting in Lima where the three WGs were present- is a good starting point.	Addressed in another comment: #32398
23990	3	32	6			Please rewrite: Geoengineering (also known as climate engineering), CONSISTS OF A NUMBER OF SPECULATIVE PROPOSALS FOR large-scale technical intervention in the	Rejected - We avoid value-laden language in the description of geoengineering
36037	3	32	40	32	44	Avoid jargon when it is not discussed or explained in plain language. Suggest deleting this paragraph, as it involves too many specifics of little interest to the general reader.	Rejected - presentation has to do justice to the scientific debate
29900	3	32	5			As geo-engineering is drawing increasingly more attention from stakeholders, I suggest the section is given more pages than currently allocated 1 page so the authors can expand the discussion.	Noted
32398	3	32	5	33	15	Please refer to WGI Ch06, section 6.5, for more details on geoengineering.	Accepted.
29703	3	32 of 14	10		12	AT THE END OF THE PARAGRAPH, INSERT: It should be noted that, like the scientific discussions of geoengineering, the debate about the morality of geoengineering is inchoate and, to-date, has included few participants.	Rejected - no essential info and only partly correct.

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29704	3	32 of 144	13		18	We suggest that this paragraph be edited to read: "The moral debate about the possible future deployment of geoengineering and preparatory research into them is in its infancy. Geoengineering poses major ethical dilemmas and challenges for international cooperation, international, intra- and inter-generational justice, as well as global climate change governance. While scientific research on different geoengineering options is also in its infancy, some have argued that geoengineering could be implemented at relatively low cost, but with considerable adverse side-effects and/or may address only some aspects of change in natural systems."	Taken into account -- the paragraph will be entirely deleted. It is misleading, tends to be normative and is also superfluous; the point it makes are introduced below in a more careful language. This paragraph has rightly attracted the most critical comments.
29705	3	32 of 144	24		25	AFTER: "Such efficiency arguments have been criticized in the ethical literature..." INSERT: "and, as has been noted earlier [1.2.1.5, Weitzman (2009)], cost-benefit analysis and expected utility theory have difficulty dealing with climate change decisions, owing to the uncertain probability of catastrophic impacts."	Rejected - while that's true (and Weitzmann is surely not the first to note) the section on geoengineering is not the place to make systematic references to all the more general, climate-related moral and ethical issues.
29706	3	32 of 144	30		31	In list of references for overviews of geoengineering's risks, ADD: ETC Group (2012). The full citation is: ETC Group, "Darken the sky and whiten the earth: The dangers of geoengineering," _Development Dialogue_ no. 61, September 2012, pp. 210-237.	Rejected - No scientific publication.
29707	3	32 of 144	33		33	In list of references for "geoengineering might make things worse rather than better (Hegerl and Solomon, 2009)" ADD: Fleming 2010 and Hamilton 2013. The full reference for Hamilton is: Hamilton, Clive (2013). _Earthmasters: The Dawn of the Age of Climate Engineering._ Yale University Press. 2013.	Noted. Will consider references.
29708	3	32 of 144	37		39	REPLACE: "Geoengineering schemes might aggravate some inequalities because they only partially control climate change and modify regional precipitation and temperature patterns (Bunzl, 2008; Svoboda et al., 2011; Preston, 2012) WITH: "Geoengineering schemes might aggravate some inequalities if, as expected, they modify regional precipitation and temperature patterns with unequal impacts, sometimes referred to as 'spatial heterogeneity' (Bunzl, 2008; Royal Society, 2009; Svoboda et al., 2011; Preston, 2012)."	Noted. Will consider references.
29709	3	32 of 144	42		44	Fleming's "hubris" argument does not rely on general critiques of "modern civilization," but on historical instances of attempts at weather modification, which he shows to be the precedent for climate interventions (geoengineering).	Rejected - the historical analysis which backs up the hubris argument represents a broader critique of modern technology and its deployment.
29702	3	32 of 144	7		8	DELETE: "It represents a third kind of response to climate change, besides mitigation and adaptation. The effect of this sentence is to create a new "holy trinity" of climate change response, where mitigation, adaptation and geoengineering are equally valid responses. This sentence must be deleted or edited to read: "Geoengineering is neither mitigation nor adaptation."	Rejected - Referring to geoengineering as a third type of response doesn't imply that is "equally valid" as mitigation and adaptation.

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24097	3	33	14	33	15	The sentence is either wrong or misleading. It is unclear what it means by "blueprint". Apart from proposals in literature, there are already two existing governance examples on geoengineering research, neither of which is mentioned here: Most notably, the London Convention and Protocol have agreed on an elaborate governance model for ocean fertilisation, and the Biodiversity Convention has taken over the essence of this model in decisions that apply to all geoengineering concepts. See Markus, Till, Ginzky, Harald, Regulating Climate Engineering: Paradigmatic Aspects of the Regulation of Ocean Fertilization, Carbon and Climate Law Review 4 (2011), pp. 477-490; and Bodle, Ralph, Climate Law and Geoengineering, in: Hollo, Erkki, Kati Kulovesi and Michael Mehling (eds.), Climate Change and the Law, Ius Gentium: Comparative Perspectives on Law and Justice 21, Dordrecht: Springer (2013), 447-470. DOI 10.1007/978-94-007-5440-9_17. (peer reviewed and published before end of January 2013), in particular at 453	Accepted and addressed in another comment: #29629
30830	3	33	14		15	An assessment of the international community's state of affairs regarding geoengineering should note decisions taken in the London Protocol (regarding marine interventions) and in the UN Convention on Biological Diversity.	Accepted and addressed in another comment: #29629
21266	3	33	15			"let alone on its deployment" Add reference to Robock (2012): Robock, Alan, 2012: Will geoengineering with solar radiation management ever be used? Ethics, Policy & Environment, 15, 202-205.	Taken into account. Accepted and addressed in another comment: #29629
36038	3	33	21	33	23	Rewrite: subsequent section (3.5), we examine the implicit ethical assumptions in cost-benefit analysis being applied in climate policy decisions.	Taken into account. Text revised.
24506	3	33	29	33	33	Can explicit reference be made to 'ecological economics' as a growing field in economics today (e.g. the idea of our economy as a subsystem of our planet's ecosystem; the idea that we need better systems of measurement than GDP...) Most of the economics that is being taught at universities - unfortunately - still doesn't take these views as plain common sense....	Noted.
29336	3	33	29			Note 13: to the reference how the EU emissions trading system "works" it should be added that in practice the system does not work as it was supposed to do.	Noted.
21613	3	33	31	33	31	Statement that "Economics at its core is the evaluation of trade offs" overlooks the breadth and history of the discipline. Has only been mainstream conception since Robbins in the 1930s. Better "There are economic tools available for the evaluation of trade offs".	Taken into account. Text revised to address this
19447	3	33	35	33	36	I disagree with the statement, "economic analysis yields correct normative conclusions only under very specific ethical assumptions." Who gets to define what the "correct" ethical assumptions are? Suggest deleting.	Taken into account. Text revised to address this
24445	3	33	35			It is strange to see the term "correct normative conclusions" immediately after dealing with the complexities of ethics. The assumption here is still that if done in a certain way economics will have "the" answer, which is precisely a rationale for having both ethics and economics. Just a softening of language in here would fix the problem - something like, 'economic analysis can yield useful insights about costs and benefits when specific ethical assumptions are used;	Taken into account. Text revised to address this
19448	3	33	39	34	2	The comments about the scale of analysis are confusing because both cost-benefit analysis and integrated assessments can both take place at different scales, and also they are not mutually exclusive. Suggest deleting.	Taken into account. Text revised to address this
24338	3	33	7	33	7	A recent paper adds another important way in which geoengineering imposes major risks on future generations—viz., by creating the risk of a “double catastrophe.” See: S. D. Baum, T. M. Maher, Jr., & J. Haqq-Misra, “Double Catastrophe: Intermittent Stratospheric Geoengineering Induced by Societal Collapse,” Environment, Systems and Decisions (2013) DOI 10.1007/s10669-012-9429-y.	Rejected - only major aspects can be taken into account

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27477	3	33	9	33	10	A more cautious wording would be more appropriate when talking about the geoengineering option, e.g.: "...geoengineering m i g h t b e c o m e a viable way of addressing it quickly...".	Addressed in another comment: #29629
29629	3	33	9	33	11	"... addressing it quickly...". This gives the impression that also geoengineering category CDR will have a quick effect. However, the effect of removing CO2 from the atmosphere on temperature will be slow and long-term due to inertia of the climate system, large stocks of C and relatively small flows between atmosphere, biosphere, oceans, as well as "rebound" effects in form of e.g. slower ocean uptake of CO2 when concentration is reduced.	Taken into account -- Text revised. Moreover, the last paragraph is changed to: "Arguments in favor of research on geoengineering point out that research does not necessarily prepare for future deployment, but can, on the contrary, uncover major flaws in proposed schemes, avoid premature CE deployment and eventually foster mitigation efforts (e.g., Keith et al., 2010). Another justification for R&D is that it is required to help decision-makers take informed decisions (e.g., in a climate emergency (Leisner and Müller-Klieser, 2010))."
19671	3	33	16	36	13	A general comment applicable to the entire section 3.4: It is misleading to equate economic analysis with cost-benefit analysis. As mentioned in comment 22 above, CBA represents one of the approaches (though indeed a predominant approach) used by economists and is typically associated with welfare traditional economics. There are many other schools of economic thought (some part of mainstream such as behavioural economics and elements of Keynesianism) that do not necessarily adhere to the principles of cost-benefit analysis and aggregation of individual welfare functions and draw on wider ethical values. For example, the ethical assumptions of ecological economists are different than those of new classical economists (the former adhere to strong sustainability principles and limited substitution between man-made and natural capital as opposed to the latter - traditional economists who assume different types of capital are substitutable, monetisable and do not acknowledge the ecological limits of our planet. This is to say that ethical values are implicitly different amongst different schools of economic thought. Some qualifications need adding in this sense, perhaps along the lines that "traditional economic analysis (cost-benefit analysis) is being predominantly used to make climate policy decisions though there are other economic approaches that circumvent the aggregation and monetary evaluations of the CBA". Also preferably, in order to support a rigorous analysis, the entire section would need to be substantially revised to account for different theories of values, ethical assumptions underpinning the many existing (often competing but also complementary) schools of economic thought. Otherwise, the entire section and chapter 3 as a matter of fact risks caricaturising economists and not providing a more in-depth analysis of ongoing debates within economics.	Taken into account. Text revised in several parts to remove the source of a wrong impression of equating economic analysis with CBA
29711	3	33 of 144	15		15	AFTER the sentence ending on line 15, INSERT A NEW SENTENCE: "There have been few multilateral discussions of geoengineering to-date; however, acknowledging the uncertainties associated with geoengineering, the UN Convention on Biological Diversity reached decision X/33 para 8(w) in 2010, which restricts geoengineering activities unless certain conditions are met." A citation for decision X/33 should be provided in the chapter's bibliography: UN Convention on Biological Diversity (CBD), COP10 Decision X/33. The text of the Decision is available here: https://www.cbd.int/decision/cop/default.shtml?id=12299 .	Accepted and addressed in another comment: #29629

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29710	3	33 of 14	7		7	AFTER the sentence ending on line 7, INSERT A NEW SENTENCE: "Others point out geoengineering's historical roots in weather modification techniques used in warfare and the potential for geoengineering to be weaponized (Robock 2008; Fleming 2010; ETC Group 2012; Hamilton 2013).	Rejected - dual use problem is a prominent objection, but subsumed here under geopolitical arguments (for reasons of limited space)
19449	3	34	26	34	31	This paragraph conflates "economic activity" with "economic value"--even to economists, the two are not the same thing. Stated preference analysis might show that people have a high willingness to pay to save a small island with no economic activity, in which case it would still have economic value. I agree that this type of analysis would not inform the issue of procedural and compensatory justice, but I think the example is confusing.	Noted
19450	3	34	37	34	45	I suggest deleting this paragraph. The critiques of economics are extremely vague. In contrast, the following paragraph with five specific limitations of the use of economics for analysis of climate change is a very clear and helpful.	Taken into account. Paragraph made more concise.
24424	3	34	4	34	36	Although the methods of economics are not perfect and involve some limitation, economics take into consideration of ethical aspects in various ways. For example, read Amartya Sen, "On Ethics and Economics" London: Blackwell, 1989. Sen discusses generally the kind of theoretical ethics needed to provide a basis for welfare economics. Discussion of this section seems not well balanced.	Noted
36039	3	34	19	34	24	It is important to note that how these weights are generated is also an ethical decision.	Noted
36040	3	34	32	34	36	Having a home/a country has some intrinsic value not always easily measured in monetary terms. This should be acknowledged here.	Noted
21615	3	34				Wouldn't it be appropriate to introduce here Cost effectiveness analysis and how it might be one possible way to use economics and ethics together	Noted.
21614	3	34	34			"Should this ethical position be adopted, economics cannot be used to determine who should mitigate, even if the overall level of mitigation can be determined." Is this statement accurate? One may argue that economics can still be used to determine who should mitigate, but ethics would determine who would pay for it, no?	Taken into account. Text revised to address this and statement removed.
20298	3	35	13	35	14	The formulation "One of the greatest achievements of economics has been to show how decision-making can be decentralized through market mechanisms." is in my view misleading. Is it "that economic instruments and market mechanisms can be used to achieve policy goals" ?	Taken into account. Text revised to address this
29337	3	35	14			A reference to Hayek may be added, e.g. F. A. Hayek, Law, Legislation and Liberty, Volume 1: Rules and Order (Chicago: The University of Chicago Press, 1973).	Rejected: no specific reference needed for such a general point.
19451	3	35	15	35	17	Regarding the phrase "...if a carbon price is established... every agent that emits GHG will bear the cost of doing so," it is worth clarifying here or elsewhere in the text that not every sector of the economy will likely be covered under a climate policy. E.g., agriculture and forestry emissions are typically exempt, as are emissions from very small sources--so not every agent will bear the relevant costs.	Noted
23084	3	35	2	35	3	The point about questions of distribution can be strengthened with a citation to the following publication, which describes how standard IAM models use a technical-sounding assumption to finesse issues of global inequality: Stanton, E., 2011. Negishi welfare weights in integrated assessment models: the mathematics of global inequality. Climatic Change 107 (3), 417–432.	Noted.
19452	3	35	21	35	25	Suggest deleting this paragraph--it doesn't really provide any information.	Taken into account. Text revised to address this
24447	3	35	26	35	36	This paragraph starts by talking compensatory justice and procedural justice but it might be useful to place rights in the introductory sentence (it comes up later in the paragraph but for those unfamiliar with the challenges of compensatory justice this may not be clear that this is the core issue here)	Rejected - the page number and line number are not correct for this comment

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23086	3	35	26	35	29	The paragraph about "how groups of individuals interact" should be deleted. The language of free-rider problems and policy mechanisms assume a world in which individuals and nations are unrelentingly self-interested, which is both empirically incorrect and an assumption that gets in the way of meaningful action on climate change. It was invented by economists pursuing a narrow vision of methodology, and has no place in a summary of scientific findings. For an analysis of the damage done by this assumption, including in the context of climate change, see Nelson, J.A. 2012. Poisoning the Well, or How Economic Theory Damages Moral Imagination. INET Research Note #017 (forthcoming in The Oxford University Press Handbook on Professional Economic Ethics, ed. George DeMartino and Deirdre McCloskey). Currently, only a brief passage on p. 43 (lines 21-22) about how individuals might have "different preferences when...in the voting booth" hints at the problems with the market- and self-interest based assumption.	Taken into account. Text revised to address this
24425	3	35	32	36	13	I suspect this type of overly simplistic dichotomy between rich countries and developing countries potentially creates a gridlock of the climate change negotiation under the UNFCCC. Currently, the principle of "common but differentiated responsibilities and respective capabilities" set up a confrontation between Annex I countries and non Annex I countries. The real world, however, is of great variety and very dynamic. It is impossible to argue the real world challenges with such a simplistic classification. Need to develop the logic with further details and deep insights into the real world situation.	Noted.
22720	3	35	33	35		What does it matter "where" emissions are reduced so long as they are extensively reduced?	Noted
36043	3	35	41	35	41	The second sentence here should be changed to read, "However, it does not NECESSARILY follow that they..." As originally drafted, this would be policy prescriptive.	Taken into account. Text revised to address this
23085	3	35	6	35	8	The point about true uncertainty and way in which standard economics fails to come to grips with it could be strengthened with citations to Taleb, N.N., 2010. The Black Swan: The Impact of the Highly Improbable. Random House, NY and, in the context of climate change, Nelson, J.A., 2013. Ethics and the economist: What climate change demands of us. Ecological Economics 85: 145-154.	Taken into account. Reference considered.
24446	3	35	8			Another example to include here would be the difficulty that economics has with rights and non-substitutable elements of trade offs	Noted. Comment unclear.
36023	3	35	9	36	13	This discussion does not address a dimension of the equity issue that is an important feature in national and international discussions; namely, the proportionality of impacts on affected sectors and workers. Discussions about responsibility for bearing the costs of climate change frequently occur in the context of economic sectors, employment, and leakage, and this is arguably a more relevant issue for overcoming barriers to global action than more discussions including aggregated concepts like individuals and nations.	Taken into account. Text revised to address this
36042	3	35	9	36	13	We recommend omitting this section. Economics has a clear role that is defined elsewhere in the chapter.	Taken into account. Text revised to address this
36041	3	35	9	35	29	This section seems to assume a global price for GHG emissions, but if unilateral actions are pursued, then the lowest cost abatement opportunities may not be available, which means the policy is no longer cost effective. Also there is likely to be leakage. This is not the right section to discuss these concepts in detail, but the overarching framework of what aspects of climate change are important to keep in mind for policy design is curiously absent from this chapter. Certain attributes - global pollutant, long lived - matter when discussing the effectiveness of global vs. national level approaches.	Noted
22509	3	35	33		36	"the greatest reductions should be made where they can be made most cheaply. Ideally, emissions should be reduced in each place to just the extent that makes the marginal cost of further reductions the same everywhere." this point of view will do harm to the developing countries, where have the relative low cost but they should not reduce the same even more than developed countries.	Noted

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32473	3	355				<p>The page numbers refer to the pages of the pdf document (and do not coincide with the page numbers as printed in the bottom right of the document. Life Cycle Assessment (LCA) is standardised by ISO with that name. Therefore, it should never be referred to as Life Cycle Analysis. Furthermore, once defined, it can be referred to simply as "LCA". Many important works of Brandão et al. (e.g. 2013) and Lavoisier are missing, which are particularly relevant to chapters 8 and 11. These are:</p> <ul style="list-style-type: none"> -Brandão M, Lavoisier A, Kirschbaum M, Cowie A, Weidema B, Jørgensen SV, Hauschild M, Chomkamsri K, Pennington D (2013) Key issues and options in accounting for carbon sequestration and temporary storage in life cycle assessment and carbon footprinting. The International Journal of Life Cycle Assessment 18 (1) 230-240. DOI: 10.1007/s11367-012-0451-6. http://link.springer.com/article/10.1007%2Fs11367-012-0451-6 -Lavoisier A, Lesage P, Margni M, Brandão M, Samson R (2012) Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches. Climatic Change. DOI: 10.1007/s10584-012-0473-x. http://www.springerlink.com/content/b3251u56v728m870/?MUD=MP13. -Lavoisier A, Brandão M, Lesage P, Margni M, Pennington D, Clift R, Samson S (2012) Valuing temporary carbon storage. Nature Climate Change 2, 6–8. doi:10.1038/nclimate1335. http://www.nature.com/nclimate/journal/v2/n1/full/nclimate1335.html. -Brandão M, Mila i Canals L, Clift R (2011) Soil Organic Carbon changes in the cultivation of energy crops: implications for GHG balances and soil quality for use in LCA. Biomass & Bioenergy 35 (6). 2323–2336. Special issue: Modelling Environmental, Economic and Social Aspects in the Assessment of Biofuels. http://www.sciencedirect.com/science/article/pii/S0961953409002402 -Brandão M, Clift R, Mila I Canals L, Basson L (2010) A Life-Cycle Approach to Characterising Environmental and Economic Impacts of Multifunctional Land-Use Systems: An Integrated Assessment in the UK. Sustainability 2(12): 3747-3776. Special issue: Life Cycle Sustainability Assessment. http://www.mdpi.com/2071-1050/2/12/3747/pdf -Mueller-Wenk R and Brandão M (2010) Climatic impact of land use in LCA - carbon transfers between vegetation/soil and air. The International Journal of Life Cycle Assessment 15(2) 172-182. http://www.springerlink.com/content/02628184t2q98051/fulltext.pdf -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. Springer. 125pp. -Brandão M (2012) Food, Feed, Fuel, Timber or Carbon Sink? Towards Sustainable Land Use: a consequential life cycle approach. PhD thesis. Centre for Environmental Strategy (Division of Civil, Chemical and Environmental Engineering), Faculty of Engineering and Physical Sciences, University of Surrey, UK. 246 pp. Appendices 541 pp. -Mulligan D, Edwards R, Marelli L, Scarlat N, Brandão M, Monforti-Ferrario F (2010) The effects of increased demand for biofuel feedstocks on the world agricultural markets and areas. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-16220-6. http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16193/1/en24464_iluc%20workshop.pdf -Brandão M, Lavoisier A (2011) Assessing temporary carbon storage in life cycle assessment and carbon footprinting: outcomes of an expert workshop. Joint Research Centre, European Commission, Ispra, Italy. 	Taken into account. Comment is duplicate of comment 32472, and will be addressed in response to that comment.
36045	3	36	14	86	28	These subsections could be pared down quite a bit if for each tool state only application, ethical assumptions and red flags. Let citations lead subject area experts to more details.	Noted. Will be pared down.
36047	3	36	15	36	26	At the beginning of section 3.5, we suggest noting that this section focuses on describing standard practices in neoclassical economics. It can briefly acknowledge that critiques have been made to the neoclassical framework, referring to sections later in the text that discuss alternatives like behavioral economics in more detail.	Noted.
19454	3	36	16	36	19	Suggest deleting the first four sentences of the paragraph to avoid redundancy.	Taken into account. Section condensed to avoid redundancy

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19453	3	36	3	36	13	The final two paragraphs of Box 3.4.1 are confusing and don't add much value--suggest deleting.	Taken into account. Consider in revisions, but see comment 27478. Box can be significantly reduced in length.
36044	3	36	3	36	13	Suggest deleting these 2 paragraphs in the interest of space.	Accepted - wording will be improved
27478	3	36	8	36	13	This para is not based on science and must not remain in its current form. In particular the sentences "Much of the harm that is being done by these gases is suffered by people in poorer countries. A case might be made for saying that the poor should be compensated for the harm done them by the rich." must be reconsidered. Detection and attribution of specific damages is subject of WGII and is not straight forward as suggested in this sentence. In addition, words "harm" and "suffer" indicate a moral case, which is not justified. As the text rightly states: "This type of compensatory justice is beyond the scope of economic methods." Please refer to effort sharing concepts discussed in chapter 4.	Taken into account. Will consider re-wording, but reject essence of comment - the statements are soundly scientifically based and are relevant in the context of the chapter.
29338	3	36	8	36	9	For a different view, reference to Paul Harris, World Ethics and Climate Change: From International to Global Justice" (Edinburgh University Press, 2010) may be added. He emphasises the internal inequality in China, US and India.	Rejected. Better references could be found but are not necessary for such a high level discussion.
21616	3	36				Although this section is interesting and covers a lot of elements, it fails to cover one element which is essential. Why have most studies and analyses stopped using CBA to address the optimal level of climate change ? Why are most of the results presented in the report related to coste effectiveness analyses? Are there contexts (one example made in the beggining of 3.5 is the local application of CBA to less complex element of climate policy making) where CBA might be more appropriate?	Noted. But point is unclear.
29339	3	36		48		The relation of section 3.5, 3.5.1., and 3.5.2. to the later parts of the chapter on behavioural economics and culture could be clearer. The two sections may be shortened by summarizing the main points in the style of section 3.9. (page 87-88)	Accepted. Section condensed and text revised to make connection to later sections more clear.
19672	3	36	14	53	30	General comment: same as comments 22 and 24: Why is the focus of economic analysis only on standard cost-benefit analysis, traditional welfare economics and conventional integrated assessment models when the literature on climate economics is much more diverse, rich and interesting? This section and chapter 3 overall is heavily biased as presented with a focus on the economic analysis of the marginalist and welfarist type typical of a undergraduate economic textbook, whilst downplaying research in this area that has advanced significantly in various directions.	Rejected. Disagree with comment. Certain sections explain the standard neoclassical approach, but other sections explain alternatives.
36046	3	36	14	53	30	This section seems too early in the chapter. Before discussing aggregation, it would seem important to lay the groundwork for the aim of economic analysis in informing policy; the basics of market failure/public goods problems and why government intervention may be justified.	Noted.
36048	3	37	10	37	10	Equation 3.5.1 is unnecessary. It is just a substitution of the equation on line 31 into the equation on line 38.	Accept. Equations made less redundant
19456	3	37	33	37	46	This paragraph is very confusing, possibly because the concept of "lifetime equality" hasn't been adequately defined. If it's not essential, perhaps it can be deleted.	Accepted. Term deleted.
36049	3	37	28	37	32	Before getting to aggregation, it would also make sense to discuss the concept of the discount rate. Explain why we discount; what role it serves.	Rejected: discounting comes later.

