Expert Review Comments on the IPCC WGIII AR5 First Order Draft – Chapter 2

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
14521	2						Noted. Commenting files will be amended accordingly.
3319	2					I find it odd that the chapter does not include the policy directive of expanding public education around risk and uncertainly in climate change. Especially given the last sections of the chapter which focus on public perceptions and openness to climate policies, the issue of what people in general think and feel becomes crucial. These are affected by education in the broadest sense, and governments or NGOs looking to deal with risk and uncertainty bias should consider education as a deep response to the problem, indeed, as an adaptive response.	Informational deficits are one barrier to public action on CC mitigation, as the chapter now acknowledges in the introduction to Section 2.2, and a widely known one, but by no means the only impediment. Section 2.2 therefore focuses more on two other barriers to action, namely cognitive and motivational ones which have received less attention than they deserve in the past.
4114	2					Who is the audience and what can this audience learn from this chapter? Large parts of the chapter address 'the decision-maker', an apparently uniform entity. Climate change as a global collective action problem involves a large group of heterogenous decision-makers. What is the nature of uncertainty arising from social systems (e.g. politics) and how do they relate to the natural system uncertainties (e.g. climate sensitivity)? It could be useful to frame your discussion from a political decision-making perspective because that would move many targeted end-users centre stage.	Accepted. In our view the realms of natural system and social system uncertainties are not nested. This chapter is more focused on the latter. In this regard a new table (Table 2.1) develops a taxonomy of different types of decision-makers and the choices they face
4115	2					There are gaps and inconsistencies between chapter 2 and other framing chapters and between framing chapters and subsequent chapters. As the first of all chapters (after the Introduction), chapter 2 is encouraged to play a pro-active role in mainstreaming its framing into the remainder of the report and seek support from the TSU for doing so.	Table 2.1 provides a link to the other framing chapters
4116	2					It would be useful to prioritize more and carve out key insights. Some sections seem almost encyclopedic, some sections are skin, not all pieces of information seem relevant.	Sect. 2.1 now provides more key insights. Other sections will address this point
4117	2					It might be useful to add a discussion on insurance. Which types of risk are insurable and what types are not, and what happens if people become insurable, how does that alter behavior, on the individual level and on the level of the group?	The SOD will incorporate material on insurance and how insurance can affect behavior
4118	2					When is uncertainty a reason to wait and learn, and when is it a reason to act and learn later? You assess this question but it would be helpful to parsen your answers more clearly because they seem very important. Perhaps you could even provide case-specific answers related to the risks that matter on the UNFCCC level.	We highlighted the effects of climate and technology response uncertainty in the section on IAMs. However in the SOD we will also mention it in the introduction and the summary. We will extend the statememt to also include regulatory uncertainty.
4120	2					Please review chapter 4 section 4.7.1. If you feel that this section contains redundant and/or inconsistent duplications of chapter 2 discussions, please advice chapter 4 authors on how to revise their section.	Done.
4128	2					It would be useful to highlight the relation of your chapter to the AR4. What has happened since? How was uncertainty treated in the AR4 (if at all) and how do you extend on this assessment?	We will highlight this in the introduction.

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4133	2					Please review chapter 3 section 3.11.1.4 on "Human ability to understand climate change" and, if needed, discuss this section with its authors.	We have reviewed Sect. 3.11.1.4 and discussed this section with some co-authors of Chap. 3
8915	2					risk and uncertainty' are often used as one entity that is followed by a verb in singular. Uncertainty is an inherent part of risk, but the two concepts are still distinct. There is more to risk than uncertainty and there are uncertain situations that do not entail risk.	Thank you for this comment. Throughout the chapter, and in the Glossary, we are clarifying the distinction between risk and uncertainty. At the same time, "risk and uncertainty" is often treated in the literature as a single issue (because the two concepts, while different, are closely related). It is in this sense, as a single issue, that we may have used the two together followed by a verb in the singular.

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8917	2					One main argument in the chapter is that people are myopic, that is, focus on short-term consequences and overly discount delayed future outcomes (e.g., element ' Risk perception and behavioral responses ...' of the framework on page 5 and page 8; Sections 2.2.3, 2.2.4.1, 2.2.4.2). It is true that this is a reliable finding, but mainly in the domain of financial and health risks. In the domain of environmental risks, it has been found that people do not discount long-term future environmental consequences (Böhm & Pfister, 2005; Gattig & Hendrickx, 2007). Thus, it might be that climate change consequences are much less discounted or that the discount rate varies substantially depending on the domain that is affected (finance, health natural environment, etc.). Böhm, G., & Pfister, H.-R. (2005). Consequences, morality, and time in environmental risk evaluation. Journal of Risk Research, 8, 461-479. Gattig, A., & Hendrickx, L. (2007). Judgmental discounting and environmental risk perception. Journal of Social Issues, 63, 21-39.	Thank you for the two references. It may well be that time delay does not play as much of a role in fairly general, nonpersonal environmental decisions of the kind used in the Boehm & Pfister paper, where subjective perceptions of temporal distance of the adverse consequences were significantly different but still very similar(from 1.96 to 2.92 on a scale from 1 to 7. And even there, greater perceived distance WAS correlated with less perceived risk and less tendency to help. Other studies, triggered in part by the Gattig & Hendricks paper did find evidence that both American and Chinese respondents discount future environmental accounts very similarly to financial outcomes and also far more than normative economic discount rates would suggest (Hardisty, D. H., & Weber, E.U. (2009). Discounting future green: Money vs. the environment. Journal of Experimental Psychology: General, 3, 329-340); Gong, M., Krantz, D.H., & Weber, E. U. Why Chinese discount future financial and environmental gains but not losses more than Americans. Under review, Journal of Risk and Uncertainty.)
8140	2					How is the content of this table selected? Or is it comprehensive? Source?	The Table is reviewing all existing literature covering climate change analysis using IAMs in a stochastic framework to the best of our knowledge.
8139	2					How is the content of this figure selected? Or is it comprehensive? Source?	The Figure 2.4 is a product of the Uncertainty Guidance group a whole Appendix is devoted to it
8142	2					In this section the complexity of the whole issue is addressed in a suitable way. However it stays quite alone.	Thank you for the first sentence in the comment. I do not understand the second sentence of the comment.