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36050	3	37	43	37	46	The statement that a case can be made to treat intergenerational discounting differently has not been made here. While there are unique issues that arise in an intergenerational setting, most economists would say that intra and inter-generational discounting are conceptually similar and that their treatment should be consistent. Using two different discount rates for each setting would also cause a number of complications, such as time consistency, which are not discussed in this chapter but probably should be. See a paper by Cropper: http://www.rff.org/Publications/Pages/PublicationDetails.aspx?PublicationID=22072 and Arrow et al. at https://www.sussex.ac.uk/webteam/gateway/file.php?name=wps-56-2013.pdf&site=24 for some of the latest thinking on this issue.	Rejected: The case is made in the reference cited in the text. The first reference cited in the comment is irrelevant; it is about discount rates that decline over time. The second has two paragraphs that are relevant, and the say nothing useful.
26049	3	38		41		Since well-being will be explained in length later; and will also be part of the discussion in chapter 4, this can be shortened	Noted.
19458	3	38	32	38	44	These paragraphs seem redundant and could probably be cut.	Rejected: These are foundational concepts that have not previously been discussed.
19457	3	38	7	38	10	The definition of costs and benefits is confusing. These terms should be defined more clearly earlier in the chapter. A cost is a decline in wellbeing; a benefit is an improvement in wellbeing.	Accepted. This passage is not meant as a definition. Will change wording from "Costs and benefits are ..." to say "Costs and benefits include ...".
30263	3	38	9	38	9	Mention is made of, "...damage to health caused by climate change." Suggest the inclusion of a reference to a relevant US-based study in this chapter, which provided a cost calculation of health effects associated with six case studies of US events related to climate change in the prior decade, representing types of events that "can reasonably e expected to occur more frequently in the future" (Knowlton et al. 2011). [complete citation: Knowlton K, Rotkin-Ellman M, Geballe L, Max W, Solomon GM. 2011. Six climate change-related events in the United States accounted for about \$14 billion in lost lives and health costs. Health Affairs 30(11):2167-2176. doi:10.1377/hlthaff.2011.0229.]	Taken into account - will consider reference
36051	3	38	1	39	20	This seems very textbook-y and at an unnecessarily technical level. There is a way to communicate the basic concept of willingness to pay, why it is important, and how it is typically measured in a revealed vs. stated preference setting - and why this comes into play in this setting - without getting quite so far into the weeds.	Noted.
19459	3	39	1	39	20	The discussion of the numeraire is confusing. First, there's an internal contradiction in saying that using money implies equal value for money across people, since the chapter notes in several places that distributional weights can be applied. Second, the statement that use of money to measure value without distributional weights could lead to "egregious error in cost-benefit analysis" is hyperbolic and contradicts the goal of the chapter in not being prescriptive. I would suggest instead of making a strong recommendation to use distributional weights (as the chapter currently does), it instead recommend that analysts conduct sensitivity analysis using different weights to better understand the effect of this key assumption on policy results. Economics cannot tell us that one weighting scheme is more correct than another, it can just tell us how different the results are under these different assumptions.	Taken into account. The discussion of numeraire is made more concise. Economics is not as bad at judging weighting schemes as the comment suggests. The word 'egregious' removed.
23088	3	39	22	40	14	These approaches to "valuing a life" are not scientifically rigorous. For discussion, cite Frank Ackerman and Lisa Heinzerling. 2004. Priceless: On Knowing the Price of Everything and the Value of Nothing. By New York: The New Press.	Taken into account. The box is all about QALY's or quality adjusted life year. It is NOT about the value of life, which is a different discussion.

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36055	3	39	22			In the US it is common to use "value of statistical life" in these sorts of calculations. It is curious that this chapter never mentions this concept. Seems like this would be appropriate somewhere around page 39 in discussing Monetary Values and Cost Benefit Analysis (section 3.5.1.2).	Accepted. VSL will be discussed more in revision.
36054	3	39	22	40	14	The text could add a caveat noting that this type of calculation does not account for cultural norms such as altruism.	Noted
36052	3	39	6	39	7	This seems very prescriptive in a way that is out of step with the rest of the chapter and the literature generally. It states that distributional weights MUST be applied, but since most governments when doing assessments of policy actions do not use weights this seems false on its face. And it ignores the reasons why this is the case - for example, one may want to use distributional weights when discussing international approaches but not use them when contemplating unilateral action since the implication may be problematic from a sovereignty perspective (poor non citizens will have greater standing than citizens in richer countries). And what weights to use is as much a reflection of societal priorities as it is a reflection of differences in income - the chapter often ignores the ethical part of this decision, as though one can objectively select the weights. (See Anthoff and Tol JEEM paper on implications of various weighting schemes). Also, distributional weights at the country level are rather rough and imprecise - ideally we would weight individual utility which varies widely within a country, not some sort of country-level average. Finally, if weights are applied, they should be used on costs as well as benefits.	Accepted- text revised to remove prescriptive statements.
36053	3	39	6	39	7	This chapter does not take a nuanced look at the challenges and complications that arise if one uses weighting. For example, the possibility of inconsistency implied by distributional weighting and the parameters chosen for eta in the Ramsey discount rate formula.	Noted
19460	3	40	15			GDP is not a "monetary measure of value," though it's often used as a proxy measure. Economists acknowledge that because GDP does not include important non-market effects (like clean air, recreational value of public parks and other environmental amenities), it is at best an imperfect measure of wellbeing.	Taken into account. Can note its imperfection, but it is "a" monetary measure of value.
36056	3	40	15	40	17	GDP is not a welfare measure. We suggest deleting mention of it here.	Taken into account. We could change to say "GDP is another example of a monetary value sometimes used in effect as a proxy measure of value, but it omits many items of value and it does not incorporate distributional weights.
27479	3	40	24	40	26	Is "the power of taxation to redistribute income limited by the fact that redistributive taxes create inefficiency" or is the willingness to redistribute income using taxes the limitation?	Rejected - our sentence does not say it is "the" limitation. It just says it is a limitation.
36057	3	40	35	43	42	Section 3.5.1.3 is unnecessary and could be cut. The Paretian approach is of theoretical interest, but will play no practical role in a climate change policy. The references are also dated. Box 3.5.2 seems to be the justification for the inclusion of a section on Pareto efficiency. The conclusion reached in the box that "it would be possible to correct the externality, making some people better off without making anyone worse off" (p. 41, line 4) "is in all practical terms incorrect. Correcting an externality in this case requires imposing a cost on some party, which will not lead to Pareto improvement. The box here might be alluding to a "double-dividend" or "efficiency paradox" type argument. If this is so, we recommend making that argument directly. The notion that costs are avoided because "investment" (p. 41, line 7) will reduce future GHG emissions any comparison to welfare without the investment (which is the proper counterfactual). Investments are not free.	Taken into account - Box and discussion on the Paretian approach and Pareto efficiency made more concise.

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23089	3	41	1	42	38	This box, and in particular the accompanying (unnumbered) figure, do not belong in this report. The radical assumptions (e.g. extreme substitutability between natural and environmental capital) underlying the portrayal of "future generations' consumption" that exceeds that of the present generation are not even mentioned, and if analyzed can be easily seen as highly suspect, if not bizarre.	Rejected. The particular choice of the production possibility frontier is for illustration only.
36058	3	41	16	41	18	A lot of normative judgement is embedded in these two depictions. This is worth mentioning.	Taken into account. We could say that the assumptions in Stern and Nordhaus are normative.
19462	3	42				The discussion of distributional weights in Box 3.5.3 is redundant with the already extensive discussion of weighting in previous sections. I suggest consolidating all discussion of weighting in one or two sections.	Accepted - Box removed and discussion consolidated.
36060	3	42	20	42	29	Pareto maximums are actually relevant and meaningful to climate policy--but the discussion is too abstract rather than applying these concepts usefully to the situation at hand.	Accept. Will reword in revision.
22721	3	42	29	42	29	In the previous para, it was said that the potential pareto 'has problems'. It seems an overly cautious formulation, and this is implicitly acknowledged here, in saying that the reversed condition is *also* false.	Taken into account - language removed.
36061	3	42	30	42	38	This paragraph should be reworded to remove the normative statements suggesting that economic analysis is not appropriate for climate policy. It can instead acknowledge that economic analysis does not reflect distributional considerations, which should also be considered in climate policymaking. In particular we suggest deleting the statements, "The potential Pareto criterion has incredible implications," and "This is not credible."	Noted.
24448	3	42	40	42	43	I would like to commend the authors for reworking the discussion of cost benefit analysis substantially. This version is much improved and better represents the literature.	Noted. Thank you for your comment.
36059	3	42	1	42	38	This section could lead someone to believe that BCA is not a useful tool for decision-making, though it is standard. (For example the Paretian basis ... is hard to justify). A more constructive approach would be to make sure that policymakers understand the limitations of the approach for making decisions. Also this section is very technical and repeats - for example textbox 3.5.3 discusses much of the same material but in a less technical way. Finally, this section seems out of step with the way decisions are actually made - BCA is rarely the sole criteria for decision making, it's one input of many. Distributional implications are often treated separately (vs. integrated into the BCA), for example - which also makes the strong recommendation to use weights problematic. Political feasibility, administrative costs, monitoring and enforcement, etc. are all other criteria considered along with BCA, among others.	Taken into account. Will consider how to change the section in light of this comment.
26050	3	43		44		Since many scholars now agree, that "discounting goods" is highly problematic, this might be another place where the text could be shortened	Rejected: most economists continue to support discounting. The debate is about the level of the discount rate.
36064	3	43	18	43	19	Box 3.5.3. The notion that preferences are not measured precisely is so general that it has no particular meaning here. It is always the case that there is measurement error in empirical work. Recommend striking point #2.	Taken into account - box removed.
36065	3	43	33	43	33	Typo: The line should refer to "point #3 above" rather than "point #4 above."	Taken into account - box removed.

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36066	3	43	44	48	34	The references and discussion of discounting are dated. For example, a constant discount rate is assumed, but recent literature has shown that a declining discount rate may be more appropriate in an intergenerational context (e.g., work by Newell and Pizer). More recent sources were presented at the 2011 Resources for the Future workshop on discounting (papers online at http://rff.org/events/pages/intergenerational-discounting-workshop.aspx)	Taken into account. This point is already covered on page 48, lines 6-12. We added the following RFF publication: Arrow, K., M. Cropper, C. Gollier, B. Groom, G. Heal, R. Newell, W. Nordhaus, R. Pindyck, W. Pizer, P. Portney, T. Sterner, R. Tol, and M. Weitzman, Determining benefits and costs for future generations, Science, forthcoming.
19589	3	43	45	44	9	Shorten. Can be explained more efficiently.	Noted
36063	3	43	9	43	42	Given these critiques, please expand on the options to address them.	Taken into account - will address somewhere in 3.5 that CBA is not meant to be the only approach, and it's not valid with all of these problems. Will say one needs to use multiple criteria.
36062	3	43	1	43	8	This is a much more appropriate way of discussing the issue of distributional weights than the other sections in the chapter that are prescriptive.	Noted.
22503	3	43	44			The range of the social discount rate is very wide and the discount rates are different among different countries. Thus, although the literatures on the discount rates in developing countries is few, the author should list these outcomes and compare them with the outcomes of developed countries. Some diagrams showing this comparing may be useful.	Accepted: Will be revised in FD
22510	3	43	24		26	"The marginal value of money is the same for all individuals in the population. This means that from a societal point of view, giving (or taking) an extra euro to or from a poor person is societally equivalent to giving (or taking) an extra euro to or from a rich person." The monetary criteria between the rich and poor are totally different. policy-maker should take the implicit ethical assumptions into consideration.	Rejected. This comment shows a misunderstanding. That is not an assertion but a condition.
19590	3	44	17	44	17	Would be fair to quote Weitzman (2007). Reference: Weitzman M.L. (2007). A Review of The Stern Review on the Economics of Climate Change. Journal of Economic Literature 45, 703–724.	Accepted. Added reference: Weitzman M.L. (2007). A Review of The Stern Review on the Economics of Climate Change. Journal of Economic Literature 45, 703–724.
19591	3	44	18	44	28	State something on observed behavior in public policy? Positive frameworks basing inference on market behavior and purely normative approaches are discussed, but there are many relevant approaches in between. Reference: Groom, B., and D. Maddison. 2012. "The Changing Shape of Inequality Aversion in the UK: An Analysis over Time and My Income Quantile." Grantham Research Institute on Climate Change Economics and the Environment, working paper. London School of Economics. – and – Tol, R.S.J. 2010. "International Inequity Aversion and the Social Cost of Carbon." Climate Change Economics, 1(1): 21–32.	Rejected: We made the decision to limit positive analyses of discounting to a minimum in this section, which is normative. The first paper is not published and cannot be cited.

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36068	3	44	19	44	19	The current draft includes discussion of the positive perspective (p. 44, line 19) assuming that the market interest rate reveals the discount rate. Substantial literature, however, reveals a wide range of individual discount rates which are implied by ranges of observed behavior (such as durables purchases) or by experimental methods. The text could include mention of these wide ranges of observed values at an individual level. Frederick, Loewenstein, and O'Donoghue (2002) Journal of Economic Literature would be a good citation. This citation does receive a mention on p. 46, line 21, but the range of discount rates implied in the study is not mentioned.	Taken into account: Text revised
36067	3	44	2	44	2	Include the formula at the end of the sentence. E.g. "uses a discount rate of 4% on good I ($\$960 \cdot e^{0.04}$)."	Accepted
36069	3	45	1	45	9	We should also mention the likelihood of needing to pay *more* to achieve a given effect if action is delayed.	Rejected: This is a standard CBA argument that needs not to be restated there.
23090	3	45	22	45	30	The assumption of a growing economy is based on extreme assumptions about the substitutability between natural and manufactured capital. Analysis based on such an assumption--such as that in this section--should be eliminated.	Rejected: This critique is already covered on page 45, lines 1-9.
19593	3	45	22	46	9	Doesn't it make more sense to discuss the "wealth effect" after deriving the Ramsey equation since it follows from it by being the product of η and g (Gollier, 2011). It is by specifying this equation, the concept is given meaning. Reference: Gollier C. (2011). Pricing the Future: The Economics of Discounting. Princeton Press, Princeton.	Rejected. This is a question of taste. Usually, we prefer to give the argument before quantifying the effect.
22722	3	45	27	45	27	Why is this a *prioritarian* assumption?	Taken into account. This is covered in section 3.2.2.6.
19592	3	45	3	45	9	Two other recent and relevant references are: Traeger C.P. (2011). Sustainability, Limited Substitutability, and Non-constant Social Discount Rates. Journal of Environmental Economics and Management 62, 215-228. – and – Weikard H.-P. and X. Zhu (2005), Discounting and environmental quality: when should dual rates be used?, Economic Modeling 22, 868-878.	Noted. We will consider adding the references, if relevant
36070	3	45	1	45	9	This section should address the issue of time inconsistency.	Taken into account: text will be revised
36071	3	46	10	46	11	The terms "pure rate of time preference" or "pure discount rate" could be confusing to the reader. If this terminology is used, it should be made clearer that the "impure" rate of time preference is the relevant rate discussed in the rest of the chapter. The authors use "Implied social discount rate" in Table 3.5.1 when they mean to say the same thing that they call "discount rate" in the rest of the section preceding Equation 3.5.3 (p. 46, line 10).	Taken into account: Will clarify language
19594	3	46	14	46	15	The statement is not true. For it to be, one must condition on the sign of the other variable.	Taken into account: Change made in revision
19595	3	46	17	46	17	Would forecast be a better word than belief?	Editorial
36073	3	46	21	46	30	This discussion should provide more balance, adding citations and reasons supporting a positive discount rate. Currently only the arguments supporting a zero or near-zero discount rate are raised.	Taken into account. Also will change words from "pure discount rate" to say "pure rate of time preference", and then later in line 26 change the word "discounting"; that is confusing, because we are not talking about discounting, we are talking about weights in a SWF.

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19596	3	46	30	46	30	Other stands are agent relative ethics (Arrow, 1999) or emphatic distance (Schelling, 1993). But this approach may violate the foundations of the Ramsey equation since delta will no longer necessarily be a constant. References: Schelling T.C. (1993) Intergenerational Discounting. Mimeo, University of Maryland.	Taken into account: section will be revised, references will be examined.
19597	3	46	32	46	45	Rather than a thought experiment, I would appreciate an overview or discussion of relevant values of eta since it is of policy relevance and no consensus seems to exist. Also the discussion on L. 14-20, same page, should be more precise.	Noted. We do indicate there is a consensus on the range for eta.
36072	3	46	11	46	20	The discussion of the eta parameter in the Ramsey discounting framework should make more explicit the link between distributional weights and the discount rate. If distributional weights are used, that implies a higher social discount rate according to the Ramsey framework.	Taken into account. Will revise sentence but clarify: "If prioritarian distributional weights are used (inequality aversion), that implies a higher social discount rate according to the Ramsey framework."
19466	3	47				The footnote about US government discount rates seems out of place because they are not based on Ramsey discounting, they're based on a positive approach to discounting.	Taken into account: footnote adjusted and US approach to discounting noted.
21618	3	47	19	48	4	As per previous comment - editing to emphasise the contribution of recent literature with explanations for differences (for example as in these lines) would benefit the whole chapter.	Noted.
21617	3	47	3	47	4	This table illustrates an important purpose of the chapter that is somewhat lost in the build up, i.e. to present the existing relevant literature and illustrate salient points. In editing the chapter down, sections like this should be retained at the expense of the "text book" paragraphs.	Noted.
19598	3	47	3	47	3	A discussion of the numbers provided in the table and limitations in these approaches would be preferable. A table does not say much in itself. This is especially important since motivation and calibrations of the Ramsey equation differ so much between the sources.	Rejected - other reviewers liked the synthesis that is provided by a table, in comparison to a text. However, more discussion of the numbers can be added.
22504	3	47	17	47	18	it's unclear that whether aggregated cost and benefit or per capita ones are considered in the evaluation of the global discount rate. From the perspective of justice, it seems that cost and benefit per capita should be considered here. Population should be considered. And it needs to be discussed on how to apply population into the evaluation of global discount rate.	Taken into account. This is covered in section 3.5.1
19599	3	48	11	48	12	Papers criticizing the validity of this approach are in the making. These should be referred to if published before the chapter is finished.	Noted
19468	3	48	29			Where does the 4 in $0.5 \times 4\% = 2\%$ come from?	Taken into account
19469	3	48	30	48	34	The conclusion that the literature implies a discount rate between 1-7% or 0-8% doesn't seem to be well supported by the entire discussion preceding it. For example, it doesn't match with Table 3.5.1. It's also not clear if these ranges are supported by both the normative and positive literature since the section puts more emphasis on the normative approach. Any conclusion should probably incorporate both literatures.	Noted. Will revise for clarity. Table 3.5.1 is for the risk free rate. A risk premium should be added to it, as explained on page 49. The link with the conclusion has been reinforced.

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23092	3	48	30	48	34	Stating that social discount rates of up to 7-8% have "medium" or "high" evidence or agreement vastly misinterprets the literature! As widely discussed, suggested discount rates above zero or small fractions rely on one or many extremely suspect assumptions, including (1) people think about future generations in the same way they think about short-term financial investments (2) the degree of substitutability between natural and manufactured capital is (against all evidence) assumed to be so extreme that economic growth can be projected to continue unfettered (3) the Ramsey Rule with its perspective of the all-knowing social planner and framing of the problem as decision-making over quantifiable (and at least probabilistically known) is appropriate for the analysis of climate change. Relevant citations include: Howarth, Richard B. 1998. An Overlapping Generations Model of Climate-Economy Interactions. The Scandinavian Journal of Economics 100 (3):575-591; Howarth, Richard B. and Richard B. Norgaard. 1993. Intergenerational Transfers and the Social Discount Rate. Journal of Environmental and Resource Economics 3:337-358; Norgaard, Richard B. and Richard B. Howarth. 1993. Resolving Economic and Environmental Perspectives on the Future. Research on Social Problems and Public Policy 5:225-241; Howarth, Richard B. and Richard B. Norgaard. 1992. Environmental Valuation Under Sustainable Development. American Economic Review 82(2):473-477; Nelson, Julie A. "Economists, Value Judgments, and Climate Change: A View from Feminist Economics," Ecological Economics 65(3), April 2008, pp. 441-447; Frank Ackerman, Stephen J. DeCanio, Richard B. Howarth and Kristen A. Sheeran, "Limitations of integrated assessment models of climate change," Climatic Change, 2009, 95, 297-315; Frank Ackerman, "Climate economics in four easy pieces", Development (2008) 51(3): 325-331; Simon Dietz and Nicholas Stern, "Why economic analysis supports strong action on climate change: A response to the Stern Review's critics," Review of Environmental Economics and Policy (2008) 2(1): 94-113.	Taken into account. We clearly differentiated the discount rate used by people in their own life, and the rate of pure preference for the present that should be used at the collective level. Uncertainties are discussed in the section. They indeed reduce the discount rate. They don't reduce it a lot, however. Substitutabilities are also discussed in that section. Finally, if ambiguity and ambiguity aversion have a role to explain individual behaviours, we believe that ambiguity aversion has no strong support on normative grounds. We added the following reference: Simon Dietz and Nicholas Stern, "Why economic analysis supports strong action on climate change: A response to the Stern Review's critics,"? ?Review of Environmental Economics and Policy (2008) 2(1): 94-113.
36075	3	48	30	48	34	It may be helpful to briefly link the discussion of the discount rate to the implications for the cost of delayed action. For example, http://desmogblog.com/2013/03/14/climate-disruption-tax-costs-americans-... provides some citations for the cost of delayed action reconceptualized as a tax.	Rejected: this section focuses on the concept of discounting. Other sections focus on applications in this chapter and in other chapters.
36076	3	48	30	48	34	This conclusion does not reflect the range of views on discounting presented in the text or the broader literature. There is no single accepted characterization of the correct approach to discounting. The 1-7% and 0-8% ranges are also so wide as to not provide useful guidance to policymakers.	Taken into account. The literature has no consensus. The point can be made here that we therefore resort to voting. The point of this discussion in the text is to help the voter think about how to vote.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24449	3	48	35	48	42	This is a strangely narrow discussion of "co-benefits", especially as for many developing countries many other "co-benefits" are desired. Indeed the entire framing of this paragraph at the start of a section on cobenefits places climate change policy only as a GHG reducing policy instead of ALSO a policy about adaptation and human development. For many developing countries the main goal is an economically viable long term development trajectory which will reduce poverty and in which the "co-benefit" is lower GHG emissions. In the current framing any human development that could be caused by mitigation focused policies is excluded from this discussion. Similarly, biodiversity, one of the central "cobenefits" of REDD + discussions is also excluded. References would include the vast literature on REDD and biodiversity cobenefits and on the link between development and mitigation (such as literature on CDM). While this literature often points out how hard these 'cobenefits' are to achieve, it would at least signal to readers that they are important in any discussion of co-benefits that is of relevance to a broader base of countries. There are so many potential references it is hard to know where to start but try Kok et al Climate Policy 2008; Stickler et al Global Change Biology 2009; Boyd et al. 2007 Environmental Science and Policy	Taken into account - a phrase will be added to the text to note other examples of co-benefits applicable to developing countries and will clarify primary/secondary. However, any extensive discussion of those particular co-benefits properly belongs in Chapter 4.
36077	3	48	35	48	42	This is a one-sided characterization of the issue. Policies can also lead to increases in co-pollutants; there can be dis-benefits associated with some policies.	Accepted. Add 'adverse side-effects' to the section title and making sure that the negative effects of mitigation measures and policies are also covered semantically throughout the section.
26173	3	48	40	48	42	Please simplify 'the use of coal and other fossil fuels' to 'use of fossil fuels' as it is no of importance to distinguish fuels.	Editorial
25680	3	48	40	48	42	This part should be deleted completely because SOx/NOx emission can be technically decontaminated by installing SOx/NOx removal equipments into coal power plants, as shown in (Margaret, 2005, page369-370, Fig9) and (Sonia, 2005, page3 and 6). <Reference> [1] Margaret R. Taylor, Edward S. Rubin, and David a. Hounshell (2005). Regulations as the Mother of Innovation: The Case of SO2 Control LAW & POLICY, Vol.27 No.2 April 2005 [2] Sonia Yeah, Edward S. Rubin, Margaret R. Taylor, and David A Hounshell (2005). Technology Innovations and Experience Curves for NOx Control Technologies Journal of Air Waste Management Association 2005 Dec.;55(12):1827-38. Available at: http://gsppi.berkeley.edu/faculty/mtaylor/taylor_expcurvenox.pdf	Taken into account - will change text in lines 40-42 to say "carbon policy would all else equal ... reduce emissions of other local pollutants ...".
36074	3	48	1	48	12	The extensive discussion of a single paper's approach to discounting here is not reflective of the wider literature on discounting and uncertainty. For instance, there is no discussion of the confusion with eta representing more than one concept (risk aversion and equality) and ideas for separating these out per Geoffrey Heal.	Rejected. Equation 3.5.4 forms a cornerstone of the modern theory of finance. It is very far from being taken out of a "single paper". Concerning the separation between risk aversion and equality, much of section 3.5.1. deals with this aspect.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29340	3	48		53		A note on the similarities and differences to "positive externalities" may be added.	Rejected. A private activity (like electricity generation) may have externalities. But we are talking about a government activity such as climate policy. It is not an "externality" of climate policy that SO2 is reduced.
34283	3	48	35	48	35	Please consider adding 'advers side-effects' to the section title and making sure that the negative effects of mitigation measures and policies are also covered semantically throughout the section. Additionally, I would suggest relating the co-benefit framing provided here to existing literature, such as OECD (2000) (http://www.oecdbookshop.org/oecd/display.asp?lang=EN&sf1=identifiers&st1=5lmqcr2k80tl) - in particular to the contribution by Krupnick, Burtraw and Markandya ('The Ancillary Benefits and Costs of Climate Change Mitigation: A Conceptual Framework', www.oecd.org/environment/cc/2049184.pdf).	Accepted. Add 'adverse side-effects' to the section title and make sure that the negative effects of mitigation measures and policies are also covered semantically throughout the section.
32399	3	48	40	48	42	Please specify that you probably refer to near-surface/tropospheric ozone.	Accepted -- will consider the qualifier but it may be too much detail.
34284	3	49	11	49	14	In my understanding, co-benefits and adverse side-effect are not necessarily restricted to changes in "a different set of objectives" but may also describe the effects on the objectives that are here called climate objectives - albeit through channels that are unrelated to climate effects (such as biodiversity loss due to biofuel monocultures or health gains due to local air quality improvements related to mitigation measures). I would hence refrain from the clear-cut distinction between direct benefits with respect to climate objectives, on the one hand, and co-benefits with respect to additional objectives, on the other. Part of this is already discussed in the paragraphs at the end of 3.5.3.2 (page 51, lines 3-15) that might be moved up.	Taken into account. Can move up the lines 3-15 of page 51
34285	3	49	21	49	24	I would suggest clarifying that the reductions in SO2 discussed here are restricted to those that are co-benefits of mitigation measures. Otherwise, the sentences might seem trivial and unrelated to the assessment of co-benefits. Doesn't a situation where the welfare gain from one ton reduction in SO2 is less than its MED imply that the externality from SO2 is 'over-corrected' (as opposed to "partly corrected")? Please consider adding that for many objectives, this is a rather theoretical distinction since many environmental objectives are achieved to a sub-optimal degree only - particularly in developing countries.	Taken into account - the first sentence is not necessary. The statement is true for any reduction in SO2 (whether from climate policy or from any other effort). The paragraph starts with discussion of cobenefits.
34286	3	49	26			Please make sure that the co-benefit framing provided in chapter 3 is not restricted to the effects of "climate policy" but also applies to the assessment of alternative mitigation technologie as the latter is the focus of the sector chapters and the synthesis in section 6.6.	Taken into account - will clarify that "climate policy" can include a tax, permits system, mandated technology, or other mitigation policy.
34287	3	49	30			I suggest adding a sentence relating the major steps laid out here to the assessment of existing literature done in other parts of the report, e.g. along the following lines: "The few studies that attempt a full evaluation of the global welfare effects of mitigation co-benefits focus on but a few objectives due to methodological challenges and are assessed in section 6.6. Studies that focus on specific countries or regions are not comprehensively assessed in this report but some examples are provided in the next section."	Accepted: an appropriate reference to section 6.6 will be added.
21597	3	5	0			This is a very important chapter and many of its sections are well connected and written, although some topics are missing. It is however hard to link this with Chapter 6. Some of this chapter section are redundant and not well connected with the rest.	Noted. Will work to improve.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21598	3	5	0			This chapter contains no discussion of GDP, employment effect, the justification for the 5% discount rate used in chapter 6. There is also no discussion on the difficulties of determining the social cost of carbon. There is a discussion of the shortcoming of different model types but not of their strengths.	Taken into account. Will discuss the difficulties of determining the social cost of carbon in 3.9.4. Chapter is coordinating with Ch. 6 on discount rate used.
25060	3	5	10	5	10	Add after 'climate system' the following; "while taking account of sustainable economic development". Please check the Article 2 of the UNFCCC.	Reject--not necessary.
19581	3	5	11	5	11	This could also be an issue of forecasting, and not only judgment and decision.	Noted
35933	3	5	11	5	11	Could drop this point to avoid redundancy.	Noted
35934	3	5	11	5	11	Typo: sentence should end ..."about it." with a period rather than a question mark.	Taken into account. ES rewritten.
40564	3	5	18	5	18	It is not sure whether there exists a consensus view that an evaluation of these questions is ultimately a matter for ethics. No doubt that ethics play an important role. But the above expression is rather in too much assertive tone. How about to change the sentence to "Ethics, no doubt, plays an important role in evaluating these questions".	Noted.
25061	3	5	18	5	18	I am not sure whether there exists a concensus view that an evaluation of these questions is ultimately a matter for ethics. No doubt that ethics plays an important role. But the above expression is rather in too much assertive tone. How about to change the sentense to "Ethics, no doubt, plays an important role in evaluating these questions".	Taken into account. This comment repeats exactly what is stated in comment 35934, and will be addressed in response to that comment.
35930	3	5	2	8	3	Even highlighting historic responsibility in the exec sum the way the text does reflects a normative judgment on the part of the authors regarding the legitimacy of that concept in determining issues of responsibility (the authors purport in several places to just be describing the state of the literature, and not making normative judgments). The text needs to be revised substantially to remove these normative statements.	Reject--it is an issue that is important to some. Historic responsibility includes the concept of zero responsibility.
24438	3	5	22			Why is the ethics discussion here limited to only a mitigation-focused burden-sharing approach? As has been seen in debates within the ADP and within academic literature (see Adger and Paavola 2006 for instance) adaptation presents complex ethics questions as well	Noted. We focus on both.
19582	3	5	28	5	31	Delete or make this more precise.	Reject. In any event, ES is completely rewritten for FD.
35936	3	5	28	5	29	"The right decision-making process does not always lead to the right outcome." The statement introduces additional questions. What does it mean by the "right" decision-making process and the "right" outcome? To determine what is "right" would also involve judgment, value and ethical concerns. More neutral phrasing is suggested.	Taken into account. ES rewritten.
25062	3	5	28	5	31	I don't think this paragraph is necessary. The example of criminal trial may not be the relevant one.	Taken into account. ES rewritten.
35937	3	5	29	5	31	This example does not seem to be the most appropriate example and diverts the key point. Suggest to delete the sentence, and combine this and the next paragraph and work on the flow of the argument.	Taken into account. ES rewritten.
23074	3	5	32	5	45	The limiting of ethical criteria to only "justice" and "value," both of which start from a individualist point of view, omits the important criterion of a positive responsibility for care based on interdependence. See citations in my comments on Sec. 3.2.1.	Taken into account. Covered in section 3.4.1.
35938	3	5	33	5	37	The example used here to describe the relationship between rights and justice is not accurate in terms of a causal chain-- it is not possible to directly correlate climate change in isolation from other factors as a reason for displacement. We suggest revising accordingly.	Noted

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
40563	3	5	6	5	14	These two paragraphs are written based on insufficient understandings of the Article 2 of the UNFCCC. First of all, the objective of the Framework Convention is not solely "to prevent dangerous anthropogenic (not anthropocentric as written in line 8) interference with the climate system. In the same Article, you may find the following sentence; "Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner". This explanation contradict to Chapter 1 of SOD (refer to Ch. 1 from page 15, line 26 to page 16, line 14). There interpretation of the Article 2 is well summarized as; "Article 2 requires that societies balance a variety of risks and benefits—some rooted in the dangers of climate change itself and others in the potential costs and benefits of mitigation and adaptation" (from lines 12-14). This is one of the most important messages of AR5. We should be very careful not to mislead readers on the interpretation of the Article 2. In this sense, please rewrite to reflect the above discussions.	Rejected--purpose is not to review entire treaty. ES has changed substantially in any event.
35932	3	5	7	5	8	Misquotes UNFCCC. States "to prevent dangerous anthropocentric intereferece with the climate system" should be "anthropogenic." This error is repeated elsewhere (page 8 line 14) so the authors should do a global find and replace	Accepted. "Anthropocentric" changed to "anthropogenic" when related to UNFCCC.
25059	3	5	8	5	8	Add after 'climate system' the following; "while taking account of sustainable economic development". There are two reasons; 1) Article 2 of the UNFCCC says after 'climate system' that "Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner". 2) IPCC/AR4/WG3/Ch1 describes the article (the objective) as "The choice of a stabilization level implies the balancing of the risks of climate change (risks of gradual change and of extreme events, risk of irreversible change of the climate, including risks for food security, ecosystems and sustainable development) against the risk of response measures that may threaten economic sustainability" (p. 97).	Reject. This issue is adequately discussed in the chapter; no need for elaboration.
27456	3	5			8	Overall, this ES reads more like an introduction of a text book. Please devote more space to your key findings and leave introductory remarks to the Introduction. Every paragraph should state its key finding in the first sentence (in bold), qualified with an uncertainty statement, and then substantiated with relevant evidence in the paragraph body and referenced to sections at its end. As it stands now, it is absolutely not clear to the reader what your key assessment results are. Moreover, some paragraphs are not linked to each other, i.e. the storyline is not there (e.g. p. 7, l. 29-46). The ES would also benefit if it was shortened. Please be as concise and policy-relevant as possible. The ES lacks a final paragraph that outlines research gaps.	Noted. We recognize that ES and intro overlap and will work to make them distinct in FD.
24216	3	5	1	8	3	The executive summary should have clear policy implications, works as guidance and provide reference in the negotiations afterwards. The current executive summary should enhance its policy implications based on the key conclusions from the main text, and the following are examples: (1)"A carbon tax or other policy may be enacted to reduce GHG emissions, but it may also increase or reduce other emissions. It may thus require changes in other non-carbon policies, such as sub-national restrictions on sulphur dioxide or other local pollutants."(P56,Line 20-23); (2)"Many developing countries have less human and financial resources, advanced technology, and poorer institutional and administrative capacity compared to developed countries. This may constrain their ability to evaluate, implement and enforce policies." (P56,Line 35-37); (3)"Developing countries may require significant international financial resources in order to support their mitigation activities or make them economically viable." (P57,Line 2-3); (4)"To the extent that the adverse impacts of climate change are likely to be borne more by poor than rich countries, the lack of weighting understates the damages."(P76,Line 15-16)	Taken into account. ES rewritten.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21599	3	5	1	8	3	The Executive Summary is poorly structured and would benefit from being rewritten. It is too long and confusing. This will be the part read by those who will go beyond the Report executive summary and so it has to be a clear and well focused document. Also The framing chapter should be more clearly linked with the other two framing chapters, what is in here and what in the other two? We read that in the introduction but maybe it would be worth mentioning here too.	Taken into account. ES rewritten.
35929	3	5	1	8	3	The ES jumps from topic to topic. In particular, the last part of the ES reads like a laundry list of disconnected items.	Noted. Will be rewritten.
35931	3	5	2	8	3	In the executive summaries of other chapters, there are section references, though there are not in this chapter. There should be consistency across chapters.	Taken into account. ES rewritten.
34448	3	5	21	5	23	This seems policy-relevant. It's sad though that you ask the question without providing answers. What kind of ethical arguments can be used to justify different effort sharing principles? Under what circumstances and for whom tend these ethical arguments to be valid? Please provide more detail.	Noted. There is plenty in the chapter about this. It would be very hard to put these answers into the short summary.
27454	3	5	21	5	23	It is a pity that you only raise the question without providing answers. What kind of ethical arguments can be used to justify different effort sharing principles? The ES should provide results and reference to where in the chapter the reader can find more on the respective assessment result. If you concluded that there is not definite answer, then explain why.	Noted--beyond the scope of the chapter. We say countless times that burden sharing is a normative issue and we make no recommendations.
34449	3	5	24	5	27	This seems policy-relevant. Please provide an answer to the question by assessing the range of damage cost estimates that are available in the literature; especially new evidence that was published since AR4. Please add to your finding that expected damage cost need to be weighted against the cost of mitigating damages. This is missing from your paragraph. If you conclude that a definite answer cannot be provided by science, make this clear and state why it cannot be provided. Please provide more detail.	Noted--beyond the scope of the chapter.
35935	3	5	24	5	27	The summary description of how to understand how much mitigation to undertake has a one-sided focus on the effects of climate change. Economists usually also evaluate the costs of taking action to avoid these damages. Please revise accordingly.	Taken into account. ES rewritten.
27455	3	5	24	5	27	Please, provide an answer to the question you raise e.g. by assessing the range of evaluations on expected damage cost weighted against the cost of mitigating these damages. If you conclude that a definite answer cannot be provided by science, make that clear and state why it cannot be provided. Please be more specific.	Noted--beyond the scope of the chapter.
30826	3	5	9	5	19	Overall, there is a general confusion in this chapter (illustrated here for the first instance, but later on too) between risk, danger, and impact/damage. "The science of climate change has not conclusively defined a sharp threshold that divides safe concentrations of GHG from highly damaging ones." - this talks about impacts. But then "Consequently, determining what is dangerous is a matter of human judgment regarding tolerable levels of risk." This is not right. The judgment is on what level of impact is tolerable -- not what level of risk equates to a certain impact that is tolerable. Words like "Dangerous" and "Risk" are used sometimes to imply a level of possibility of occurrence, and then sometimes a level of impact, and then sometimes both. Suggest this be clarified.	Noted
24571	3	5	1	8	3	Given the likelihood that some degree of climate change is now unavoidable, discussion of the economics of climate change adaptation within Chapter 3 is referred to but not discussed in adequate detail. A more thorough examination of this important emerging area of climate change economics is recommended. (Alternatively, if this topic is discussed in detail in other chapters (i.e. within WG II chapters), reference to that discussion should be included within relevant areas of chapter 3).	Noted--WG2 has a chapter on economics of adaptation.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34288	3	50	3	50	34	To save space, I would suggest restricting this assessment to post-AR4 references that cover topics which are not already covered by other chapters. Based on these criteria, Ryan (2012), Groosman et al. (2011) and Riekkola et al. (2011) seem to stand out. This choice might be complemented with studies focusing on regulation rather than carbon prices (such as Knittler and Sandler, http://www.nber.org/papers/w17390) and covering other parts of the world (such as Yang et al. (http://www.sciencedirect.com/science/article/pii/S0306261913002365)). Please make sure that the term co-benefit is only used for the physical effects and not to the related welfare effects (see, e.g., lines 16/17, 22, 27 and 32).	Noted.
19472	3	50	35	50	36	Not all of these examples are necessarily benefits or costs--e.g., employment is more of an economic impact.	Rejected - an increase in employment is a benefit.
36078	3	51	16	52	30	It is confusing to talk about second best before discussing first best approaches. This is particularly true of the double dividend since whether this will occur is related to the particular policy instrument used.	Taken into account. Add a sentence p.51 to the paragraph ending line 39 that says "if every externality μ_i is corrected by a tax rate or price exactly equal to μ_i , then the outcome is "first best". In that case, dU in equation 3.5.6 is equal to zero, which means welfare cannot be improved by any change in any policy. If any t_i is not equal to μ_i , however, then the outcome is not optimal, and a "second best" policy might improve welfare if it has any direct or indirect effect on the amount of that good, Z_i ."
36079	3	51	16	53	30	Sections 3.5.3.3 and 3.5.3.4 discuss carbon pricing in the context of a "second-best setting" and also the double-dividend hypothesis. However, this material comes before the discussion of policy evaluation (Section 3.7) and therefore carbon pricing in the first-best setting (e.g., graph on p. 58). It would make more sense to reorganize this material and have the material currently in Sections 3.5.3.3/4 come after the discussion in Section 3.7.1.	Taken into account. Consider re-arranging the order in revision.
19473	3	51	4			The "social cost of carbon" needs to be defined before being casually mentioned in the text.	Accepted: Will change text so as not to equate μ with "social cost of carbon"
32400	3	51	8	51	9	Please specify that you probably refer to near-surface/tropospheric ozone.	Accepted
21619	3	52				Why not talking about double dividend etc, in section 3.6?	Noted: Organizational decision.
34289	3	52	25			Is there any post-AR4 literature that would need to be assessed here?	Noted. Not much post AR4.
36081	3	53	31	55	46	The discussion of policy instruments (Section 3.6) is incomplete and outdated. "Pure," first-best economic instruments (taxes/permits/subsidies) are contrasted with prescriptive regulatory approaches. However, many regulations blend these elements using "second-best" incentive-based approaches, e.g., tradable performance standards. The discussion would be improved by recognizing that between the extremes of "efficient pricing of externalities" and "prescriptive regulation" there is a sliding scale of approaches that incorporate economic incentives (flexibility, trading, etc) to varying degrees. Frequently the practical question facing policymakers is not whether to adopt one extreme or the other but how to use incentives to improve the cost-effectiveness of regulation.	Accepted - more reference to second best alternatives
36082	3	53	32	53	33	Delete first sentence of paragraph.	Accepted

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
34290	3	53	33			Please consider rephrasing the sentence as the meaning of 'measure' in the glossary is non-generic and might lead to confusion if used in a generic way as is done here.	Accepted
26503	3	53	18	53	30	Regarding the double dividen hypotehsis: "Thus, an increase in the carbon tax that reduces emissions () has a direct benefit of increased economic welfare through the second term, but only to the extent that emissions damages exceed the tax rate (). If the labour cost cuts increases labour supply, then the first term also increases welfare (a double dividend). But the carbon tax also raises the cost of production and the equilibrium output price which itself reduces the real net wage (the tax interaction effect). If that effect dominates the reduction in the labour cost rate (from the revenue recycling effect), then labour supply may fall (). In that case, the first term has a negative effect on well-being. In other words, the double-dividend is possible under some circumstances and not others. If the revenue is not used to cut the labour cost rate, then the real net wage does fall, and labour supply may fall. Then Fullerton and Metcalf (2001) show cases where the very first step to introduce a carbon tax may reduce economic welfare, if the welfare cost of exacerbating labour supply distortions (the first term) exceeds the gain from reducing the pollution externality (the second term)". SUGGEST proposing references to findings from IILS 2009 that at the global level, for instance, if a price on CO2 emissions was imposed and the resulting revenues were used to cut labour taxes, then up to 14 million net new jobs could be created (IILS, 2009). Source: International Institute for Labour Studies (IILS) 2009. World of work: The global jobs crisis and beyond (Geneva, ILO).	Taken into account. Will consider reference. Can add text explaining the fallacy in the bolded text.
22463	3	53	31			It would be useful if this chapter could establish a definitive categorisation of climate policies that could be widely used by ensuring that each category of policy instruments includes a list of all the main specific types of policies that come under it, rather than just examples. In particular it needs to be made clear exactly where feed-in tariffs and quotas for low carbon energy fit in.	Taken into account - this particular taxonomy has been revised and improved endless times in order to accommodate different aspects. Importantly, it is also consistent with previous IPCC reports. It is very likely that this "improvement" process will continue. However, note that it is also likely to be impossible to accommodate ALL the different conceptual connotations and thus provide a "definite" categorization.
36080	3	53	31	53	41	A discussion of the concept of market failure, the unique characteristics of climate change, and how they influence choice of policy instruments should be added here.	Accepted - text about market failures will be integrated -albeit briefly due to the fact that most of the chapter do touch upon the very same issue.
36083	3	53	32	55	46	This section could be reframed to give the reader more intuition for why market instruments are generally more efficient or cost effective. For example, cap and trade allows for flexibility in how, when, and where reductions occur - firms can reduce output, substitute to other inputs, or change the production function (technology). Also it is dynamically efficient - allowing for smoothing of decisions over time. And it induces innovation to go beyond the standard if it is cheap to do so. Regulatory approaches usually limit this degree of flexibility in some ways - performance based approaches may allow firms to substitute inputs or change technologies but if they are rate based then they do not allow for reductions in output as a form of compliance. And they often do not afford firms flexibility over time or space. They also usually only induce compliance up to but not beyond the standard.	Accepted - some of the aspects mentioned in the comment will be taken into account (e.g. flexibility), however generalizations are not recommended and empirical aspects are covered by sectoral chapters, including Ch13 and 15.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29341	3	53		57		The overview of different economic instruments are too short. If they can't be expanded, they may be cut out.	Rejected: The overview of instruments is needed to support the discussion and specific section. At all events, full details of policy instruments are given in section 3.6 and also across all sectoral chapters, including Ch. 15: National and sub-national policies
24450	3	54	1	54	30	This comment pertains to the entire "co-benefits" discussion and is simply to highlight that this discussion remains focused almost entirely on very traditional economics oriented aspects of co-benefits but does not encompass what is commonly discussed in climate policy as cobenefits (including as I've noted above - many aspects of development, biodiversity protection and other elements that are difficult to value). I think that one of the difficulties with this section is that longer more technical sections on estimating co-benefits fail to address many of the issues developing countries have been most concerned about, AND do not reconnect with the earlier caveats and discussions of the limits of CBA. If you wish to leave these examples in, tying them to a richer initial discussion of cobenefits in the paragraph I have discussed above, AND to the caveats about valuation in CBA might help to place this in a broader climate policy relevant context.	Rejected: the text in no way precludes the alternative co-benefits mentioned by the commenter.
36084	3	54	12	54	12	Typo: delete "than anticipated."	Editorial
23514	3	54	15	54	36	It would be crucial to mention here that taxes and trading schemes can be applied down-, mid-, and upstream and that administrative costs and potential effectiveness differ depending on the level at which they apply.	Rejected - I agree but for specific applications see sectoral chapters and Ch. 13 and 15
36085	3	54	15	54	26	Consider mentioning upstream vs. downstream (point of compliance) research on carbon taxes. This is some of the most useful research on how to implement a carbon tax. A sentence could acknowledge this literature and cite the recent discussion draft by Waxman et al. http://democrats.energycommerce.house.gov/index.php?q=news/waxman-whiteh... The draft includes discussion of other important issues surrounding carbon taxation, too. But it is a good reference for the point of taxation issue.	Rejected - I agree but for specific applications see sectoral chapters and Ch. 13 and 15
19478	3	54	23	54	26	It is important to note that tax thresholds or exceptions would reduce the efficiency of the climate policy.	Rejected. Too detailed for framing chapter
25609	3	54	30	54	31	Delete "excellent" to avoid the misunderstanding of readers that ETS is best policy. Chapter 15 mentions that "there is no best policy".(P51 FAQ15.2)	Editorial
26171	3	54	30	54	31	Please remove 'excellent' as EU ETS doesn't work well due to low carbon prices and backloading.	Editorial
25681	3	54	30	54	34	The part of "EU ETS is an excellent example." should be deleted completely and there should be an explanation that market-based mechanism such as emission trading has several problems. Volatility of emission permit prices affects volatility of product prices as evidenced by fluctuating price developments in the EU-ETS. Therefore, the market-based policy tools of cap-and-trade cannot provide credible incentives for the technological change, as described in (Montgomery, 2005, abstract) and (Baldursson, 2009, page29). In addition, CO2 leakage caused by the implementation of the ETS happened actually through transfer of industry from one country to others. Market mechanisms at least under Kyoto-like international scheme, where the condition of all countries' meaningful participation is not met, do not work well, as shown in (Rosendahl, 2011, abstract), (Aichele, 2012, page336), and (Peters, 2011, page1). These literatures are listed in the No9 line of this table.	Noted. Will work to rephrase.
32104	3	54	31	54	31	The word "excellent" could better be substituted by "appropriate".	Editorial
26172	3	54	31	54	32	Please add 'ideally' in front of determined.	Editorial

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21620	3	54	31	54	34	The actual case of the EU ETS in recent years has been quite unlike a stylised economic description. The oversupply resulting from the post-2007 economic downturn has substantially reduced incentives and investment in low carbon technology with other policies dominating in decarbonisation.	Accepted- wording will be improved
22440	3	54	31			Delete the word "excellent". This sentence impresses as if the EU-ETS is an excellent system, which is not true.	Editorial
22441	3	54	31	54	32	Add " In well-functioning markets" at the beginning of the sentence starting with "The marginal abatement costs", because in a real world, marginal abatement cost does not always equal to market price for allowance.	Editorial
36086	3	54	37	55	5	This is a very useful list--it would be even better connected to more detailed empirical findings about behavioral effects.	Rejected - note that Ch. 3 is a "framing/conceptual" chapter. Empirics about the performance of policy instruments are given in sectoral chapters and Ch. 13 and 15
36087	3	54	38	54	42	It might be better to introduce this via the free rider problem or 3.10.1	Taken into account - wording will be improved
34293	3	54	47			Please add energy intensity before carbon intensity.	Editorial
34291	3	54	15	54	26	Please refer to the concepts of 'static efficiency' and 'dynamic efficiency' here.	Taken into account - text will be improved to the extent that this is consistent with sectoral chapters and Ch13-15
20299	3	54	27	54	36	When referring to the EU-ETS as "excellent example", one has to address the caveats and inefficiencies of the system as broadly discussed within the EU: e.g. the generous cap results in a very low price, that fails to act as an effective signal for investment and innovation. This is partly the result of the divergence of an ideal theoretical setting and the respective assumptions versus the effects of real world uncertainties as e.g. ex ante setting of cap (given specific forecasts for economic growth) and unexpected (dramatic) changes in growth compared to previous forecast. In this context I find the paper by Metcalf interesting (Metcalf, G., (2009), Cost containment in Climate Change Policy: Alternative Approaches to mitigate price volatility, Working Papers 15125, National Bureau of Economic Research, Cambridge).	Taken into account - wording will be improved
34292	3	54	27			The term 'tradable allowances' is not used in the glossary, but instead, other equivalent terms are defined. Please consider using those terms defined in the glossary (often those that were prominently used in previous IPCC assessments).	Taken into account - coherent terminology is under improvement all the time
22723	3	55	3	55	3	Perhaps replace 'should' with 'otherwise would'.	Editorial
25065	3	55	46	55	46	After Coglianese, 2009, add "Yamaguchi (2012)". For Reference; Yamaguchi (2012), Policies and Measures. In Climate Change Mitigation, A Balanced Approach to Climate Change. M. Yamaguchi, (ed.), Springer, London pp. 129-159. The reason is this is the most recent literature discussing the environmental effectiveness of voluntary measures based on concrete cases.	Taken into account. Will consider references, though cannot use grey literature.
34294	3	55	6	55	14	Please include examples from the power sector in this section.	Taken into account - examples will be improved
21621	3	55	7	55	14	The Montreal Protocol and regulation of Ozone-Depleting Substances is a good example of a predominantly prescriptive approach at an international level having successful outcomes. Cite Mader et al. (2010) and Vaders (2009) for simultaneous global climate co-benefits.	Accepted - examples will be improved
20709	3	55	1	55	5	Bring into SPM and TS.	Noted.
34295	3	55	27	55	32	Is government procurement intended to be covered by 3.6.4? If yes, this is not clear from the current text.	Taken into account: Yes, government procurement is covered in 3.6.4.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
25682	3	55				This section should include "Japan's industry Voluntary Action Plan" as an good example for voluntary actions, as described in the section 15.5.7.4. There are successful examples of "voluntary target scheme" in the world. Each industry in Japan has voluntary target and the voluntary target scheme has played a big role, as described in (Yamaguchi, 2012, page35 and 154), (Manuel, 2010, page 6 and 13), and (Yamaguchi, 2010, abstract). In addition, there is also a successful example of "voluntary target scheme" in Netherlands, as shown in (Martijin, 2002, page162). These literatures are listed in the No22 line of this table.	Accepted. Will try to reference 15.5.7.4
22464	3	56	10	56	18	These two sentences need to be revised to make it clear exactly why tradable certificates on top of emissions trading increase costs and serve the dirtiest power technologies. Referring to shadow costs without explanation is not helpful.	Accepted- text will be improved
26174	3	56	14	56	18	A good comment.	Noted. Thank you for your comment.
25683	3	56	14	56	18	This section should be kept in the final version report because this is a good example of problem caused by combination of several policies. Levying "carbon tax" and "cap & trade" simultaneously is not meaningful and would fail to reduce CO2 emission because carbon tax and cap & trade are theoretically same mechanism to reduce CO2 emission, as described in (Clive, 2007, page4-5). <Reference> [1] Clive Hamilton, Frank Muller (2007). Critique of the McKibbin-Wilcoxon Hybrid Emission Trading Scheme, Australia Institute. Available at: http://www.tai.org.au/documents/downloads/WP98.pdf	Noted. No change requested.
22442	3	56	23			Add following sentence: "A carbon tax or other climate policy will imply the increase in commodity price including energy and food, and thus require changes in non-environmental policies, such as expanded tax deduction for low income group."	Rejected - the general point is covered in discussion of revenue use from carbon pricing. The specific suggested wording would be policy prescriptive.
20300	3	56	8	56	18	The reasoning of this paragraph is not clear. Feed in tariffs is widely used instrument but not mentioned here.	Accepted - FiT will be more explicitly treated
34296	3	56	8	56	23	Please liaise with Chapter 15 authors to prevent redundancy and consider deletion of these two paragraphs to save space.	Accepted - it is very likely that Ch. 15 is in a much better position to address policy interactions.
36088	3	56	1	56	27	Policy interactions and the second best section could be combined into one section here.	Taken into account- merging the two sections will be duly considered
30185	3	56	11	56	14	This may need qualified, as it depends on the design, and if the tradeable certificate scheme has a volume target. My own work on this with renewable energy (RE) financiers when the EU was considering its Renewable Energy Directive (after the introduction of its Emissions Trading Scheme) is that RE goals generally (but would apply to volume targetted RECs as well) would not undermine GHG values necessarily, if full compliance with RE targets was assumed prior to allocations under the ETS. I'm afraid I can't find written evidence for this however a simple qualification would retain accuracy.	Taken into account. Revision does not contain the specific detail that the comment requests qualification for.
23515	3	57	12	57	22	re "distributional objectives" - would it not be more coherent to say that mitigation policies primarily aim at emission reduction? Of course they have distributional outcomes, but do they really have distributional objectives? Distributional outcomes can also be dealt with through adjacent policies, they do not need to be dealt with through the mitigation policies themselves. Should the third point (line 19) become the first?	Taken into account - could say "... a carbon policy may raise distributional concerns, and so an objective might be to mitigate those concerns."
36092	3	57	12	57	22	Good categorization of additional considerations.	Noted. Thank you for your comment.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36089	3	57	2	57	3	"Developing countries" should be defined. Also, this statement suggests there are no financial resources currently being provided, which is not the case.	Noted. Please refer to glossary. We do not consider that the text implies anything about resources currently being provided.
23516	3	57	23	57	26	Similar to my comment above - I'm not sure that mitigation policies need to "appropriately balance" economic cost, distributional considerations and environmental objectives" all at the same time - their main aim is climate change mitigation - distributional issues can be dealt with separately if they are considered to be a problem.	Taken into account - could say "A policy package aimed primarily at mitigation might require appropriate balance of these different objectives."
36093	3	57	23	57	31	Some discussion of the difference between international vs. unilateral policy choice in the context of climate should be discussed	Taken into account
36094	3	57	26	57	31	also it is important to acknowledge the notion of tradeoffs here in achieving multiple policy objectives with one instrument.	Taken into account - will restate the point
36091	3	57	8	57	10	Consider restating that BCA is often an input into the decision of what policy instrument to use.	Taken into account - covered in section 3.7
21622	3	57				While up to 3.6 the chapter is well connected this section much less connected, parts are repetition for others it is not clear how to relate them with what in above sections	Noted
36090	3	57	4			Section 3.7 could be shortened by dropping table 3.7.1 and FAQ 3.3, which are redundant with the main text discussion.	Taken into account - text will be revised and integration with other sections or chapters duly considered.
32106	3	58	6	58	6	The expression "think electricity" should be substituted by "e.g. electricity" or "for instance consider electricity".	Editorial
19673	3	58	3	61	10	The approach taken in this section to discuss economic frameworks for policy analysis leaves much room for improvement. As it stands, this section tends to resemble text coming straight out from a standard economics textbook - I would have thought IPCC reports would want to go well beyond this and put forward a more balanced critical and comprehensive review of the literature. My recommendation would be to exclude the modelling of economic efficiency and distributional issues using a textbook partial equilibrium models; there are many serious limitations attached to this and I am happy to provide more detailed feedback if needed. Suffice to mention that having a partial equilibrium model to discuss static resource allocation effects in a report that is about the highly complex, dynamic and systemic problem of climate change induces a relative disruption into the flow and structure of this section and chapter. Perhaps an alternative option is to simply discuss economic efficiency, growth (and I would include employment here) and distributional impacts of climate policies from a much wider /descriptive perspective covering the various recent advances made in the climate economics literature.	Taken into account. The discussion can be improved.
36097	3	59	23	59	27	In what instance efficiency vs. cost effectiveness applies is not clear in this section. For example, if the EU decides what its emission reduction goal is, then countries set up their own processes for achieving it and evaluate the cost effectiveness of achieving that goal. The benefits don't matter in this context because the goal is pre-selected.	Taken into account

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24451	3	59	3	59	34	This section does not work. I note that the authors wish to use this framework as a generalized model that is not supposed to "downplay other ethical considerations" but want to use it as a way of integrating economic and non-economic objectives. BUT as the authors note -- for those issues for which economic values CANNOT be placed in this framework (which includes rights - an absolutely central point of contention about using economic framework) this simply ends up negating all of the earlier discussions of economics and insists on using economic language and concepts as the only way to frame decision-making with some handwaving towards ethics. I do not see what this framework adds in general that is not covered in the next section on economic considerations, and I think it detracts from a very nice discussion of a multi-criteria framework established in the immediately preceding section. Since you are over your page limit anyway, I simply suggest deleting this whole little section.	Rejected. We feel the treatment is inappropriate.
36095	3	59	5	59	27	This doesn't do a very good job of building intuition for a non technical audience. How efficiency is achieved - meaning how an individual responds - should be added. This also applies to box 3.7.1	Taken into account - text will be improved.
36096	3	59	5	59	30	Which of the policy instruments discussed have the potential to be efficient and under what circumstances?	Taken into account - will improve this discussion
22507	3	6		31		When we discuss the responsibility and welfare of individuals, we should first guarantee that every individual has the living right. Discussing how much burden should people share between who wish to get rid of hungry and who pursue a healthy diet is unreasonable.	Reject. Prescriptive.
23508	3	6	1	6	3	Also mention other important criteria here such as capacity (ability to pay), benefits (beneficiary pays) and unequal distribution of climate change impacts?	Reject. Not appropriate.
35939	3	6	1	6	3	In noting the issues of justice, this portion notes the question of "historic responsibility for climate change" is important among the justice issues. Presenting the issue as one of historic responsibility presupposes that there is historic responsibility and it is only a matter of sorting out how to address that responsibility. This represents a normative judgement about the concept of responsibility for historic emissions. This is inconsistent with the statement later in the chapter (page 10) which states the Chapter is not intending to offer normative judgments on these issues. The question of what responsibility there may be for historic emissions is an important one, but a more neutral presentation of the issue is required. Better phrasing would be "The question of what responsibility there may be for historic emissions contribution to climate change is important among them."	Noted. See 35930
23509	3	6	11	6	11	If one has not yet read the whole chapter, it is unclear what is meant by "values" here as they are usually understood as personal values that underpin behaviour/practices. Perhaps make it explicit that it is used in an economic sense here.	Noted
26927	3	6	11	6	15	Many different sorts of value are affected by climate change. Human well-being is a critical one. This value can be further partitioned between concern over the sum of total well-being and the concern over the distribution of well-being. Potentially separate from well-being is a concern for human justice and rights. In addition, some ethicists suggest other values are relevant beyond human well-being. These include cultural and social values, the well-being of animals, and an intrinsic value possessed by nature.	Noted
24439	3	6	11			This is an incomplete statement, and seems biased towards one way of settling historical responsibility. For instance, both legal systems (which are, by the way, both western which points out an ongoing limitation to any discussion of values in a global system when the bulk of literature comes at it from a western perspective only) also have punishments for accidents causing serious harm, as do most ethical systems. While intention is important, responsibility is not entirely waived for harms caused without intent although it may be lessened (see Haider 1965 for a good discussion of levels of causal responsibility)	Noted
19583	3	6	11	6	22	Can be combined in one paragraph and shortened.	Noted

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27458	3	6	12	6	12	Please delete addition "according to many authors", as this statement gives a special flavor to nature, different from other value. Can nature "possess" a value, or should it rather be "attributed" to it?	Reject. Comment noted.
27459	3	6	12	6	12	Please explain the concepts of common and civil law for lay persons.	Taken into account. ES rewritten.
23071	3	6	14	6	15	These lines assume that well-being can be numerically measured, and that the way to consider the well-being of a society is to begin with individual levels of well-being and then aggregate them using a mathematical function, arriving at a unique value. Such assumptions are considered highly debatable among both economists and philosophers. It would somewhat better to address the question of "whether" (not "how") such aggregation can be done, and even better to concentrate on qualitative descriptions and measures of specific aspects of well-being.	Noted.
24440	3	6	16			Would be good to acknowledge economics really does deal best with monetarized value, that you can try to include non-monetary values but this has limitations	Noted--we do this.
35940	3	6	17	6	17	It is confusing to say that climate change "affects cultural and social value," since the linkage is far from direct. In addition, the use of the term "value" is unclear here. Please revise.	Reject. The issue is adequately covered.
25063	3	6	2	6	3	Please change "historical responsibility" to "both historical and future responsibility".	Reject. Changes meaning.
23072	3	6	23	6	28	In contrast to p. 34 of this chapter (lines 46-49), this passage in the Executive Summary assumes that the changes in well-being related to climate change are of a small, marginal nature suitable to evaluation by standard cost-benefit analysis. While cost-benefit or cost-effectiveness analysis can be helpful in evaluating individual projects over short time horizons, it should be recognized in the Executive Summary that standard techniques can be quite misleading when applied to problems of substantial, non-marginal impact (as well as plagued by overwhelming uncertainties and ethical considerations that go beyond adding on welfare weights).	Noted. We say this in text.
19435	3	6	30	6	31	I disagree with the strong assertion that use of distributional weights are necessary to avoid "serious error" in cost-benefit analysis. Weights have a strong subjective/normative element that makes it difficult to say one approach has more "errors" than another. It also contradicts the assertion elsewhere that the chapter is meant to be "policy-relevant but not policy-prescriptive."	Taken into account. ES rewritten.
21600	3	6	39	6	40	The specific meaning of "normative" should be clarified. Normative perspective of discount rate might better be explained as "...determining what discount rate ought to be used for long term decisions..."	Taken into account. ES rewritten.
35231	3	6	4	6	10	These arguments on the regulation of historical responsibilities of developed countries are highly disputable. They are based only on three articles, two of which are from the same book "Climate Change Liability" (it was not peer reviewed) while the other one is from the review of that book (also not peer reviewed), thus it should not be labeled as "high confidence". It is strongly suggested that these arguments should be deleted or be redrafted as follows: "The historical responsibilities has been acknowledged by international laws, such as the UNFCCC and it Kyoto Protocol) which have been signed off and ratified by more than 180 countries globally, and represent high political consensus. It ascribes the largest historical emissions to the developed countries, and holds that in line with the principle of equity and in accordance with the principle of common but differentiated responsibilities and respective capabilities, climate change should addressed by widest international cooperation in carrying out effective and appropriate mitigation measures."	Reject. Too normative.
22506	3	6	4	6	10	Responsibility for climate change is not something like in the common law and civil law. Actions in laws usually related to criminal things. Although developed countries should take the main responsibility for the climate change, they did not make crimes. Now, all the people in the world faced the common problems and responsibility is quite clear. So the casual link is not proper to describe the responsibility for the climate change.	Reject. Context is discussed.
27460	3	6	40	6	40	Explain "positive perspective" in the Glossary, and add a reference here.	Accepted. Should be in glossary.
22686	3	6	43	6	43	The term 'Ramsey Rule' seems to appear here for the first time, but its meaning is not explained.	Noted. See text.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27461	3	6	43	6	43	Please explain "Ramsey Rule" in Glossary.	Noted. Glossary editors may wish to consider this.
23073	3	6	45	7	1	Stating that social discount rates of up to 7-8% have "medium" or "high" evidence or agreement vastly misinterprets the literature! As widely discussed, suggested discount rates above zero or small fractions rely on one or many extremely suspect assumptions, including (1) people think about future generations in the same way they think about short-term financial investments (2) the degree of substitutability between natural and manufactured capital is (against all evidence) assumed to be so extreme that economic growth can be projected to continue unfettered (3) the Ramsey Rule with its perspective of the all-knowing social planner and framing of the problem as decision-making over quantifiable (and at least probabilistically known) is appropriate for the analysis of climate change. Relevant citations include: Howarth, Richard B. 1998. An Overlapping Generations Model of Climate-Economy Interactions. The Scandinavian Journal of Economics 100 (3):575-591; Howarth, Richard B. and Richard B. Norgaard. 1993. Intergenerational Transfers and the Social Discount Rate. Journal of Environmental and Resource Economics 3:337-358; Norgaard, Richard B. and Richard B. Howarth. 1993. Resolving Economic and Environmental Perspectives on the Future. Research on Social Problems and Public Policy 5:225-241; Howarth, Richard B. and Richard B. Norgaard. 1992. Environmental Valuation Under Sustainable Development. American Economic Review 82(2):473-477; Nelson, Julie A. "Economists, Value Judgments, and Climate Change: A View from Feminist Economics," Ecological Economics 65(3), April 2008, pp. 441-447; Frank Ackerman, Stephen J. DeCanio, Richard B. Howarth and Kristen A. Sheeran, "Limitations of integrated assessment models of climate change," Climatic Change, 2009, 95, 297-315; Frank Ackerman, "Climate economics in four easy pieces," Development (2008) 51(3): 325-331; Simon Dietz and Nicholas Stern, "Why economic analysis supports strong action on climate change: A response to the Stern Review's critics," Review of Environmental Economics and Policy (2008) 2(1): 94-113.	Disagree. We offer a range 1-7%.
19037	3	6	47	7	1	This is a strange use of confidence levels here in the context of this sentence. Not sure how to interpret it.	Noted.
19436	3	6	48	6	48	I'm not sure that discount rate ranges of 1-7% and 0-8% should be called out as areas of high agreement. While I don't necessarily disagree with them, these specific ranges don't appear to be supported by the literature cited later in the text.	Reject. Discussed in text.
27462	3	6	48	7	1	Please provide only one statement.	Noted.
25064	3	6	8	6	8	Change "some or all past GHG emissions" to "some recent GHG emissions including LULUCF and future emissions". Reasons are as follows; I don't think all past GHG emissions satisfy that standard. To satisfy the standard, it is crucially necessary that the action be considered wrongful conduct at the time of the action. In this sense, it is logical to say that some recent emissions, including LULUCF, and future emissions satisfy the condition. Change "some or all past GHG emissions" to "some or all past GHG emissions, including those from LULUCF,".	Reject. Too detailed for ES.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19669	3	6	16	6	22	This paragraph provides only a partial view of economics and its contributions to understanding socioeconomic behaviour and its contribution to informing policy-making: that of standard, traditional or conventional economics (based on a utilitarian, optimisation, equilibrium, representative agent approach and typically incorporated into CBA tools) that continues to dominate mainstream economics. However, there are several other methods of economics that present different theories of values and do not necessarily advocate an anthropocentric value to individual human beings, such as ecological economics, behavioural economics, evolutionary economics, Post Keynesian economics, institutional economics (that can be akin to other decision-analysis tools than CBA such as MCA tools) - some of these such as behavioural economics have also penetrated the mainstream. In other words, a more in-depth understanding of economics (rather than just discussing intertemporal optimisation models and integrated assessment models) would reveal a host of different schools of economic thought putting forward quite different theories of value and modelling approaches to social-economic behaviour (despite the mainstream being dominated by standard economics). My recommendation is to explicitly acknowledge such pluralism in economics or at least refer to "standard or traditional methods of economics" in the respective paragraph instead of a general misdescription of "methods of economics"	Reject—we do touch on these issues but the literature is sparse.
35941	3	6	23	6	28	The description of benefit cost analysis only discusses the social value side of things - the benefits side. The notion of comparing benefits to costs should be made clear.	Reject--social value is net.
35942	3	6	23	6	28	If distributional weights are used, they should also be applied to the cost side of the equation, not just the benefits	Noted -- we do this.
35943	3	6	31	6	33	The recommendation to use distributional weights in cost-benefit analysis is too prescriptive and does not reflect the state of the literature. First, there is no consensus on which weights to use. Second, use of weights in a national cost-benefit analysis could give greater weight to non-citizens than citizens, which could violate the notion of sovereignty. The chapter should instead acknowledge that the choice of weights could lead to significant differences in the results from CBA. An alternative approach to using weights is to conduct unweighted CBA as well as a separate distributional analysis that policymakers can consider as distinct criteria for policymaking. A useful reference for the effect of weights on the results of CBA of climate policy is Anthoff and Tol (2010) in JEEM - also available at: http://ideas.repec.org/p/ces/ceswps/_2373.html	Taken into account. ES rewritten.
34447	3	6	4	6	10	This seems policy-relevant. Please elaborate. From when onwards can emitting GHGs be considered wrongful and on what grounds? How can one define 'wrongful'? How does international law relate to the systems of common law and civil law? Please provide more detail.	Noted. Covered in 3.3
27457	3	6	4	6	10	From when onwards can emitting GHGs be considered wrongful and on what grounds? How do you define 'wrongful'? How does international law relate to the systems of common law and civil law? Please be more specific.	Noted. See 3.3
35944	3	6	46	7	3	The finding on discount rates is misleading. It talks about social discount rates typically found in the literature as ranging from 1 to 7% per annum but it implies that these are always constant rates over very long time periods. This is often not the case and is not adequately discussed here or in the chapter generally. Nor are the issues that a non-constant discount rates raises, such as time inconsistency. This is an important issue to visit since at least two countries - the UK and France - use schedules of declining discount rates to evaluate inter-generational policies.	Noted. These issues are discussed in the body of the chapter.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24572	3	6	23	6	33	On page 6, the limits of traditional cost-benefit analysis (CBA) as a decision-making framework for issues with a 'social value' dimension are discussed. However, suggested modifications of traditional approaches also have significant limitations. For example, it is implied (on page 6, lines 27-28) that the application of a 'weighting factor' is widely accepted but this is clearly not the case. As noted, most CBAs conducted by mainstream economists do not apply a weighting factor. Choosing weighting factors is a normative value judgement which (arguably) lacks robust empirical evidence regarding societal preferences and consensus about the justification for application to CBA. Suggest that for a more balanced discussion of this issue, a discussion of the challenges associated with determining exactly what the appropriate weighting factor is recommended.	Taken into account. ES rewritten.
24573	3	6	43	7	3	It is noted in the Executive Summary that the literature presented in chapter 3 suggests a range of discount rates from 1% to 7% has medium evidence and high agreement. Subsequent discussion in 3.5.2 Discounting future goods (pages 43-48) provide extensive discussion of rationales for the application of low discount rates and reiterates the observation that there is wide range of discount rates in the literature presented. However, the value of such a lit review style discussion is debateable, as it falls short of taking a clear position on this key issue; which, in turn, does not provide any clarification as to the IPCC's position on how cost-benefit analysis can be applied to decision-making with 'social value' dimensions in practice. Suggest that IPCC make its position on discount ranges clear and consistent.	Noted.
36099	3	60	29	60	32	Add "assuming the gainers and losers receive equal weights."	Editorial
21623	3	60	7	60	32	Useful example linking framework, theory and example. Recommend retaining during editing process.	Noted. Thank you for your comment.
36098	3	60	7	60	32	Section 3.7.1.2 could emphasize the importance of distributional considerations in many discussions of emissions-reducing policy, particularly by referring to Figure 3.7.1, which illustrates that the distributional implications of imposing efficient externality pricing (i.e., areas A+B) are often much larger than the efficiency gains (area C). This point could be specifically made in Box 3.7.1, or elsewhere in these pages, but regardless of where it appears it would be helpful if this section gave an intuition about why distributional considerations often loom large in debates about climate policy.	Accepted.
36100	3	61	11	61	25	Leakage should be discussed here - for example, if a sectoral or non-economy wide approach is taken, environmental effectiveness can be undercut by "leakage" (the shifting of emissions from a covered sector/location to uncovered sector/location).	Taken into account - the issue of leakage will be briefly addressed.
24576	3	61	16	61	25	This is an important paragraph. Suggest further text noting that climate policy that reduces emissions may (through the operational actions enterprises take to achieve those reductions) have benefits for environmental values like water quality and thus biodiversity and human health.	Rejected - agree but covered in section "co-benefits"
36101	3	61	16	61	25	The interaction between policies can go the other way - you can increase emissions of other pollutants, resulting in co-disbenefits.	Rejected - we already have a whole subsection on "Co-benefits and Adverse Side Effects"
21402	3	61	23	61	25	delete this sentence - Climate policy should be chosen in consideration for both energy security and economy growth	Rejected - policy prescriptive aspects are outside the scope of the IPCC. In addition, the performance of policy instruments are context- or country-specific. For that reasons, please refer to sectoral chapters, and Ch. 13, 15 and 16.
34298	3	61	25			Please add a cross-reference to section 6.6 and consider cutting text to save space.	Taken into account - cross-ref will be added

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22465	3	61	33	61	40	This paragraph unintentionally gives the impression that political feasibility is solely a function of instrument design. To rectify this it would be worth mentioning other determinants of political feasibility as well, such as the policy preferences of policy makers and stakeholders as well as the degree to which they have the capacity to block initiatives, frustrate their implementation, or impose economic or political costs on governments that go ahead. It also depends on the political tactics employed by governments. See, for example, Compston, Hugh (2010), 'The Politics of Climate Policy: Strategic Options for National Governments', Political Quarterly 81(1): 107-115.	Taken into account. Will consider reference
21624	3	61	33	62	4	Small paragraph given over to area of major significance and substantial body of research literature (political science, political economy, environmental economic & political geography) on environmental problems, regulation and agreement. With 3.7.2.2, this is one limited example in text. Should be linked to Chapter 13 more effectively.	Taken into account - will link to chapter 13
32401	3	61	16	61	17	Please specify that you probably refer to near-surface/tropospheric ozone.	Editorial
36102	3	62	13	62	13	The criterion of one instrument per political goal has not been previously mentioned. And it is often not the case. It may be better to discuss this idea as an ideal in the first best section and explain why, but ultimately it may be more useful to recast this in terms of policymakers understanding potential trade-offs between goals if they are using 1 instrument vs. using multiple instruments. In some cases it may matter a lot; in others less so.	Accept. Remove "use one instrument per political goal."
34300	3	62	13			I have not been able to find the respective finding in the text ("one instrument per political goal").	Editorial
36103	3	62	16	62	16	Strike the phrase "undermined with exemption to protect certain groups" - it is a normative statement - and instead point out that this is an example of policymakers trying to satisfy two goals simultaneously. They are trading off efficiency or cost effectiveness with political feasibility or distributional concerns.	Accepted- text will be improved and trade-offs stressed
24452	3	62	26			Would be good to have one or two sentences saying what this section will aim to do in light of how decision support is discussed elsewhere	Taken into account - linkages with other sections/chapters will be mentioned.
29538	3	63	20			The first bullet point describing bottom up models is incomplete and inaccurate. The statement that bottom up models "may overlook critical market imperfections such as transaction costs and information asymmetries" is actually more true of top-down models, which ignore most market imperfections BY ASSUMPTION. It is incorrect to single out bottom up models for these failings when it's the top down models that ignore virtually all market imperfections (by assuming perfect markets and excluding increasing returns to scale to avoid multiple equilibria). Laitner, John A. "Skip", Stephen J. Decanio, Jonathan G. Koomey, and Alan H. Sanstad. 2003. "Room for Improvement: Increasing the Value of Energy Modeling for Policy Analysis." Utilities Policy (also LBNL-50627). vol. 11, no. 2. June. pp. 87-94. DeCanio, Stephen J. 2003. Economic Models of Climate Change: A Critique. Basingstoke, UK: Palgrave-Macmillan.	Taken into account - See 24426
24426	3	63	22	63	23	Bottom-up models as well as top-down models cannot explicitly deal with transaction costs and information asymmetries, but treat them implicitly, adjusting some parameters, such as implicit discount rate. See M. Sugiyama, O. Akashi, K. Wada, A. Kanudia, J. Li, J. Weyant. "Energy-efficiency potentials for global climate change mitigation," Climatic Change (forthcoming) .	Noted
36104	3	63	33	63	40	Do governments actually use MCA? It would be helpful to provide a real-world example, or mention if it is typically only used in an academic setting.	Rejected - for applications see sectoral or assessment chapters.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36105	3	63	41	63	42	This is an example of an either/or description that doesn't reflect reality very well - a lot of researchers also combine top-down IAMs with more detailed bottom up PE sector models. This description should reflect that reality and the advantages and disadvantages that such an approach brings with it.	Accepted - text will try to incorporate the points being suggested. However, please do note that by no means this is an exhaustive assessment of ALL methods including ALL their pros and cons. To some extent, as mentioned in the introduction of section 3.7.2, this has been done already in previous IPCC reports.
19674	3	63	33	63	40	There are several other recent studies using an MCA or MCDA approach to climate policy analysis that are worth mentioning here. Please see full references as in comments 20 and 21	Taken into account. Will consider references, see comment 19675.
36106	3	64	12	64	14	The discussion of other quantitative approaches could be strengthened by adding a table giving a brief characterization of each approach and noting whether the tool is still current or is no longer in use.	Taken into account - see response to comment 36105.
36107	3	64	15	64	31	The discussion of qualitative approaches could be made more robust by giving a brief characterization of each approach and noting whether the tool is still current or is no longer in use. This could be done in a table.	Taken into account - see response to comment 36105.
26691	3	64	3	64	9	General equilibrium and other computational models... What are the other models? How do they differ from CGE models and how this can impact the modelling outcome?	Accepted - clarification will be made. Metcalf (1999) is not a CGE model.
24453	3	64	32			I realize that you probably can do little about this at this point, but this section once again focusses only on mitigation and so fails to speak to some of the most pressing international policy questions. This may also speak to the need for economists to start grappling with adaptation more seriously (which may be a gap you wish to identify)	Accepted: text will be revised to refer to analyses of costs/benefits of adaptation
36108	3	64	16	64	24	Some of this seems to lend itself to different data collection methods rather than qualitative approaches to analysis. Also where do experimental and focus group methods fit?	Rejected - some of these methods (if not all) have been already treated in previous IPCC reports.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19675	3	64	3	64	9	There are also several other types of climate-economy models available in the literature that are worth mentioning and provide interesting alternatives in addition to CGE models (also IAM models typically include a CGE or optimal growth model component so there is no difference in essence between many IAMs and CGEs). Examples of other climate-economy modelling approaches include: macro-econometric Keynesian-driven simulation models in Barker T, Scrieciu S. Modelling Low Stabilization with E3MG: towards a 'New Economics' approach to simulating energy-environment-economy system dynamics. Energy J (Special issue 1 "The Economics of Low Stabilization") 2010, 31:137–164; AND Lutz C, Meyer B, Wolter MI. The global multisector/multicountry 3-E model GINFORS. A description of the mode and a baseline forecast for global energy demand and CO2 emissions. Int J Global Environ Issues 2010, 10:25–45; AND Bach S, Kohlhaas M, Meyer B, Praetorius B, Welsch H. The effects of environmental fiscal reform in Germany: a simulation study. Energy Policy 2002, 30:803–811; OR agent-based models such as studies in Beckenbach F, Briegel R. Multi-agent modeling of economic innovation dynamics and its implications for analyzing emission impacts. Int Econ Econ Policy 2010, 7:317–341; AND Janssen M, de Vries B. The battle of perspectives: a multi-agent model with adaptive responses to climate change. Ecol Econ 1998, 26:43–65. In such alternative climate-economy simulation models, it is important to notice that the concept of "marginal abatement curves" and other neoclassical marginalist concepts do not hold, and that "costs" may be viewed in different terms (e.g. not necessarily as a carbon price but rather dynamic slow-downs in GDP growth rates, if the case). A comprehensive review of the climate-economy modelling literature is provided in the recent study: Scrieciu, S., Rezai, A. and R. Mechler (2012) "On the Economic Foundations of Green Growth Discourses: The Case of Climate Change Mitigation and Macroeconomic Dynamics in Economic Modelling", WIREs Energy Environ. doi: 10.1002/wene.57	Taken into account. Will consider references
26821	3	64	31	64	32	Please add "A recurring feature of various modeling approaches (quantitative and qualitative) is their high requirement for data and modeling capabilities, something that decreases their attractiveness for developing and lower income countries. For example, a review of criteria for ex post evaluation of renewable energy deployment indicates that most models are have been defined/developed by OECD analysts for OECD countries and rely upon sophisticated levels of human capital and data availability (Source: Nicholls J., R. Mawhood, R. Gross, A. C. Castillo, (forthcoming), "Evaluating renewable energy policy: a review of criteria and indicators for assessment", UK Energy Research Centre (UKERC) and International Renewable Energy Agency (IRENA))."	Noted
21625	3	64				While up to 3.6 the chapter is well connected this section much less connected, parts are repetition for others it is not clear how to relate them with what in above sections	Noted
36109	3	64	32	86	28	Section 3.8. Recommend shortening this section significantly and eliminating deep technical material.	Noted. Will work on shortening, but this section mostly contains material not addressed since the 2nd Assessment Report.
24577	3	64	33	86	28	Chapter 3 has been allocated 65 pages and is 33 pages over target. A section that should be significantly shortened is 3.8 Metrics of costs and benefits.	Noted. Will work on shortening, but this section mostly contains material not addressed since the 2nd Assessment Report.
36110	3	65	1	65	1	Reword: "may be reduced with mitigation."	Editorial
36111	3	65	13			This graph should be close looped, to visually show that human activities both contribute to the chain of effects and are also affected by the changes in climate and its impacts.	Accepted
29940	3	65	16	65	16	Typo in reference: Should be Fuglestvedt et al. (2003)	Editorial

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
30831	3	65	4			The damage element, both in the text and in Figure 3.8.1, needs to reflect both positive and negative effects, i.e., net result of damages and benefits.	Accepted: text will be revised
20736	3	66	1	66	2	It is a minor comment, but it should be General Circulation Models instead of Global Climate Models. Or Earth System Models (ESMs) would be more appropriate here.	Rejected: both terms are widely used.
19485	3	66	16	66	31	The social cost of carbon does not incorporate information about mitigation costs--it is a measure of the damages of climate change (i.e., the benefits of mitigation).	Accepted: the text will be clarified
36115	3	66	33	77	6	Suggest combining and condensing sections 3.8.1 and 3.8.2.	Rejected: 3.8.1 covers the economic literature (appearing since AR2) on the damages from climate change, typically specific studies of particular sectors and particular locations. 3.8.2 covers the damage functions used in IAMs, which are broad extrapolations from the type of studies discussed in 3.8.1 (though drawing considerably on studies covered by AR2).
36112	3	66	1	66	10	Note that a sector by sector approach also means some linkages and feedbacks between sectors are not adequately addressed.	Noted
36113	3	66	17	66	18	Please eliminate the alternative definition of the SCC. SCC is not a net concept - it is the additional social cost (or marginal external damages) of an extra ton of CO2 emissions, and as such is often used as an expression of the marginal benefits of taking action. It is then compared to the additional cost of mitigation, which is measured separately. At the optimum, marginal emissions damages = marginal abatement costs.	Accepted: the text will be clarified. But note: it is not necessarily assumed that one is at the optimum
36114	3	66	21	66	23	The decision on whether to mitigate one gas more than another is not only dependent on the relative damages. It also depends on the costs of mitigation.	Accepted: Instead of "presumably" we could add "ceteris paribus"
19486	3	67	18			The "value of statistical life" is well-accepted within the discipline of economics and should be mentioned here as a counterweight to the notion that we cannot quantify the value of reducing risks to human life.	Taken into account. Will add cross-reference to value of statistical life discussion elsewhere in the chapter. Note that, while the VSL is commonly used in economics, it remains somewhat controversial.
36116	3	67	25	68	2	This paragraph is much clearer and succinct than the earlier EV-CV text. The earlier text could be replaced by this type of discussion.	Taken into account. EV-CV text will be revised
24454	3	67	33			It would be useful to link the earlier discussions of CBA and co-benefits to this section.	Accepted: a link will be added
19487	3	68				The hedonic method is an approach to non-market valuation, not valuation of market goods.	Rejected: the hedonic method is an approach used to value the attributes of marketed goods.
22724	3	68	7	68	22	Consider mentioning criticisms of revealed preference (e.g. those made by Sen).	Rejected: Space constraint precludes extending this text
36118	3	69	18	69	18	Delete the word "computable."	Rejected: The C in CGE stands for "computable"

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36117	3	69	4	69	7	This paragraph is worth unpacking--small changes in survey wording/framing can have big effects on stated preferences.	Rejected due to space constraint. Note that small changes in wording can have big effects on survey responses in ways that are well understood and can be controlled for with appropriate survey design methods.
34297	3	7	10	7	15	This finding apparently is only based on 4 lines in section 3.7.1 (p. 57, lines 26-29) that are not substantiated by references although it is an important finding.	Noted. This is a noncontroversial statement.
27339	3	7	11	7	11	The term "environmental sustainability", used in the line, may be replaced with "environmental protection", as to avoid mistaking it for "sustainable development".	Taken into account. ES rewritten.
24441	3	7	128			I recognize that the authors have tried hard to more carefully bound the economics discussions, but I do think it must be acknowledged at some point in the executive summary that income and wellbeing are not the same thing, and that income is only a proxy commonly used in economic analysis for broader human wellbeing.	Noted. We do make this point.
27463	3	7	16	7	18	IPCC uses the term "co-benefit" only wrt to physics? This does not seem reasonable, and is not consistent with the Glossary.	Noted. Not just physics. Physical effects include biologic effects.
27464	3	7	16	7	24	This para is difficult to understand, please reformulate.	Taken into account. ES rewritten.
35946	3	7	18	7	20	It is not clear whether "changes in mitigation costs and other impacts spread through society" refers to changes resulting from the climate policy or changes in costs and impacts from SO2 reduction policy.	Noted.
34299	3	7	20	7	21	It is not clear how "changes in mitigation costs and other impacts spread through society" relate to the net welfare changes due to co-benefits. Instead of using such a specific example, the Executive Summary might be able to show the relevance of the framing provided in Chapter 3 for the other chapters of the WGIII AR5.	Taken into account. ES rewritten.
23510	3	7	21	7	21	Whilst climate policies may not necessarily raise revenues for the government, they can still raise funds, either for independent bodies, companies or individuals directly, and thus still have positive welfare effects (but of course distributional effects depend on the design). Could simply remove "for the government"?	Reject. Essential part of paragraph.
23550	3	7	25	7	28	The third dimension, left out here, is the INSTITUTIONAL. Not only technological and behavioral change are needed and involve ethical issues, but also INSTITUTIONAL CHANGE, which involves, often justice and the value of democracy besides the justice of it.	Noted.
21601	3	7	25	7	26	Technology/infrastructure and behaviour/actions of individuals are not isolated. Better to word the opening of this paragraph as "Reducing GHG is a matter of changing how individuals and organisations deploy technology, intentionally, and also how technology shapes social routines and habits." The binary framing of technology and society (implicitly represented here as behaviour) as exclusive domains in the two opening sentences is problematic. There is a substantial literature (Actor Network Theory and the sociology, geography, political economy, political ecology, and other empirical work that uses it) describing how technology is social, in an ontological sense. Another literature (practice theory, after Bourdieu) is being used effectively in energy research to describe how technology and behaviour are co-constitutive and how policy makers need to recognise that.	Noted
27465	3	7	25	7	25	The relevance of behavioral changes in consumption here is underestimated. Please change "...in consumption ADDITIONALLY ARE a major way to reduce GHG emissions."	Reject. Covered in chapter
35947	3	7	27	7	28	Consider changing the term "income" to "consumption" to describe how changes in wellbeing are measured.	Reject. Small difference.
23511	3	7	28	7	28	Measuring wellbeing only in terms of income is very limited - this also does not reflect the discussion later on in the chapter in which a wider range of wellbeing indicators is considered.	Reject. Misunderstanding of sentence.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
24217	3	7	33	7	35	Besides negative mitigation costs, the emphasis on the increasing positive mitigation costs in Section 3.8.3 is not reflected in the executive summary. The unbalanced reflection of viewpoints from the main text makes the current executive summary subjective and arbitrary. It is highly recommended to add the following sentences (page 77, line 8-11) into this paragraph: "the reduction of GHG emissions imposes economic costs on various actors, including firms, households and governments. Those costs may take the form of changes in prices, changes in revenue and net income, and changes in the availability or quality of commodities".	Noted.
27467	3	7	33	8	3	The single paragraphs and arguments seem rather unconnected. The comprehensive and common logic is not clear	Noted.
29912	3	7	36	7	38	I suggest mentioning emissions metrics and the GWP explicitly to make this more concrete and related to what is being used in policy making, assessments and analyses.	Noted. See chapter.
35948	3	7	38	7	38	It would be helpful to give more specifics about what "biases" can result from simplifications.	Noted. See chapter.
23075	3	7	39	7	41	This point, that "aggregate measures of the economic damages of climate change, embodied in many integrated assessment models, may have serious flaws..." should be emphasized, and the "may" removed. In line with this point, Chapter 6 could be shortened by removing space wasted on flawed work, with corresponding changes to the TS and SPM.	Noted.
22688	3	7	4	7	9	Paragraph could be cut to save space. The substantive information is given in the next para.	Taken into account. ES rewritten.
22689	3	7	43	7	43	It is not clear which 'non-price intervention' methods are being referred to. If there is no room to explain, perhaps this should be dropped.	Noted.
22690	3	7	45	7	46	I don't see the point of this sentence. At least it seems out of place here.	Accepted. Deleted in ES.
35945	3	7	16	7	21	The description of co-benefits here and later in the chapter is one-sided. It seems to assume co-benefits are always positive, but there are many cases where a policy aimed at decreasing one pollutant results in increases of another pollutant. There are also important interactions that should be accounted for - for example, cleaning up SO2 emissions contributes to increased warming, making it harder to reach climate goals. Setting these goals without accounting for this interaction will either mean they are not achievable (won't yield the expected benefits) or will be more expensive than anticipated.	Reject. Discussion is balanced.
30248	3	7	18	7	21	Please consider rewording as the example is not clear to the lay reader	Noted. Will reword
30249	3	7	25	7	26	Please consider replacing "behavioural changes can be" with "behavioural changes are ", as these seem to be considered on equal terms to technological options in all sectoral chapters	Noted
30250	3	7	25	8	3	Please improve this last part of the ES as it seems an incoherent collection of unclear messages	Taken into account. ES rewritten.
27466	3	7	29	8	3	These sentences seem like loose bits and pieces. Where is the storyline? If they are main results, then provide underlying arguments.	Taken into account. ES rewritten.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23517	3	71	4	72	20	The section on the evaluation of non-market values seems less clearly structured than the section on market values. Consideration of health impacts is not mentioned even though central to this topic.	Accepted. The small economic literature on health impacts will be noted. Note that most of the literature on the health impacts of climate change contains no economic valuation, and properly belongs in the WGII Report.
26504	3	71	6	71	15	<p>“Some economic studies have assessed the impacts of climate change on labour productivity and national income. Several pathways have been considered. Exposure to high ambient temperatures is known to diminish work capacity and reduce labour productivity. In some studies labor productivity is estimated to result in the largest cost to the world economy of any effects analysed. Measures to reduce CO2 emissions may also reduce other pollutants associated with fossil fuel combustion, such as NOx and particulates, that lead to time lost from work and reduced productivity (Östblom and Samakovlis, 2007). Recent studies have focused on the correlation between high temperatures and poverty (Nordhaus, 2006), and the link between fluctuations in temperature, cyclones, and fluctuations in economic activity (Dell et al., 2009, 2012; Hsiang, 2010). The economic metric in these studies is change in productivity and economic output, but not a money measure of the loss of wellbeing, including social disruption, health impacts and loss of life. The International Labour Organisation has documented that climate change might lead to more job destruction and income losses, and lower productivity over time (ILO, 2012). For example, the Cyclone Sidr in Bangladesh has adversely affected 567,000 jobs and the estimated value of non-agricultural private assets lost amount to some US\$25 million". Source: Kjellstrom et al., 2009; Zivin and Neidell, 2010; International Institute for Labour Studies (2012), Working towards sustainable development: Opportunities for decent work and social inclusion in a green economy (Geneva, ILO, 2012); DARA 2012: Climate Vulnerability Monitor, A guide to the cold calculus of a hot planet. “; International Labour Organisation and Ministry of Labour and Employment, Government of the People’s Republic of Bangladesh (MLE). 2008: Cyclone Sidr – preliminary assessment of the impact on decent employment and proposed recovery strategy – focusing on non-farm livelihoods. Available at: http://www.lcgbangladesh.org/derweb/cyclone/cyclone_assessment/Preliminary20assessment20of20the20impact20on20decent20employment20and20proposed20recovery20strategy20by20ILO20and20MoLE_March202008.pdf [17 May 2012].</p>	Noted. References will be considered.
36121	3	72	23	72	23	The effects of climate change also vary due to infrastructure issues, planning and preventative measures, and other policy choices, as noted particularly in the SREX. This should be reflected. GHGs in isolation will have effects, but impacts are also influenced by a range of other factors.	Rejected: the sentence in question is making a point about location, not causation.
26067	3	72	13	72	20	I disagree with this conclusion. I think replacement and mitigation costs can be seen as minimum WtP if they are actually paid.	Accepted: text will be clarified
19490	3	73				Suggest moving footnote 77 on IAMs into the main text.	Taken into account: text may be revised.
36125	3	73	10	73	11	PAGE 2009 (latest version) has 8 world regions	Taken into account - text revised.
32107	3	73	15	73	16	I would delete the first time that "in year t" appears.	Editorial
36124	3	73	7	73	7	Reference for FUND: Anthoff, D. and Tol, R.S.J. 2013. The uncertainty about the social cost of carbon: a decomposition analysis using FUND. Climatic Change	Accepted: reference may be added
36122	3	73	1	74	18	The characterization of the IAMs seems to be based on old versions. For example, the most recent published version of RICE (2010) includes sea level rise in its damage function as a separate component. And previously released versions also break out catastrophic impacts. See http://nordhaus.econ.yale.edu/documents/Nordhaus_Copenhagen_2010_text.pdf	Accepted: The text will be revised.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36123	3	73	1	74	18	The WITCH model should also be discussed here.	Accepted: The WITCH model is already noted in fn 80. Space constraint may preclude expanding discussion.
25450	3	74				The plotted points do not reflect the recent literature reviews. In addition to the above literature (listed in No.2), see Roson et al., 2012, Climate damage and economic growth, International journal of sustainable economy 4, 270-285.	Rejected: that paper is cited in fn 80.
25808	3	74	10			Omit the words "in early versions of DICE" - the sentence is true of all versions of DICE.	Taken into account. Will be considered in revision.
25449	3	74	16	74	18	Please explain how the aggregate damages in DICE and FUND are reflected in Figure 19-5 of WGII AR5, since the estimated climate damages are different between DICE and FUND according to the literature. See Ackerman et al., 2012, "Climate damages in the FUND model," Ecological economics, and Nordhaus, W., 2011, "Estimates of the Social Cost of Carbon: Background and Results of the RICE-2011 Model," Cowles Foundation Paper.	Rejected. Figure 19-5 plots damages as a function of warming, separately, for DICE 2007, DICE 2010 and FUND 3.5
36130	3	74	19			The markers need to be changed--they are difficult to read.	Accepted
36126	3	74	6	74	6	The most recent DICE model has sea level rise and temperature as separate variables.	Accept
36127	3	74	10	74	11	FUND and PAGE can also be run probabilistically.	Accept
36128	3	74	14	74	16	This point should be emphasized that IAMs are calibrated to the existing literature; they do not uniquely estimate the main parameters. RP and SP studies underlie the damage functions and the information available is better for some sectors than others; and naturally the models lag the literature to varying degrees.	Rejected: The IAMs are overwhelmingly not calibrated to the post-2000 literature. That these damage functions are seriously out of date was made clear at the Climate Impact World Conference in Postdam, May 2013.
36129	3	74	18	74	20	This figure seems of limited value - it includes some very old estimates that are based on very outdated versions of the models (Nordhaus and Boyer 2000; Mendelsohn 2000 et al; Fankhauser 1995; Tol 1995), not the latest estimates. And it is an incomplete depiction of available estimates. (Also it appears to include WITCH even though the text doesn't discuss it.) It might be more useful to have side by side graphs with estimates based on old models and those from relatively recent versions to see how they've changed.	Accepted. We will use the most recent estimates; a comparison with earlier estimates might be useful but is not crucial.
32108	3	75	10	75	11	In my opinion this sentence presents a significant problem: "The damages are offset by a large gain to agriculture, which reduces the total cost by half". When accounting for the positive impacts of climate change on agriculture in FUND, major environmental non marketable externalities, such as erosion, are not taken into account, which is a sign lack of precision that strongly affects the outcome of the damage function. These externalities would substantially affect the outcome of the damage function if included. So the sentence mentioned above show underline the negative features of FUND when offsetting damages by gains in agriculture, because the externalities of this economic activity are omitted.	Rejected: The sentence accurately describes how FUND assesses the sectoral damages associated with warming. The commenter apparently disagrees with FUND's assessment. He is not alone.
25809	3	75	11			Insert after "...reduces the total cost by half." the following sentence: Recent research has identified a serious flaw in the logic of FUND's calculation of agricultural damages, as well as the use of physically implausible estimates of optimal temperatures for agriculture (17°C above or below current temperatures) in FUND's Monte Carlo analyses (Ackerman and Munitz 2012). REFERENCE: Frank Ackerman and Charles Munitz, "Climate Damages in the FUND Model: A Disaggregated Analysis," Ecological Economics 77 (2012), pp.219-224, doi:10.1016/j.ecolecon.2012.03.005.	Rejected: this is too much detail for the level of review in the chapter.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36134	3	75	24	75	26	Models adjust global temperature to account for the differential temperature impacts on populations living at higher latitudes.	Accepted: the text will be revised to clarify that, while DICE and FUND make some adjustments to account for differential climate impacts at different locations, those adjustments are inadequate.
36135	3	75	27	75	27	Of course there are differences across regions. The point is that on balance, the models provide estimates of global costs and impacts. Delete the footnote about Hayhoe, which is scant evidence to make such a sweeping dismissal of all IAMs.	Taken into account. Will review wording about how the models handle the issue. Retain footnote.
36131	3	75	1	75	13	The description of the IAMs seems overly harsh. These models are attempting to provide estimates in circumstances where there is a paucity of data and a lot of uncertainty regarding future projections and impacts. Any modeling exercise would face the same constraints. And the modelers are fairly open about these disadvantages and drawbacks. Instead of dismissing the models as a tool altogether - which is the current tone of the chapter - the authors could characterize them as useful for giving order of magnitude and directional estimates to inform policy. Also the NAS report on the cost of energy provides a very fair and useful summary of IAMs that would be a useful reference here. Its summary is also more mainstream than this one.	Noted. We will try to balance the discussion more.
36133	3	75	10	75	13	DICE does not provide sector by sector breakdowns of impacts, so where are these coming from?	Taken into account. The underlying sectoral breakdown of damages in DICE comes from the breakdown provided in Nordhaus and Boyer (2000), who specifically state that the damage functions in RICE and DICE are the same. That breakdown has been used by researchers wanting a sectoral disaggregation of the damages in subsequent versions of DICE. It is used, for example, by Lint Barrage as the basis for her sectoral decomposition of the damages in DICE 2010 in her 2013 Ph.D. dissertation at Yale, written under Nordhaus' supervision.
36132	3	75	4	75	6	While it is true that the modelers sometimes have to make "heroic" assumptions, they do try to calibrate the models to available information. Nordhaus and Boyer is an attempt to document that process for DICE. This paragraph is a bit too dismissive.	Noted. The role of "guesses and interpolation" in these damage functions is noted by Fisher-Vanden et al. in Climatic Change (2013), p.487.
26175	3	76	10	76	11	Please check an example of 10-15°C temperature increase with the category 6 in chapter 6 as this looks extreme.	Accepted: the range will be changed to 10-12C. That range is mentioned by Sherwood and Huber (2010) and also Weizman (2011); it is intended by them to be a tail event.
19493	3	76	14	76	16	Suggest deleting the paragraph on equity weighting--this is discussed extensively elsewhere in the chapter.	Rejected: The text is brief, and the issue is hardly irrelevant in a section on metrics.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36138	3	76	14	76	16	PAGE 2009 produces equity weighted damage estimates based on the amount of coast line a particular world region has.	Taken into account. Will be considered in revision.
36137	3	76	14	76	16	Another example of the aggregation issue - please delete this instance and make the point in one consolidated section.	Rejected: analytically, the weighting issue is a separate point. There is no reason to move it.
36136	3	76	7	76	13	This also seems outdated. You can depict climate sensitivity using a distribution, per the interagency working group that developed US government SCC estimates. FUND has integrated this improvement into the model.	Rejected: concern about the tails of the distribution of climate sensitivity are primarily post AR4.
23722	3	77	18		20	The above proposed language would then also better balance the claim here that "The initial economic effect is often an increase in the cost of energy..." In fact, if the costs of low-carbon energy supplies and enhanced efficiency technologies decrease enough, the economic effect of mitigation could easily imply a decrease in energy costs, compared to the baseline scenario where more energy would be fossil-fuel based. Thus, whether energy costs go up or down in a mitigation scenario relative to a baseline scenario depends on the relative values of many input assumptions, or endogenously derived parameters.	Rejected: The existing language, with its qualifications of "initial" and "often," is accurate.
22731	3	77	18		20	The above proposed language would then also better balance the claim here that "The initial economic effect is often an increase in the cost of energy..." In fact, if the costs of low-carbon energy supplies and enhanced efficiency technologies decrease enough, the economic effect of mitigation could easily imply a decrease in energy costs, compared to the baseline scenario where more energy would be fossil-fuel based. Thus, whether energy costs go up or down in a mitigation scenario relative to a baseline scenario depends on the relative values of many input assumptions, or endogenously derived parameters.	Taken into account. This comment is a duplicate of 23722, and will be addressed in response to that comment.
36139	3	77	32	78	10	Delete paragraphs repeating findings from ch 6.	Rejected: The paragraph serves a valid purpose and does not repeat findings from Chapter 6. First it explains the difference between models labeled there as IAMs and the models discussed here as IAMs. Second is makes an important analytical point -- not clarified in Chapter 6 -- about the role and economic significance of the utility function in these models.
32109	3	77	34	77	34	"But" should be substituted by "Although"	Rejected: That would change the meaning intended here.
25810	3	77	4			Insert after "... (b = 4 or 5)." the following sentence: Ackerman and Stanton (2012) perform sensitivity analyses on the DICE estimate of the social cost of carbon, varying the discount rate, climate sensitivity, and the shape of the damage function (drawing on other work by Weitzman); combinations of these factors imply that the social cost of carbon could be up to 30 times higher than the DICE default estimate. REFERENCE: Frank Ackerman and Elizabeth A. Stanton, "Climate Risks and Carbon Prices: Revising the Social Cost of Carbon," Economics E-journal 6, 2012-10, doi: 10.5018/economics-ejournal.ja.2012-10.	Taken into account. Because of space constraints, the reference may be added, but not the text.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
23721	3	77	8		15	This paragraph is not balanced in light of the material quoted from other sections of the report, as above. We suggest the following language: "Aside from avoided climate damages, the reduction of GHG emissions imposes economic costs and/or benefits on various actors....Those economic costs or benefits may take the form.... The changes in wellbeing could be measured, in part, in monetary terms.... For example, reductions in household or business income could be more than off-set in some mitigation scenarios due to lower energy costs paid by those households or businesses due to the lower demand for energy and fossil-fuels than in baseline scenarios.	Reject: Footnote 100 could be modified to state "There may also be economic benefits. As noted in Chapter 5, economic costs are far from...."
22730	3	77	8		15	This paragraph is not balanced in light of the material quoted from other sections of the report, as above. We suggest the following language: "Aside from avoided climate damages, the reduction of GHG emissions imposes economic costs and/or benefits on various actors....Those economic costs or benefits may take the form.... The changes in wellbeing could be measured, in part, in monetary terms.... For example, reductions in household or business income could be more than off-set in some mitigation scenarios due to lower energy costs paid by those households or businesses due to the lower demand for energy and fossil-fuels than in baseline scenarios.	Taken into account. This comment is a duplicate of 22730, and will be addressed in response to that comment.
19676	3	77	7	84	20	Same observations apply to these subsections as in comment 28 above	Rejected. No information on what comment 28 is.
21626	3	78	18	78	19	Kesicki & Ekins (2011) detail further problematic aspects of use of MAC curves in climate policy	Accepted: the reference to the published version (2012) will be considered.
25583	3	79				Add "Global" for the figure caption.	Accepted.
25584	3	79				The unit of horizontal axis of the figure is unclear. Please check it.	Accepted.
25452	3	79				The regions of the MAC curves in Figure 3.8.3 should be clear.	Accepted.
26009	3	79				I get the impression that it must be fraction on x axis not %.	Accepted.
24427	3	79				Do these figure represent global MAC curves or Asian MaC curbes? In addition, the note of the figures says "we are not able to independently validate the accuracy of these functions". If authors cannot validate them, they should not use the figures.	Taken into account. These are global MACs. We state that the curves are taken from Chapter 6
25585	3	79	10			Before the existing sentences, general observations for MACs should be discussed. Firstly, the MACs are very different among countries and regions due to the levels of existing energy efficiency, renewable energy potentials, expected energy demands etc. Secondly, Larger emission reduction potentials compered from reference case are estimated in the long future (e.g. 2050, 2030) than the near future (e.g. 2020) due to facility vintages, expectations of cost reductions of technologies. Also see K. Akimoto, F. Sano, T. Homma, K. Wada, M. Nagashima and J. Oda, Comparison of marginal abatement cost curves for 2020 and 2030: longer perspectives for effective global GHG emission reductions, Sustainability Science 7(2), 157-168 (2012).	Taken into account. These are global, not regional MACs. The reference will be added.
19495	3	79	12			It is not correct to say that aggregation of mitigation costs into a MAC precludes analysis of distributional issues. Such an analysis can be done by looking at the impact of higher fossil-based energy costs on different groups. E.g., Blonz, Burtraw and Wall, "Social Safety Nets and US Climate Policy Costs," Climate Policy Vol. 12, Issue 4, pp. 474-490 is a useful citation.	Accept. The sentence will be eliminated in the revision.
25451	3	79	9	79	9	The description "we are not able to independently validate the accuracy of these functions" is not appropriate. Reliable sources should be used in the report.	Accepted. The language will be changed to state that these data are taken from Chapter 6.
26047	3	8		10		Since the reviewer was asked to make proposals for shortening this chapter: These pages repeat what has already been said and what will be explained later on - maybe they could be omitted	Accepted. Final draft avoids duplication between ES and 3.1
21603	3	8	1	8	1	For reasons cited above, suggest wording as "Achieving strong mitigation will require major changes in present combinations of technology and behaviour."	Noted.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35949	3	8	1	8	3	This closing paragraph does not reflect the breadth of the arguments presented in the ES. It should be a much more comprehensive summary leading into the Introduction. The ES would be improved by taking a less introductory approach to the concepts. An improvement would involve presenting the arguments directly without superfluous language and redundant definitions, qualifiers, etc.	Noted.
35952	3	8	16	8	30	Word for word, many of these sentences were repeated in the ES. The content should be summarized in one or the other. No reason for duplication.	Same as 26047
35953	3	8	17	8	17	Typo: Delete extra question marks.	Taken into account -- Question marks removed.
19585	3	8	19	8	19	Can also be an issue of forecasting and not purely judgment and decision.	Noted
35950	3	8	2	8	2	Consider adding a reference to the statement "markets will underprovide technological change even in the presence of a carbon price" since this concept is less than intuitive.	Taken into account. ES rewritten.
27468	3	8	2	8	2	The necessary innovation with regard to climate change encompasses technological AND structural change (not only the technological dimension). Please change ".....will require technological AND STRUCTURAL change...." Thus chapter 3.10 should not concentrate on the technological dimension. It should have a broader view - encompassing structural change and innovation as well.	Noted.
35954	3	8	20	8	20	Typo: The word "is" should not appear.	Editorial - sentence corrected.
22691	3	8	22	8	23	This sentence makes it sound as if science *could*, but has so far failed, to discover the threshold for dangerous climate change. But surely it can't do this before we've worked out what counts as dangerous.	Noted

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27469	3	8	22	8	26	<p>It is wrong that "it has found that damage and risks increase steadily with increasing concentrations." Please see the previous IPCC reports: "The climate system is particularly challenging since it is known that components in the system are inherently chaotic; there are feedbacks that could potentially switch sign, and there are central processes that affect the system in a complicated, non-linear manner. These complex, chaotic, non-linear dynamics are an inherent aspect of the climate system." As the IPCC WGI [...SAR (IPCC, 1996)..] has noted, future unexpected, large and rapid climate system changes (as have occurred in the past) are, by their nature, difficult to predict. This implies that future climate changes may also involve 'surprises. In particular, these arise from the non-linear, chaotic nature of the climate system." (IPCC 2007, WGI, Chapter 14.2.2. Predictability in a Chaotic System.) Non linear increases of damage and risks as well as surprises ("tipping points") in the system have to be expected.</p> <p>The apparent smoothness of typical IPCC projections presented arises from (at least) three reasons: (i) they tend to focus on global mean quantities (e.g. temperature, sea-level) that aggregate and average over regional scale spatial variability, (ii) these global average projections often come from a simple box model (MAGICC) that has been 'trained' to emulate large scale features of state-of-the-art general circulation models (GCMs) but not their non-linear and stochastic features, (iii) where GCM output is shown it is typically averaged over relatively long time windows, and sometimes over ensembles of runs, in order to iron out short-term temporal variability. This is not to say that the overall response of the Earth system, full of non-linearity though it is, could not be smooth and quasi-linear. However, there are many components (or sub-systems) of the Earth system that could display non-linear behaviour and transitions under human (anthropogenic) climate forcing.</p> <p>Timothy M. Lenton, et al. Tipping elements in the Earth's climate system, 2007, PNAS, vol. 105, no. 6, p. 1786–1793) have identified different potential tipping elements under anthropogenic forcing that could pass a tipping point this century. There is still a lot of uncertainty regarding the threshold for tipping points and sometimes the character of tipping elements. But there is a very high probability that we have tipping elements in the climate system.</p> <p>The following changes are suggested: "But the science of climate change has not discovered a sharp threshold that divides safe concentrations of greenhouse gases (GHG) from highly damaging ones. Instead, it has found that damage and risks increase PARTLY steadily – PARTLY IN A NON-LINEAR WAY – with increasing concentrations. Consequently, determining what is dangerous is therefore a matter of judging what level of risk humanity desires to tolerate, TAKING INTO ACCOUNT THE NON-LINEAR INCREASE OF RISK THAT POTENTIAL TIPPING ELEMENTS UNDER ANTHROPOGENIC FORCING MIGHT PASS CERTAIN TIPPING POINTS WITH LARGE SCALE IMPLICATION WITHIN THIS CENTURY".</p>	Taken into account-- Removed word "steadily."
35955	3	8	25	8	26	<p>This introduction of the concept of risk could benefit from a couple of sentences noting the different senses of "risk" involved in considering the issue. Evaluating risk involves judging probabilities and uncertainties in slightly different ways. For example, one is considering risk when assessing the probabilities produced from the various science and climate models regarding correlations between emissions levels and atmospheric concentrations and between atmospheric concentrations and specific potential temperature changes. Slightly different is the risks of extreme events which we know will increase in frequency with rising temperatures, but there is nonetheless uncertainty about where/when such events will strike. Individuals may evaluate (subconsciously or consciously) these slightly different types of risks/uncertainties differently.</p>	Noted--will defer to Chapter 2

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29331	3	8	31	8	32	The relationship between ethics and economics is unclear in this passage.	Taken into account -- Discussion reworded and following paragraph added for clarification.
19586	3	8	36	8	40	Skip this part.	Noted
24574	3	8	39	8	39	Suggest replacing the word 'germane' with 'relevant' to simplify language for all readers	Noted
35951	3	8	4	11	27	The Introduction jumps from topic to topic; re-work after revising text.	Noted
21604	3	8	42	9	11	Good topic but what if the question of what is ethical is disputed? What about the question of who decides what is ethical? And how does on negotiate competing understandings of ethics internationally?	Noted
35956	3	8	42	9	11	This material should be integrated into the very beginning of the introduction rather than placed in a box.	noted--FAQs are assigned to boxes by IPCC
19584	3	8	7	8	8	Even though the chapter is not focusing on uncertainty in itself it appears like it has been relaxed in a somewhat arbitrary way.	Noted
21602	3	8				As the whole Report deals with cost effectiveness analyses, it would be probably appropriate here to say something explaining why CBA is the tool, most of the results we based the assessment report on are actually NOT DEALING with CBA but rather with CEA	Noted. We do mention CEA.
23551	3	8	31	8	31	I disagree with this claim. Only from an individual's perspective does the matter ultimately come down to ethics. The matter for most practical purposes comes down to POLITICS, to a matter of PROCESS. This is especially true with the administrative perspective that pervades the AR 5. Administering in almost all cases depends empirically on political legitimacy and certainly in all normative cases. Political legitimacy comes down to politics, that is, to political justification of a process that is fair. Once again, this report could be read to circumvent the political and the vexed matter of institutional design and legitimacy (see comment 15 and 13 on chapter 3 and 2 respectively).	Noted
23552	3	8	36	8	37	Again, as in comment 16 above, I am disturbed by this focus on decision makers acting either as individuals or as administrators, with the political level of collective determination left out. A process facilitator is different than an administrator understood as a decision maker. Similarly, a democratic citizen is different than an individual decision maker, understanding her actions qua citizen.	Noted. Politics is not a focus of this chapter.
23553	3	8	44	8	45	This distinction between an economic realm that is political and a normative realm that is ethical doesn't hold up. Ethics matters descriptively in the realm of economics -- it is just suppressed and ideologically covered in a discourse of value freeness -- and the political is saturated with ethical considerations of many kinds, many of them vicious. The normative realm, too, is not just ethical, but also economical and political. There is a normative economic outlook implied in many economic systems or ideologies and there is certainly a normative dimension to the political. Most importantly, though, the normative in the present context certainly involves politics, to wit, the normativity of democracy and of fair procedure.	Noted. These issues are discussed.
36140	3	80	19	80	21	This is only difficult to model and predict if you restrict your social science literature to economics--other fields have much more to say. For example, see Rogers' Diffusion of Innovation and related literature.	Noted. Rogers' analysis is qualitative: it does not by itself provide a tool for quantitative prediction.
31584	3	80	23	82	6	Box 3.8.2: Does this box account for the full diversity of views ? It seems to take the exclusive view that negative costs do not exist, and are just "an appearance". Couldn't negative costs occur when barriers are removed (e.g. through measures to facilitate lending, etc.) ?	Noted. The two sentences on lines 13-15 will be omitted. Lines 19-21 will be reworded.
25586	3	80	7	81	22	Good discussions. Keep these sentences.	Noted. Thank you for your comment.

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23723	3	80				<p>Here the reasonable question posed is: Could mitigation sometimes reduce costs? Unfortunately, the entire next page (page 81) provides a skeptical view of the net economics of enhanced energy efficiency technologies. Needless to say, there are many other studies which claim that there are many energy efficiency technologies that are cost effective, i.e. have negative costs over their lifetimes. These should be mentioned, at least, since the Joskow and Marron study is hardly definitive, and it is now 20 years old. Organizations like ACEEE in the US should be contacted for their latest research on this issue. But we all know that there are reasons why the market for energy efficiency technologies is not in equilibrium from a purely economically perspective, and that is, in part, because consumers consider many other factors in the purchasing decisions than economic factors. Some of these reasons are, in fact, listed on lines 32-37 on page 81, and line 1 of page 82. But there are many other factors to consider, such as the fact that some consumers do not like the color of compact fluorescent bulbs, or the Toyota Prius is ugly, or whatever causes most consumers not to even approach an optimal level of purchases of more efficient technologies in their lives. The many likely barriers to achieving a higher efficiency energy system should be discussed and policies for overcoming them presented. Finally, on this point, no one including the authors of the WGIII report, makes lifetime present value cost/benefit calculations before buying most products that they buy which consume energy. Here education plays a major role. As the customers learn how to optimize their cell phone tariffs, they might also learn how to calculate the NPV for investments, such as cars, heating systems or refrigerators.</p> <p>However, this box leaves out a discussion of many other ways in which a different set of input assumptions to the IAMs that compute the net costs or benefits of mitigating climate change could cause negative net costs to result. We ourselves have given some examples above, such as when the costs of low-carbon technologies are so low in the future in the mitigation scenario relative to the baseline scenario (due, perhaps, to higher mass production levels) that the price of fossil-fuels is much lower in the mitigation scenario than in the baseline scenario. This might cause the economy to grow faster, on average, in the mitigation scenario. And, as the report itself discusses, the equilibrium aspects of the computational basis for deriving IAM solutions may be biased towards both higher or lower net costs or benefits, depending on all the other scenario assumptions. Thus an important outcome of the report should be to make the decision makers think in scenarios.</p>	Same as 22732

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22732	3	80				<p>Here the reasonable question posed is: Could mitigation sometimes reduce costs? Unfortunately, the entire next page (page 81) provides a skeptical view of the net economics of enhanced energy efficiency technologies. Needless to say, there are many other studies which claim that there are many energy efficiency technologies that are cost effective, i.e. have negative costs over their lifetimes. These should be mentioned, at least, since the Joskow and Marron study is hardly definitive, and it is now 20 years old. Organizations like ACEEE in the US should be contacted for their latest research on this issue. But we all know that there are reasons why the market for energy efficiency technologies is not in equilibrium from a purely economically perspective, and that is, in part, because consumers consider many other factors in the purchasing decisions than economic factors. Some of these reasons are, in fact, listed on lines 32-37 on page 81, and line 1 of page 82. But there are many other factors to consider, such as the fact that some consumers do not like the color of compact fluorescent bulbs, or the Toyota Prius is ugly, or whatever causes most consumers not to even approach an optimal level of purchases of more efficient technologies in their lives. The many likely barriers to achieving a higher efficiency energy system should be discussed and policies for overcoming them presented. Finally, on this point, no one including the authors of the WGIII report, makes lifetime present value cost/benefit calculations before buying most products that they buy which consume energy. Here education plays a major role. As the customers learn how to optimize their cell phone tariffs, they might also learn how to calculate the NPV for investments, such as cars, heating systems or refrigerators.</p> <p>However, this box leaves out a discussion of many other ways in which a different set of input assumptions to the IAMs that compute the net costs or benefits of mitigating climate change could cause negative net costs to result. We ourselves have given some examples above, such as when the costs of low-carbon technologies are so low in the future in the mitigation scenario relative to the baseline scenario (due, perhaps, to higher mass production levels) that the price of fossil-fuels is much lower in the mitigation scenario than in the baseline scenario. This might cause the economy to grow faster, on average, in the mitigation scenario. And, as the report itself discusses, the equilibrium aspects of the computational basis for deriving IAM solutions may be biased towards both higher or lower net costs or benefits, depending on all the other scenario assumptions. Thus an important outcome of the report should be to make the decision makers think in scenarios.</p>	Accepted. The two sentences on lines 13-15 will be omitted. Lines 19-21 will be reworded.
36142	3	81	19	81	22	This is worded too strongly. Section 3.9.1 goes into some detail about the availability of energy savings opportunities and offers a better treatment overall.	Editorial
36143	3	81	21	81	22	Argument does not follow... if "all cost reducing options for saving energy were automatically implemented" then there would be NO options with negative mitigation costs.	Editorial
36141	3	81	5	81	5	Reword the term "free lunch" -- or just delete last sentence.	Editorial

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29539	3	81-82	28			The paragraph describing negative mitigation costs is biased and incomplete. There is a very large literature demonstrating the existence of negative net cost options that is ignored and downplayed in this paragraph and throughout the AR5. The archetypal example is this one, which demonstrates a technology (efficient magnetic ballasts in commercial buildings) that had no hidden costs, correct parameter specification, and sufficient time between introduction and adoption of the technology to prove that the market wasn't adopting a technology yielding higher than 6% real returns for 99% of commercial sector floor space. Koomey, Jonathan G., Alan H. Sanstad, and Leslie J. Shown. 1996. "Energy-Efficient Lighting: Market Data, Market Imperfections, and Policy Success." Contemporary Economic Policy. vol. XIV, no. 3. July (Also LBL-37702.REV). pp. 98-111. [http://enduse.lbl.gov/Info/37702-abstract.html]. For a discussion of how to incorporate such options into conventional economic thinking, see Sanstad, Alan H., Stephen DeCanio, Gale Boyd, and Jonathan G. Koomey. 2001. "Estimating bounds on the economy-wide effects of the CEF policy scenarios." Energy Policy (also LBNL-48104). vol. 29, no. 14. November. pp. 1299-1312. Also see DeCanio, Stephen J. 1997. "Economic Modeling and the False Tradeoff between Environmental Protection and Economic Growth." Contemporary Economic Policy. vol. 15, no. 4. October. pp. 10-27. DeCanio, Stephen J. 1998. "The efficiency paradox: bureaucratic and organizational barriers to profitable energy-saving investments." Energy Policy. vol. 26, no. 5. April. pp. 441-454. DeCanio, Stephen J., and W. E. Watkins. 1998. "Investment in Energy Efficiency: Do the Characteristics of Firms Matter?" Review of Economics and Statistics. vol. 80, no. 1. February. pp. 95-107. Laitner, John A. "Skip", Stephen J. Decanio, Jonathan G. Koomey, and Alan H. Sanstad. 2003. "Room for Improvement: Increasing the Value of Energy Modeling for Policy Analysis." Utilities Policy (also LBNL-50627). vol. 11, no. 2. June. pp. 87-94.	Noted. The language will be revised and these references considered.
36147	3	82	12	82	12	The authors may want to reword this to say, "since carbon isn't regulated to any degree in many countries," instead of "most countries" given the range of actions happening around the world.	Editorial
19497	3	82	22			I suggest saying "...one tonne increase in emissions a time 0" instead of "...one tonne increase in emission today." The SCC can be calculated for emissions at any point in the future as well as today.	Accepted
36148	3	82	24	82	24	For FUND this should be marginal net damage as CO2 fertilization can increase yields up to a threshold	Accepted. Will delete the adjective "gross"
19496	3	82	29	82	30	I have never heard the alternate definition of the social cost of carbon equating it to the net welfare effect of one more ton of carbon including avoided mitigation costs. This is not the definition used by the US government or the academic literature. I suggest only including the primary definition (ie., the marginal social damages from a ton of CO2 emissions). If needed, the alternate definition can be included in a footnote, and a reference should be provided to a paper or report that uses this definition.	Taken into account. The reference to SCC as a net concept is solely within the context of the theoretical model in 3.5.3.3; the text will be moved to footnote 114, which refers specifically to that context.
31585	3	82	3	82	6	I do not understand this paragraph - it likely needs a clarification / rephrasing.	Taken into account. This will be considered
36151	3	82	32	82	32	Reword: should only reflect.	Editorial
36146	3	82	8	82	15	Consider adding more applied examples like this to the chapter.	Taken into account. This will be considered
36144	3	82	1	82	6	There is a paper by Newell, Pizer, et al on sector vs. economy wide strategies that illustrates the importance of accounting for distortions when estimating the cost of policies. It is published but here's the link to the WP version: http://www.rff.org/documents/RFF-DP-05-08.pdf	Noted. The reference will be considered.

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36149	3	82	28	82	30	The description of SCC as a net concept is wrong. It is a way to evaluate marginal emissions damages (or foregone marginal emissions damages). It doesn't include the cost of abatement. Instead one would compare SCC to an estimate of MAC at a particular point in time.	Accepted. The reference to SCC as a net concept is solely within the context of the theoretical model in 3.5.3.3; the text will be moved to footnote 114, which refers specifically to that context.
36150	3	82	28	82	30	The reference to 3.5.3 is wrong - this is the co-benefits section.	Rejected: The reference is to a particular theoretical model introduced in section 3.5.3.3.
36145	3	82	7	82	37	SCC is conceptually broader than the way it is described initially in this section as something to be employed to inform regulatory decisions that have little effect on global emissions. Consider reframing the section to be more in line with the way this concept is described in the published literature. It is always evaluating the damages of a one ton increase at the margin. But SCC for small changes in policy doesn't have to worry about the feedback of a policy action into the economy and climate trajectory, while one used to evaluate larger-scale policy does at least further out in time. Chapter 2 in the recent IMF publication Fiscal Policy to Mitigate Climate Change makes this point. See http://dropbox.curry.com/ShowNotesArchive/2012/06/NA-418-2012-05-17/Assets/Agenda%2021/IMFclimateBook.pdf	Taken into account. This will be considered
36154	3	83	19	83	19	"Convenience is the only justification..." This is too strongly worded. All models are simplifications of complex systems, the only relevant question is the degree to which they capture the most relevant process and use appropriate index variables.	Accepted. Instead of "convenience" the text will be reworded to say "mathematical tractability is one rationale for making this assumption." The fact is that changing the formulation would entail very substantial complications for the mathematical solution of the models.
36155	3	83	21	83	21	There is no justification given for the concept of degree years.	Rejected: In the case of ice sheet melting, the length of time during which the sheet is exposed to warm temperatures is likely to be a causal factor. That exposure is measured by degree years.
36152	3	83	1	83	4	The UK has moved beyond the SCC to using a shadow price of capital concept. This is because they are no longer evaluating how much to do - that is dictated by the EU wide cap - but what actions to take first. In other words, they are in a cost-effectiveness world.	Accepted: Footnote 116 will be extended to note this.
36153	3	83	16	83	22	This paragraph seems to not accurately represent PAGE. Catastrophic impacts in PAGE are a function of the threshold temperature, the rate at which the probability of experiencing a discontinuity increases above the threshold, and the magnitude of the resulting catastrophe.	Accepted: the text will be modified to reflect this.
23830	3	84				Footnote 123. Give an example of this? Immediately is rather strong. I have never seen an IRF that is not 1 at the $t=0$, and if it the species moves quickly into the ocean then this can easily be represented (as it is for CO ₂)	Taken into account. This will be considered
36158	3	84	15	84	15	RFF did a workshop on this topic in 2011 and the papers, available online, provide a treatment of declining discount rates etc. http://rff.org/events/pages/intergenerational-discounting-workshop.aspx	Accepted: This reference will be included.

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25811	3	84	16			Insert after end of sentence: For example, use of the Epstein-Zin utility function in the DICE model leads to solutions quite similar to running DICE with a lower discount rate (Ackerman, Stanton, and Bueno 2013). REFERENCE: Frank Ackerman, Elizabeth A. Stanton, and Ramón Bueno, "Epstein-Zin Utility in DICE: Is Risk Aversion Irrelevant to Climate Policy?", Environmental and Resource Economics 2013 [accepted on-line, not yet in a numbered/paginated journal issue], doi:10.1007/s10640-013-9645-z	Accepted: The reference will be considered, but the additional text will not be included due to space constraints.
36159	3	84	17	84	20	While factually correct that the assumed future regulatory regime is critical to the computed SCC, the application of the DICE, FUND, PAGE by the U.S. government has used multiple scenarios of future emissions trajectories, including one that assumes a stabilization (mitigation/policy included) pathway. It is not accurate to imply that these models are being used without seriously consideration of future scenarios.	Taken into account. This is intended as a qualification on the general concept of SCC, not a comment on the specific analysis performed by the interagency task force. Will clarify.
29919	3	84	21	86	28	I think section 3.8.5. needs to expanded to include 1) more material that is relevant to the users of metrics. The policy community is waiting for IPCC's assessment of the metrics available and this is too general for their situation; 2) more references to work in WG1 where a part of the assessment has been done, but not enough on the economic (and political) aspects. Thus the assessment in WG1 needs to be supplemented by a real assessment from the WGIII perspective.	Noted. More cross referencing with WGI will be included.
29920	3	84	21	86	28	There is only one minor footnote reference to AR5 WG1, and one reference to Allbritton et al 1995. This does not look very up to date. After all, WGI and WGIII are parts of the same Fifth Assessment report, and coordination and more contact would be a strength. (In chapter 1 the connection to WG1 is better; see section 1.2.1.5)	Accepted: Reference to WGI added to main text.
29921	3	84	21	86	28	The metric adopted by the Kyoto Protocol; the GWP, has also (as far as I know) been adopted for the 2nd commitment period of the KP (see separate comment on this). Thus, much more focus on the strengths and weaknesses of this metric is needed. And how can it function in a setting with a stabilization target; e.g. 2 deg C. I understand that you need to keep the text short, but please also consider the possibility of an Annex or Supporting Material.	Accepted
29929	3	84	21	86	28	The overview illustration (in FOD?) now published by Deuber et al (ESP) could be useful here.	Rejected: Because of space constraints, an additional illustration cannot be included in this chapter.
29931	3	84	21	86	28	The chapter could give a reference to the 2nd commitment period of Kyoto and which metric that will be used there. See http://unfccc.int/resource/docs/2011/cmp7/eng/10a01.pdf , page 24, B 5.	Noted.
29939	3	84	21	86	28	The text incorporates to use perspectives from outside economics and give references to several multi-disciplinary or natural science papers; which I think strengthens the text. However, given the multi-disciplinary nature, and the multi-use of metrics, I think the text has to take this further. And I suggest that the authors read the text in WG1/Ch8 on metrics.	Noted. We have read WG1/Ch8.
29942	3	84	21	86	28	The Box on Metrics in the Technical Summary (Box TS.2) and the text in section 3.8.5 needs, in my view, more coordination. The text in chapter 3 should, in my view, function as a basis for the TS Box.	Accepted. Primarily a comment on the Technical Summary.
29944	3	84	21	86	28	The GWP values that are actually used for calculations of CO2-equivalent emissions should be given somewhere in the report.	Noted.
26930	3	84	22	84	24	A potential reference to the varying share of methane in different countries is Table 5 in the newly accepted paper Aamaas et al., Simple emission metrics for climate impacts, Earth System Dynamics.	Taken into account. Consider this or another reference for inclusion.
29913	3	84	23	84	23	Large (or small) in terms of what? In terms of mass is not meaningful. You could say large in terms of contribution to climate effect, or you could say "significant" or "important"	Editorial
19023	3	84	25	84	25	The term "unit by unit" is not accurate enough. If the unit is CO2 equivalent concentrations, then the two gases are equally potent when expressed in that particular unit. You need to be more explicit and say that per unit mass or per unit atmospheric mixing ratio, methane is more potent than CO2. It makes quite a difference by the way if you're talking mass or volume.	Editorial

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
29914	3	84	25	84	25	The sentence "Unit for unit, methane is..." needs rewording. What is the unit? Per molecule in the atmosphere the ratio is roughly 25, but if you relate this to emissions the picture is more complicated due to the differences in time scales of removal.	Editorial
29915	3	84	28	84	28	In addition to "fair" this comparison also depends on what aspects of climate change that is used as impact parameter in the metric; RF, dT, sea level rise, precipitation	Noted.
23828	3	84	28			"fair" for who? It does not need to be fair per se, just a method is needed. This word is not necessary here.	Taken into account. Statement removed in revision.
29916	3	84	32	84	33	Would be good if it could be explained how this is related to SCC. (Later it could be mentioned that the ratio of SCC_i/SCC_{CO2} is GDP)	Taken into account. Section revised.
29917	3	84	32	84	36	A paper by Marten and Newbold in Energy Policy 51 (2012) 957-972 is very relevant here. Many of the points in that paper could be given here.	Accepted. The reference will be considered.
20737	3	84	34	84	34	Marten et al. (2012, Energy Policy) derived social cost of non-CO2 gases (e.g. CH4) by using MAGICC-DICE model. This paper can be cited here.	Taken into account. The reference will be considered.
19024	3	84	38	84	38	Footnote: $\phi(0)=1$ by definition for an instantaneous emission. It takes a bit of time for CO2 to diffuse and for sinks to kick in. I don't think this footnote adds anything, I suggest it is deleted.	Taken into account. Footnote deleted.
23829	3	84	38			The last equation is not true. This is not a necessity and there are in fact IRFs that do the opposite. See the IRFs for the RCP85 in http://www.atmos-chem-phys-discuss.net/12/19799/2012/acpd-12-19799-2012.html	Taken into account. Equation removed.
19028	3	84	21	86	28	The quality of this section is not as good as it was in the FOD. A lot of the section is background material that is well known (but reported here with a number of errors). The conclusions are pretty weak.	Noted
19033	3	84	21	86	28	There are very few references post-AR4 in this section. You could almost restrict this section to the content of page 86.	Rejected: Since the purpose is to place the discussion of physical metrics within the economic framework of a damage function, omitting the material from pages 84-85 would be counterproductive.
36160	3	84	29	84	36	Marten and Newbold estimate the social cost of methane and NO2 and compare the results to the GWP approach. That paper should be cited here - published in Energy Policy in 2012 (working paper version available at http://yosemite.epa.gov/EE/epa/eed.nsf/WPNumber/2011-01).	Taken into account - reference considered.
36156	3	84	3	84	5	Relevant to this is whether/how the PAGE and DICE models treat catastrophic impacts - the descriptions in this chapter largely focus on the depiction of non-catastrophic impact categories.	Taken into account. This will be considered
36157	3	84	7	84	16	This issue is not unique to these IAMs and should be moved to the discussion on discount rates and the discussion of eta.	Rejected. The discussion here refers specifically to empirical analyses that examine the effect of Epstein-Zin discounting on the SCC.
23827	3	84				Frankly, I found this section on metrics a step back from the FOD. The FOD needed improvement, but the SOD version could simply refer to the WGI text. The SOD text gives a very general overview of emission metrics, but does not address the most important issues. WGI is more focused on the physical aspects of emission metrics, but necessarily needs to discuss the value issues. WGIII can really address the value issues in emission metrics, but this section fails to do that.	Noted. Will work to improve the narrative.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
32402	3	84	21	86	28	Please ensure consistency with WGI Ch08, recent publication of Tanaka et al. (2013), Climatic Change, may be useful here as well. Is a duplication of formulas necessary (WGI and WGIII reports)?	Taken into account. This is a chapter on economics, and a section on economic measures. The goal is to place the discussion of physical metrics within the economic framework of a damage function. That is the reason for the mathematical formulation used here. The publication by Tanaka et al (2013) will be noted..
32403	3	84	26	84	29	Please reference WGI Ch08 more precisely, i.e. Section 8.7.	Editorial
23833	3	85				Footnote 124. Why is this a footnote and note a reference?	Taken into account. Footnote removed.
29922	3	85	1	85	1	Here I would rather refer to the first IPCC report from 1990. I can't see why the reference to Albritton et al is relevant here.	Taken into account. Albritton et al reference removed.
29918	3	85	1	85	2	I guess this is a question of wording: RF is not an Emission metric. But RF is used as indicator in GWP where RF(t) is integrated up to a chosen time horizon and given per unit emission. So I think a slight rewording is needed.	Accepted. This will be reworded.
23831	3	85	1			"endorsed". With such a strong word I think a quote or very specific page and line number is needed in the reference. I was not aware the IPCC endorsed the GWP as strongly as suggested here.	Accepted: the verb will be changed.
29924	3	85	10	85	12	The reference to Schmalensee in this way seems very odd. I absolutely support referring to old papers that laid the basis for later work. But referring to the GWP values in this paper is not appropriate. There are so many new studies and assessments that are much more relevant to refer to. I strongly suggest using numbers from WGI here.	Taken into account. WGI values will be used.
19027	3	85	11	85	11	Why not use WGI Chapter 8 numbers here, and refer to a 1993 reference instead?	Taken into consideration - values no longer referenced in section.
36162	3	85	11	85	11	Update to 2007 IPCC values 72,25,7.6 and reference newer IPCC work on GWPs.	Accepted: we will use the values from WGI if discussion is retained in final draft.
20740	3	85	125	85	125	Footnote 125: In an idealized setting, the Temperature Proxy Index (TEMP) is similar to the Sustained Integrated Global Temperature change Potential (SIGTP) (Cherubini et al., 2013), which can be optionally mentioned.	Taken into account. The reference will be considered.
29927	3	85	17	85	23	There is a fundamental difference between GWP and GTP: The GWP integrates the RF up to the Time horizon, while GTP gives the temperature at a chosen point in time. This is not clear enough in the text. And it could also be mentioned that there is a metric called "integrated GTP" or iGTP (Peters et al., Environ. Res. Lett. 6 (2011) and Azar and Johanson, Earth Syst. Dynam., 3, 139–147, 2012	Accepted: we will clarify this, and consider adding the references.
29932	3	85	19	85	19	Pulse vs sustained step changes in emissions are discussed here, with a reference to Harvey 1993. Much work is done on this and more recent references are available (e.g. Shine et al 2005). And I think it is important to make it clear the implicit assumptions that are built into metrics using step changes; i.e. that future emitters or policy makers will continue the activity with no changes in emissions. This is also briefly discussed in WG1/chapter 8.	Taken into consideration. The reference will be considered.
30227	3	85	19		20	If an outcome variable other than radiative forcing is used, would Phi(tau) need to be changed? In case of temperature as outcome variable, path dependencies will play a role, i.e. the temperature increase at time t does not only depend on GHG concentrations at time t, but rather the concentration pathway for all times tau<t.	Taken into consideration. Equation removed.
20738	3	85	2	85	2	Is it "radiative efficiency" (i.e incremental radiative forcing per unit increase in a greenhouse gas concentration) rather than "extra forcing"?	Taken into account. Text revised.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
19029	3	85	20	85	23	This is grossly incorrect. Not only should there be no $\phi(\tau)$ term in the equation, but for GTP, there is no integral over time either. So you cannot say that GTP is a special case of equation 3.8.6 unless you define your $\Delta O(\tau)$ function as a Dirac function (ie $=0$ for $\tau < T$, and global mean temperature change for $\tau = T$).	Taken into account. Equation removed.
29926	3	85	20	85	20	"change" is missing; should be "Global Temperature change Potential".	Taken into account.
29934	3	85	20	85	23	The equation 3.8.8. does not work for temperature. Convolution and an Impulse Response Function for temperature have to be introduced to account for the temperature response to the forcing.	Taken into consideration. Equation removed.
30228	3	85	20		23	There is another crucial difference between the GTP and GWP: GWP integrates effects over time, while the GTP only evaluates the climate outcome at a specified end-point, e.g. 2100.	Taken into account. This will be clarified.
23832	3	85	21	85	23	This is actually quite incorrect. The GTP is a convolution. The Δ here would be the temperature response to a unit forcing. Since it is a convolution it would be expressed differently to Equation 3.8.8. The discount rate would also be taken as zero for the GTP.	Taken into account. Equation removed.
19030	3	85	22	85	25	The text mentions Eq. 3.8.8: what's the point of discounting an end-point metric??? The discounting just cancels out in the ratio.	Rejected: the discounting does not cancel out.
29933	3	85	23	85	23	footnote end of line 23: the integrated GTP (iGTP) by Peters et al. 2011 Environ. Res. Lett. 6 (2011) and by Azar and Johansson (Earth Syst. Dynam., 3, 139–147, 2012) should be mentioned here.	Taken into consideration. The reference will be considered.
19032	3	85	26	85	27	A constant background is assumed when computing the RF in the GWP, but this doesn't need to be the case. This said, one can compute a GWP in the future, and the result will depend on the timing of the emissions, so this sentence is not correct.	Taken into account. Section revised.
19036	3	85	27	85	28	It is good practice that IPCC does not call for further research. Use a confidence level instead.	Noted.
19034	3	85	27	85	29	Yes, and CO2 uptake by the ocean is less at higher levels than lower levels. The two effects compensate to some effect. This is all well known. Do you recommend that the definition of GWP be made scenario-dependent?	Taken into account. Statement removed in revision.
20739	3	85	28	85	29	There are approaches accounting for the change in background gas concentrations while others assume constant background concentrations. I don't think it very clear at this point which approach is preferable in general. Reisinger et al. (2011, Environmental Research Letter) look at the influence of the background concentration on metric values.	Noted.
19035	3	85	34	85	35	This is a strong conclusion. It needs to be highlighted more.	Noted.
29935	3	85	36	85	37	It could also be mentioned that it would be difficult to agree upon a discount rate in a negotiation context.	Noted.
29936	3	85	36	85	37	It could also be discussed how clear the implicit discounting embedded in the GWP is to the users.	Noted.
19031	3	85	4	85	4	$t=0$ does not have to be "now". GWPs can be computed in the past or in the future, as a number of authors have done.	Taken into account. Sentence removed.
19025	3	85	5	85	5	Equation 3.8.6: well if $\Delta O(\tau)$ is the additional forcing in year τ that results from an instantaneous emission of gas j at time $t=0$, then there should be no $\phi(\tau)$ in the equation ! You're double-counting the decay effect of the gas on the metric.	Taken into account. Equation removed.
30226	3	85	5		5	I am a bit puzzled by the formulation of Equation 3.8.6. What is the difference between the functions $\Phi(\tau)$ and $O(\tau)$? I understand that $\Phi(\tau)$ gives the fraction of a pulse emission that is still resident after time τ . If $O(\tau)$ gives the resulting extra forcing, shouldn't it depend on $\Phi(\tau)$?	Taken into consideration. Equation removed.
29925	3	85	6	85	7	Regarding "taking CO2 as base": This is a difficult and critical choice that needs more attention. At least some discussion of the adequacy of CO2 as reference gas. (see discussion in WGI/Ch8)	Noted. Will be considered. Additionally, the issue of whether there should be a single metric will be addressed.
19026	3	85	9	85	9	Note that CO2e is usually used to mean "equivalent-CO2" which is not the same as "CO2-equivalent", see eg wikipedia, http://en.wikipedia.org/wiki/Carbon_dioxide_equivalent	Taken into consideration - CO2e no longer referenced in section
29923	3	85	9	85	10	Good that this point (i.e. the importance of the choice of RF and Time horizon) is made clear.	Noted. Thank you for your comment.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36161	3	85	10	85	10	We suggest deleting the phrase "This seems relatively benign," and limiting the sentence to "The choice of radiative forcing and T are very significant."	Accepted: the wording will be changed
36163	3	85	35	85	37	This section again seems too dismissive of IAMs. It's a hard problem with many uncertainties over a very long time horizon. It's a mistake to expect a precise estimate out of these models but they can be a useful tool for understanding where key uncertainties lie and the sensitivity of the results to both economic and ethical parameters. Ethical parameters (including the discount rate) are very important.	Rejected: The issue is not precision but reliability. Based on the impacts literature, the judgment being made is that the damage functions are of low reliability.
32331	3	86	11	86	17	This paragraph is very important. There is, however, some inconsistency in the logic that should be corrected with additional consideration. Line 16 states that simple metrics are "inaccurate in representing the relevant damage trade-offs", although lines 11 and 12 note "a conceptual problem [...] on what considerations are relevant". As this conceptual problem on what is relevant indeed exists (think of the debate between CBA and CEA approaches to climate policy, for example), the problem on whether a metric is exactly accurate is of secondary importance. In a paper currently in press (Tommi Ekholm, Tomi J. Lindroos and Ilkka Savolainen, 2013. Robustness of climate metrics under climate policy ambiguity. Environmental Science & Policy, in press, doi:10.1016/j.envsci.2013.03.006, preprint available at http://sal.aalto.fi/publications/pdf-files/pekh12c.pdf) we address this problem and propose that under ambiguity in the climatic targets, a robust metric that performs well under several policy targets should be selected (instead of a metric that is optimized solely for a single target, e.g. CEA with a 2C warming limit). This consideration should be added to the discussion on how different metrics are applicable to different problem settings.	Taken into account. Text revised.
29938	3	86	11	86	11	I think it is important to stress the implicit value judgements involved in the choice of metric. E.g. what the implicit choices in the GWP100 are.	Noted.
20742	3	86	11	86	15	This point is also made by an overview paper of Tanaka et al. (2010, Carbon Management, doi:10.4155/cmt.10.28).	Taken into account. The reference will be considered.
21627	3	86	15	86	19	In the case of the Clean Development Mechanism, both the choice of GWP as a metric and the numbers used have had substantial economic and physical consequences. Suggest citing Sutter et al (2007) DOI: 10.1007/s10584-007-9269-9 and MacKenzie (2009) DOI:10.1016/j.aos.2008.02.004	Taken into account. The reference will be considered.
29928	3	86	17	86	17	Would it be possible to add a few words about the weighting over time that is done in GWP? i.e. the weighting by 1 up to the time horizon and then zero thereafter. How is this method assessed by economists? As shown in a paper by Fuglestedt et al 2003, the use of the same time horizon across gases – and assuming the same damage function – one implicitly use different discount rates across gases. Considerations like this could be useful to bridge the WG1 perspective to the perspective of economists.	Accepted: this will be noted.
23834	3	86	18			This line seems to use the wrong symbol and the wrong equation?	Taken into account. Equation removed.
32332	3	86	22	86	26	Similar results to those cited at line 23 were presented in a paper currently in press (Tommi Ekholm, Tomi J. Lindroos and Ilkka Savolainen, 2013. Robustness of climate metrics under climate policy ambiguity. Environmental Science & Policy, in press, doi:10.1016/j.envsci.2013.03.006, preprint available at http://sal.aalto.fi/publications/pdf-files/pekh12c.pdf). This paper in addition presents that under three interpretations of the 2C target and a CEA approach to mitigation, there is a wide range of CH4 weights for which the additional cost (when compared to the cost-efficient metric of each target setting) remains below 5%. This addition should be made to the discussion on the economic implications of climate metrics.	Accepted. The reference will be considered.
23835	3	86	22	86	28	These two articles are particularly relevant for the discussion here: Reisinger et al 2012 http://link.springer.com/article/10.1007/s10584-012-0593-3 , Smith et al http://link.springer.com/article/10.1007/s10584-012-0565-7	Taken into account. The reference will be considered.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22515	3	86	26			Please, add after the words "...economic approach." the following sentences: "This is also the result from Ekholm et al. (in press) which finds that if the weighting factor for methane is from 20 to 40 the cost increase is very moderate compared to first-best approach." Ref.: EKHOLM, T., LINDROOS, T.J., SAVOLAINEN, I. Robustness of climate metrics under climate policy ambiguity (in press). Environmental Science and Policy.	Taken into account. The reference will be considered.
36164	3	86	30	86	35	This list of classical assumptions does beg the question of how relevant any economics based on them can be-- perhaps that should be addressed?	Noted
32328	3	86	4	86	4	It could be worthy to note that Manne and Richels didn't use the name "Global cost potential" themselves in the 2001 paper.	Taken into account. This will be considered
32329	3	86	6	86	7	"Qualitatively comparable results" is ambiguous, please indicate how the results are comparable. If the point is that both GCP and GTP yield weights between CH4 and CO2 that are increasing over time, this comparability applies only if the time horizon of GTP decreases over time. This needs to be noted explicitly in the text, otherwise the comparison is misleading.	Taken into account. This will be considered
29937	3	86	6	86	6	It could be noted that the GCP is equivalent to a damage based metric assuming that the damage is zero below a temperature treshold and infinte above.	Noted.
32330	3	86	7	86	10	GTP should perhaps be not seen as an approximation of the GCP (cf. "even better approximation"). CETP is, by purpose, an approximation of GCP. Please correct the wording in this sentence.	Accepted. Text revised, sentence removed.
20741	3	86	7	86	10	This finding is corroborated by Tanaka et al. (2013, Climatic Change, doi:10.1007/s10584-013-0693-8). This paper compares the values of several different metrics (GWP, GTP, GCP, CETP, TEMP, etc) under 2 degree target.	Taken into account. The reference will be considered.
36165	3	87	1	87	15	This section does a good job of speaking directly to the implications of findings in concrete terms. This should be done earlier in the chapter as well.	Noted
36167	3	87	34	87	35	Please fix this triple negative to make the sentence more comprehensible. Does it mean: "The features of choice situations that lead to consumer misoptimization are difficult to observe"?	Taken into account - text will be clarified
36166	3	87	12	87	18	This section should refer back to Box 3.8.2 and cite Hil Huntington's and the EMF's work on reasons for the Energy Efficiency Paradox.	Accepted - text will be improved and the EE gap will be integrated (it used to be there anyway). HH work is cited in 3.9.
27480	3	88	17	88	28	This paragraph is missing a conclusion. It ends rather abrupt and it is not clear what to make of it. A short concluding sentence should be added.	Accepted - text revised.
27481	3	88	29	88	32	This paragraph would be more complete, if some few examples on the reasons why the majority of firms still do not implement pro-environment action, even if it is in their self-interest.	Taken into account - if peer reviewed material is available to cover these, contents will be duly integrated
27482	3	88	33	88	36	It is unclear, what this paragraph is meaning to say.	Noted.
19501	3	88	34			Loss aversion should be defined.	Taken into account - text revised.
36168	3	88	16	88	36	It is important to stress that there is very little empirical evidence here. Split incentives and other market failures are also consistent with this observation.	Noted.
23518	3	89	21	90	5	I wonder whether it might be important to distinguish "intrinsic motivations" and "altruistic" here - whilst there is evidence that intrinsic motivations can be very important for voluntary carbon reductions, the framing of "altruistic" suggests welfare or wellbeing losses related to carbon reduction which might not necessarily be required (links to discussion about decoupling emissions and wellbeing in chapter 4).	Noted
22692	3	9	13	9	13	Isn't it more perspicuous to say that different things can be judged as just or unjust, instead of speaking of 'lenses'? These "lenses" are after all not obviously mutually exclusive.	Noted. Not sure that is more perspicuous.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35957	3	9	16	9	18	The example that "all countries have a right to clean air" is misleading since this 1. doesn't exist as an established right at the international level, nor at the national level except in a few instances, and 2. human rights law does not speak about the rights of countries, but the rights of individuals in countries, and the duties of a government to its citizens vis-a-vis particular rights.	Taken into account--text revised.
22693	3	9	24	9	24	Why the scare quotes around 'correct'?	Noted--because there is no correct perspective
35958	3	9	28	9	37	Recommend cutting this paragraph in the interest of conciseness.	Noted
19587	3	9	30	9	34	This part is mixing concepts. Disagreement and uncertainty can apply to either case.	Noted
24093	3	9	34			The reference to geoengineering is not explained and does not seem necessary.	Noted
21605	3	9	38	9	47	Very well worded paragraph. Executive Summary is less effective at summarising these issues. Especially important is the chapter's stated intention to make (implicit) assumptions within cost benefit analysis (CBA) clear and explicit. Suggest taking some of these sentences into ExecSum.	Noted-- ES and 3.1 revised
35959	3	9	31	9	32	The term "cost of inaction" is imprecise. It isn't clear what is meant - the cost of literally doing nothing, or not doing any additional mitigation beyond what is already planned or in place. Does it imply an estimate of climate change absent Kyoto and other national and sub-national climate policies, or including these measures but assuming no additional action?	Noted--the term is not intended to be that precise, only to indicate that there is a cost of action and a cost of inaction.
27325	3	9	35	9	37	In case, it's truth that social goals are as important as the struggle against environmental change, but it's known that, in fact, these issues are intrinsically linked in cause-effect, but also "multiple reasons". See Smit and Wandel (2002), who argue that adaptation actions are never exclusively linked to climate change, but to a combination of factors. In fact, in many cases, one can not differentiate actions related to climate change related actions, for example, a revaluation of agriculture, poverty reduction and food security. Reference: Smit, B.; Wandel, J. "Adaptation, Adaptive Capacity and Vulnerability". Global Environmental Change 16 (2006):282-292.	Noted
29698	3	9 of 148	34		34	DELETE: "and potentially geoengineering options." Again, the phrasing implies that adaptation, mitigation and geoengineering are on the same footing -- an implication that is completely unfounded. The inclusion of "potentially" does not adequately reflect the uncertain, speculative nature of geoengineering.	Noted
29342	3	90	23			How does neoclassical economics relate to the economic theory presenting in 3.8?	Noted
36169	3	90	6	91	5	Research suggests that the "information gap" is not a major factor in the failure to act on climate change. Biases and group memberships play a significant role in how people process new, clarified, or repeated information. This should be mentioned, or decision makers will falsely infer that pure education campaigns could have a major effect on climate-related responses. Additional relevant citations include work by Maibach and Anthony Leiserowitz.	Rejected - issues already covered, e.g. political affiliation (end of section 3.9.1.5)
36170	3	90	6	91	5	This section should start with the cognitive factors that cause people to underweight climate change--long-term change, difficulty of mentally modeling an uncertain future, perception of effects as distant in space and time. Then onto the items in lines 27 onward, and only then into the ways that people might make cognitive errors that favor responding to and believing in climate change. This would better reflect the actual relative weights of these various effects.	Taken into account - the flow of the text will be improved
36172	3	90	22	90	26	This paragraph seems a bit misleading. Many aspects of risk and uncertainty can be accommodated in a neoclassical framework.	Taken into account - covered in ch 2
36173	3	90	27	90	48	Does cognitive ability to understand climate change really matter? If you price carbon and that signal is passed along in the market in the form of a higher price for electricity or other goods, people will respond by consuming less of it - whether or not they understand the science underlying climate change. it seems more relevant that because GHGs are long lived it may be difficult for individuals to place a value on a change in risk (WTP) that can be used to inform how much mitigation to undertake.	Rejected - cognitive capabilities really matter (even if carbon price mechanism are in place, e.g.. EU ETS)

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36174	3	90	46	90	48	This is a very outdated set of statistics. There is an October 2012 Pew Survey out that has 67% of the general public convinced of climate change. This undercuts the argument made here.	Taken into account - Reference removed as section was cut.
36171	3	90	7	90	9	The key here is that we don't know how important these deviations are - some deviations from neoclassical assumptions do not have a large impact on the predictions from models or the policy ranking; others may matter more. But without more serious empirical study we won't know which ones really matter.	Noted
36177	3	91	17	91	18	Rephrase--social attitudes are also held by indigenous groups.	Editorial
19568	3	91	18	91	21	I would add to this discussion the article Sheridan, J., and R. D. Longboat. The Haudenosaunee Imagination and the Ecology of the Sacred. Space and Culture 9 (4): 365–381, 2006 due to its relevance.	Noted
36178	3	91	26	91	26	Reword facilitates social acceptability	Editorial
36176	3	91	6	94	6	Relevant terms (buen vivir/vivir bien and gross national happiness) should also be defined in the AnnexII of the overall report.	Rejected: Three strategies - buen vivir, vivir bien and gross national happiness are only discussed in section 3.9.2, hence are defined and elaborated in this section and appear not necessary to include them in Annex I – Glossary.
36175	3	91	1	91	5	This Gallup poll is also old. Please update.	See response to comment 36174
36179	3	91	27	92	31	These seem like candidates for a textbox.	Taken into account, author might consider this a good option if chapter needs to reduce space.
27331	3	91	5			Interesting reference to be cited "Painter, J.; Asche, T. Cross-national comparison of the presence of climate scepticism in the print media in six countries, 2007-10. Environmental research Letters 7, number 4, December 1, 2012.	Taken into account - will consider reference
36180	3	92	28	92	28	Reword: which is the basis.	Editorial
36181	3	92	45	92	48	Reword: indigenous people sometimes are marginalized in decision making. This is an empirical question, if you look at the political science literature.	Accepted - text will be revised and the issue of "marginalization" be treated provided peer review material exists.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
36182	3	92	47	92	48	This section does not accurately state the relationship between human rights and issues related to the environment and its deletion should be strongly considered. As a general matter, human rights belong to individuals, not states or other entities, and attempts to assign "human rights" to other entities besides individuals has the potential to fundamentally weaken human rights. In addition, some of the "rights" referenced here, such as the right to development, are far from agreed or defined, and instead continue to be contentious areas of debate. Lastly, while we understand that persons who migrate or are displaced in circumstances related to climate change often do need help, and that the international community should work together to help address that concern, we would note that use of the term "refugee" in connection with climate change is inappropriate because the Refugee Convention includes a clear definition of "refugee," and in most, if not all cases, a person who migrates or is displaced as a result of climate change would not be covered by that definition. Indeed, the complex issue of cross-border movement as a result of climate change is not yet well-understood. Climate change can certainly contribute to or exacerbate existing problems -- such as poverty, social tensions, environmental degradation, ineffectual leadership, and weak political institutions -- that threaten stability and lead to population movements. However, the effort to draw clear conclusions regarding the direct and specific links between slow-onset environmental factors, including the potential adverse effects of climate change, and migration is still very much a work in progress. Indeed, most scientists who dedicate their work to this topic caution against exaggerating, particularly for media purposes, the link between migration and climate change. If retained, all of these issues need to be addressed with appropriate citations from the literature in this section.	Accepted - text will be revised and the issue of human rights be treated provided peer review material exists.
22505	3	92				The concept of GNH has not been proved strictly in scientific methods. Besides, Bhutan is only a small country with only seven hundred thousand population. It's a mountainous country which has monotonous natural environment. Thus, the experience of Bhutan can not be widely used for reference, especially for countries having large populations and complex terrains like India and China.	Rejected: Bhutan's Gross National Happiness is well referenced in scientific literatures (Uddin et al 2007, Frame 2005, Taplin et al 2013, Pennock and Ura, 2011). Besides, gross national happiness has been seen as middle path of development for other countries that follows Buddhist Philosophy for example Thailand's sufficiency economy (Taplin et al 2013). Hence, it's an example to many countries although they vary substantially in social, physical and economic systems.
19569	3	92	32			This section could really benefit from a set, perhaps one or two, documented oral history quotes regarding climate mitigation and change from a scholarly source, to illustrate how and in what ways the Indigenous societies actually speak about the issues.	Taken into account - if peer reviewed material is available to cover these, contents will be duly integrated
36183	3	93	1	93	7	The discussion of indigenous peoples' management of ecosystem services could be more balanced, with acknowledgement that experiences have varied widely. The text implies that indigenous peoples' management strategies are always successful.	Accepted - text will be revised and the issue of management strategies be treated provided peer review material exists.
27484	3	93	10	93	11	An example illustrating in what way the relation between communities and the environment is not gender-neutral would increase clarity. Leaving the paragraph like this, it is too vague to be useful.	Accepted - text/wording will be improved

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
27485	3	93	12	93	20	This paragraph again is very vague, and therefore not helpful for policy makers. Some examples might lead to more clarity (e.g. section 3.9.2.4 on indigenous peoples is more useful, the section on gender should be re-written in a similar way).	Accepted - text/wording will be improved
36184	3	93	8	93	20	This section is extremely vague--a sentence or two giving specific examples of how the relationship between community & environment isn't gender-neutral would be helpful. As throughout, this is intended to be an aid to decision makers, not an abstract discussion of ungrounded theory.	Accepted - text will be improved and specific examples (if available in peer-reviewed material) will be given.
27483	3	93	9	93	9	The term "gender" often is interpreted wrongly as "women". However, "gender" does refer to both social sexes. For this reason, it is highly infelicitous to start the first sentence in a paragraph on gender with the word "women" as this re-enforces this wrong perception about gender as referring to women. This paragraph should be re-phrased, making clear gender is about men and women.	Accepted - text/wording will be improved
36185	3	93	36	93	41	The public perception point on p. 90 seems like it would be better placed here.	Accepted.
29343	3	93	8	93	20	This section is too short: expand or delete.	Noted
20175	3	94	13	94	14	Not all private sector innovations 'suffer from market failure' (see also Chapter III, p. 97, line 16). In most industries the cost of invention is low or lead-time confers a sufficient and often durable competitive advantage (see, e.g., H. Moir, 'What are the costs and benefits of patent systems?', in C. Arup and W. Van Caenegem (editors), Intellectual Property Policy Reform. Fostering innovation and development', Edward Elgar, Cheltenham 2009, at 33).	Noted -- even though the spillovers may be small in some cases, the point is still valid. The reference is not one we can use.
20176	3	94	20	94	21	Technological change does not only include the 'three stages' mentioned in the text. Technological change takes place not only on the basis of 'invention' but also on the basis of imitation, reverse engineering and follow-on improvements; crucially, the more a technology is diffused, the more follow-on innovation takes place (see e.g. OECD, Technology and the economy -- the key relationships, 1992).	Possibly true but not central to our discussion. Noted.
20177	3	94	21	94	23	The statement that market forces do not provide sufficient incentives to develop ESTs seems to reflect a dogmatic opinion, without an empirical basis for the particular case of these technologies. As mentioned in comment 3, there is not always a situation of market failure for the development of technologies. Moreover, the range of friendly climate change technologies is so broad that any generalization is inappropriate.	Taken into account - market forces ALONE do not provide sufficient incentives. Market failures and supportive policies are thus required. Text revised.
20178	3	94	31	94	32	The 'appropriability problem' does not necessarily lead to lack of innovation, as illustrated by the case of open source for software developments and more recent initiatives on drug development (see http://www.osdd.net/about-us). There is another dimension to the 'appropriability' problem not mentioned in this chapter: the stronger the rights conferred on a certain technology to the first generation of innovators, the less the second generation of innovators will be able to improve on it and expand its use (see e.g., Benkler, Y. (2001), "A political economy of the public domain: Markets in information goods versus the marketplace of ideas", Dreyfuss, Rochelle; Zimmerman, Diane and First, Harry, (Eds.), Expanding the boundaries of intellectual property, Oxford University Press, Cheltenham, at 270).	Accepted text to be revised
36188	3	95	41	95	42	Is there data to back up the assertion that these policy changes to innovate technologically are a direct result of Kyoto? Suggest a reference at the very least, though otherwise revise to note that the KP had a likely impact, but was not the driving force for innovation.	Accepted. Text revised.
36186	3	95	16	95	17	Doesn't how transformative a price on carbon is depend on the price? If we set a high tax, then it could be pretty transformative.	Rejected - not clear what the point is
36187	3	95	30	95	42	How does the information gleaned from patent data fit in with the previous section on technological change? Does it give us any insight into how much underinvestment there is?	Noted.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
22511	3	95	36		42	This section talked about Inducing innovation, pointed out climate-friendly innovation patent such as renewable energy patents has increased dramatically, and singled out China, which ranked 4th, similar to developed countries (US, Japan, Germany). Even so, China's patents achievements conversion rate is low. When talk about the reduction of carbon emission, the number of Patents cannot be the measurement criteria.	Taken into account—the number of patents is NOT suggested as SINGLE measurement criterion. More criteria are needed to measure innovation (or 'system innovation')
20239	3	96	19	96	22	KEEP this para as it is important finding for policy makers regarding tech change. Move this para to SPM.	Noted. No change implied
36189	3	96	23	96	23	Also referred to as autonomous technological growth?	Noted.
36190	3	96	35	96	38	These 2002 and 2004 examples are not recent.	Noted.
29630	3	96	8	96	11	There is an identification problem attached to learning curves since many factors, in addition to what we think of as 'learning by doing', can contribute to reduced unit costs as investments in a technology increase, such as changes in prices and market conditions for inputs, macro-economic changes, changes in policy conditions, and institutional changes.	Noted. Will try to expand discussion.
19677	3	96	23	97	11	There are other economic models that deal with innovation and economic growth and have recently proposed alternative approaches to endogenous technological change. As it stands this subsection only refers to typical supply-side economic growth models in dealing with climate mitigation and technological change. Whilst not questioning their importance, there are other economic models adopting a demand-driven approach to economic growth processes, technological change and climate mitigation that would need to be acknowledged and referenced. These include for instance ecological macroeconomic models as in Rezai A., Taylor L, Mechler R (2013) Ecological macroeconomics: an application to climate change, Ecological Economics 85: 69-76; OR Keynesian driven economic models such as those applied in Barker T, Scricciu S. (2010) Modelling Low Stabilization with E3MG: towards a 'New Economics' approach to simulating energy-environment-economy system dynamics. The Energy Journal (Special issue 1 "The Economics of Low Stabilization"), 31:137–164. Please also see discussion on technological change, climate change mitigation and various economic modelling approaches in: Scricciu, S., Barker, T. and F. Ackerman (2013) "Pushing the Boundaries of Climate Change Economics: Critical issues to consider in climate policy analysis" Ecological Economics (New Climate Economics) vol.85: 155-165	Noted.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
20179	3	97	18			<p>Patents are mentioned as one example of policies to address market failures in innovation. Recent academic work shows a weak link in most sectors between patents and innovation, and a growing use of patents defensively or offensively to block potential competitors. For instance, a survey of 92 countries 1978-2002 found that: "National patent protection alone does not stimulate domestic innovation... However, domestic innovation accelerates in countries with higher levels of economic development, educational attainment, and economic freedom" (Qian, Y. (2007) "Do Additional National Patent Laws Stimulate Domestic Innovation in a Global Patenting Environment: A Cross-Country Analysis of Pharmaceutical Patent Protection, 1978–2002", Review of Economics and Statistics August 2007). Another study concluded that "...nations with patent systems were not more innovative than nations without patents systems. Similarly, nations with longer patent terms were no more innovative than nations with shorter patent terms" (Bessen and M. Meurer, Patent Failure: How Judges, Bureaucrats, and Lawyers Put Innovators at Risk, Princeton University Press, 2008, at 8. See also D. Burk and M. Lemley, The Patent Crisis and How the Courts Can Solve It (University of Chicago Press, 2011); A. Jaffe and J. Lerner, Innovation and Its Discontents: How Our Broken Patent System is Endangering Innovation and Progress, and What to Do About It (Princeton University Press, 2004). It should also be noted that the role of patents in the promotion of innovation is strongly dependent on the context where they apply. IP does not work in the same way in a country with a sophisticated R&D infrastructure, availability of human resources and risk capital as in a country where these conditions are absent (as it is the case in most developing countries and in all LDCs). Patents have no real impact in promoting innovation in these cases. Additionally, patents do not have the same impact in different sectors. Most importantly, even where patents and other instruments promote innovation, a crucial issue to address climate change is to ensure innovation AND diffusion. If patents promote innovation, the exclusive rights they confer can limit diffusion. Alternative mechanisms to promote innovations need to be developed and properly financed.</p>	Noted.
20240	3	97	33	97	36	KEEP this para as it is important finding for policy makers regarding tech change. Move this para to SPM.	Noted. No change implied
20180	3	97	41			<p>Trade in products is not a modality of 'transfer of technology' but a way of deploying existing technologies. Transfer of technology requires the transmission of knowledge and the opportunity for the recipient to actually learn why and how a certain technology works. The chapter should be based on a concept of transfer of technology functional to the development needs of less advanced countries. For instance, the Draft International Code Of Conduct On The Transfer Of Technology [1985 Version] negotiated under UNCTAD auspices defined transfer of technology as follows: "Transfer of technology ... is the transfer of systematic knowledge for the manufacture of a product, for the application of a process or for the rendering of a service and does not extend to the transactions involving the mere sale or mere lease of goods."</p>	Noted.
36191	3	97	12	98	34	This section would be much improved if it circled back to discuss these points on technology in the context of market based policies vs. regulatory approaches and how they do or do not incentivize innovation. E.g., a reference to section 3.6.1.3 on subsidies could be relevant here.	taken into consideration - text could be revised

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
35234	3	97	37			<p>Transfer of climate-friendly technologies from developed countries to developing countries is critical to addressing climate change (Rübelke and Mukherjee, 2006), and is closely related to the adaptation and sustainable development of developing countries, which is explicitly laid out in article 4.1(c), 4.5 and 4.7 of the Convention. As an important cross-cutting and framing issue in AR5, technology transfer (TT) should be discussed in a focused and systematic manner. However, it is now dismantled into different chapters (Ch. 3, 4, 13, 14, 15, 16), and is not fully addressed in Chapter 3.</p> <p>It is strongly recommended to have a systematic and coherent discussion on TT, including analysis on best technologies, in relevant chapters. Chapter 3 should include discussion on framing issues of TT.</p> <p>In addition, some key issues should be further elaborated, including (1)"carbon lock-in" effect in developing countries (Unruh, 2000, Understanding Carbon Lock-in. Energy Policy; Unruh, 2002, Escaping Carbon Lock-in; Unruh and Carrillo-Hermosilla, 2006, Globalizing carbon lock-in), (2) governments' role in TT (IPCC, 2000, Methodological and technological issues in technology transfer).</p>	Accepted - text to be revised considering coverage in other chapters
20182	3	98	17	98	27	<p>This paragraph limits the view about IP as a barrier to technology transfer to 'some recent studies' and only refers to one of such studies. The barriers created by patents for technology transfer have been a matter of concern and highlighted since the 1960's. Thus, upon a request from Brazil in 1961 the UN produced a report on 'The role of patents in the transfer of technology to under-developed countries'. The literature has addressed these issues quite extensively. In relation to technologies relevant to climate change, see e.g., Jayashree Watal, "The issue of technology transfer in the context of the Montreal Protocol: Case study of India", in Achieving objectives of multilateral environmental agreements: a package of trade measures and positive measures, Elucidated by results of developing country case studies Veena Jha and Ulrich Hoffmann, eds., UNCTAD/ITCD/TED/6, Geneva, 1998, at 50; Joanna I. Lewis 'Technology Acquisition and Innovation in the Developing World: Wind Turbine Development in China and India', Studies in Comparative International Development, December 2007, Volume 42, Issue 3-4, pp 208-232). The quoted study by Barton (limited to three sectors) does not provide a basis for the suggestion that patents do not constitute a barrier for technology transfer. Barton's study does argue that IP create 'access limitations on entering the industry as a producer of key components or products' in the three considered sectors (p. 18). Thus, for PV it concludes that IP erects 'possible barriers or delays in obtaining or creating the highest quality production systems' and for wind Barton notes 'Possible difficulty in obtaining most advanced technologies' P. 18).</p>	Noted--will try to expand literature cited.
19600	3	98	35	98	35	<p>There is no consensus on delta and eta in the simple Ramsey equation (cf. Arrow et al. 2012). Reference: Arrow K.J., M.L. Cropper, C. Gollier, B. Groom, G.M. Heal, R. Newell, W.D. Nordhaus, R.S. Pindyck, W.A. Pizer, P.R. Portney, T. Sterner, R.S.J. Tol, and M. Weitzman (2012). How Should Benefits and Costs Be Discounted in an Intergenerational Context?, Resources for the Future Discussion Paper 53.</p>	Noted. This is not a refereed document, though.
21267	3	98	38			<p>"AR6" Have we agreed on the need for an AR6? In any case, a potential AR6 is not a driving force for future research directions.</p>	Noted. This is only one reason for being interested in future research.
21268	3	98	40			<p>Change "In order to" to "To"</p>	Editorial.
23998	3	98	45	99	2	<p>Please change 2. to read: 2. The SOCIAL ASPECTS of geo-engineering: an emerging field that WILL be of utmost importance to policymakers. Coordinated study of historical, ethical, legal, and social implications of geoengineering is needed that integrates international, interdisciplinary, and intergenerational issues and perspectives and includes lessons from past efforts to modify weather and climate. American Meteorological Society Policy Statement on Geoengineering the Climate System (2013), http://www.ametsoc.org/policy/2013geoengineeringclimate_amsstatement.html</p>	Noted. May add social.

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
21269	3	98	45			"economics and ethics" It is not just these topics, but the actual risks and benefits of different suggested geoengineering schemes that need to be evaluated so that different scenarios will be available for ethical and economic analysis.	same as 23998
21270	3	98	45			Correct the spelling with no hyphen: "geoengineering"	Editorial.
27486	3	98	45	98	45	The topic of "geo-engineering" is overestimated by mentioning it as number 2 in this list of "gaps in knowledge". The following aspects in the list are still of higher priority for coping with climate change.	Rejected. Numbering is not significant.
20181	3	98	7	98	11	It is unclear why the issue of 'leapfrogging' is considered here without any reference to the extent to which technology transfer may contribute to that process. No reference is made either to the cost of technology transfer nor to the fact that high prices for technology may impede or slow down technological diffusion. Absorbing and adapting technologies to the local environment normally requires investment by the recipient. Lack of finance may be a major obstacle for technology transfer which should be addressed through international mechanisms and national policies.	Noted.
22512	3	98	17		26	This paragraph argued that patents boost technology transfer, and sufficient competition. As this section talked above, "developed countries should assist developing countries access new low carbon technologies." To developing countries ,the high Patent protection is not a good way to help them imitating or studing new technologies and innovation.	Accepted text to be revised
36193	3	99	27	99	29	We suggest making #9 a broader research question calling for more research on the appropriate approach to intergenerational discounting and how it is affected by uncertainty.	Noted. This is effectively what #9 is saying.
20183	3	99	29			An additional gap to be mentioned is: Innovation and technology diffusion: research on non-IP mechanisms that may promote innovation in climate change friendly technologies and its fast diffusion and on ways of addressing developing countries' financial needs relating to technology transfer.	Noted. References would have been helpful.
21271	3	99	4			What does "Ex-post" mean? This is disciplinary jargon. Use plain language.	Reject. This is standard terminology for experts reading the chapter.
36192	3	99	1	99	2	And interactions with other mitigation efforts.	Noted. Complete as is.
34503	3	ALL				Chapter 3 again lacks clear examples. I can see that you put mathematical equations for aggregation, but what about CBA, EV, CV? In addition the welfare gains/losses with EV and CV are better understood with graphs. Also is IPCC review a good place to introduce new theory?	Noted. No new theory here.