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9789	2					Research on decision-making in organizations has revealed, that the different levels individual, group, organization and external stakeholders have to be considered. Klein, K.J. & Kozlowski, S.W.J. 2000a, "From Micro to Meso: Critical Steps in Conceptualizing and Conducting Multilevel Research", Organizational Research Methods, Vol. 3, No. 3, pp. 211-236. Structure the levels of decision-making correspondingly or at least address this issue.	Thanks, to be taken into consideration by SOD.
14821	2					The chapter presents a great amount of important information. It would, however, much more illuminating and useful if be organized and structured in a more systematic framework. Specifically, the chapter currently reviews a range of different types of climate-related decisions, types of uncertainty, and types of tools. It should go on to provide guidance as to which types of decisions reflect which types of uncertainty and are thus amenable to which tools. To be more explicit... The types of uncertainty should be distinguished by their key features. Some types of uncertaintly are of fundamental importance and define the very nature of the climate problem: the deep epistemological uncertainties within the natural system and the enormous downside risk associated with climate change is this kind of uncertainty. We have no probability density functions or damage functions that can be employed with any confidence. We have no historical precedent, no capacity to do experiments with a "test planet earth". Another type of uncertainty is that associated with, say, the rate at which cost of a given technological option will decline, or its efficiency will improve. It has fairly well-defined bounds and reasonable historical precedent to make justifiable estimates of probability densities. One can imagine a fairly neatly charted spectrum of types of uncertainty, from the most profound and poorly characterized, to the mere techno-economic and well-bounded and confidently characterized. The types of uncertainties discussed in the chapter could be placed on this spectrum. Another type of uncertainty has to do with human volition: our own (unpredictable) choices will determine certain outcomes. Similarly, the tools should be distinguished by type, and placed on a corresponding spectrum, ranging from tools approrpiate for the most profound and poorly characterized types of uncertainty to those appopriate for more manageable and well-characterized types. CBA and E(U) Theory are appropriate for well-characterized uncertainties. SEJ and RDM, on the other hand, are more suitable for situations of profound uncertainty, when there is not sufficient information to use tools that rely on a probability density function. Scenario analysis would be most suitable for issues where uncertainty is determined by human volition, such as the choices of future development paths. And finally, the chapter could help the policy maker by explicitly discussion which kind of decisions entail which kinds or uncertainty, and are thus amenable to which tools. For example, the choice of a global climate goal (e.g. 1.5C? 2C? more than 2C?) cannot be determined by doing a CBA or E(U) optimization. It involves uncertainties that are ill-characterized and profound. It also involves value decisions (relating to treatment of other individuals and generations who may pay the cost of our decisions, and the worth of non-monetizable values), and is intrinsicially a process relying on democratic involvement. SEJ and participatory process could provide the process by which an objective is determined, and the objective is used subsequently in CEA processes to identify the most efficient path. A choice between different regulatory optoins for meeting this goal could then be amenable to a constrained CBA or E(U), accounting for uncertainties in, say, techno-economic parameters. (This process has been identified by climate policy analysts as being far more viable than CBA or E(U) for identifying a cliamte goal).	We will elaborate on the link between precaution, RDM and CEA more carefully. However to our understanding the literature on decision-making under deep uncertainty does provide only little guidance how to decide under multiple sources of deep uncertainty. In that sense we regard it as premature to develop an iconic figure of the type the reviewer suggests. Instead we will be very explicit on the research needs along those lines.
14833	2					The observation "an important exception..." is not particularly compelling given the caveats (no catastrophic/threshold damage, no cobenefits), which renders the observation virtually irrelevant. The exception should probably be removed, and the primary conclusino should be elaborated further.	Text has been edited accordingly

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11490	2					The charge that local decision makers tend to be "myopic" appears throughout the text. This should be reexamined on two grounds: first, that decisions based on short-term considerations rather than long-term possibilities are often entirely rational. Second, that it is extremely difficult for policy makers to consider the complex challenges and numerous factors faced by individuals who are forced to adapt to climate change. One can argue that the models employed by policy analysts often contain simplifed heuristics and hyperopia (the approximate opposite of myopia), by which critical context-specific factors affecting adaptation are obscured.	These are all excellent points and this and other comments by you are a good reminder to be cognizant of unintended connotations of expressions like "myopia" or "myopic". The term is used to contrast observed behavior from the rational-economic assumptions about human goals and processing ability currently used in the models on which policy prescriptions are based. The arguments you provide for why such behavior is observed are, of course, dead on: limited processing capacity and far more complex goals and psychological and material constraints than considered in those normative models.
11521	2					This chapter is much improved from the previous draft in terms of clarity and order. However, it is still lacking the incorporation of indigenous perspectives on/reactions to climate change. Such perspectives could be added to the chapter through specific examples, and also through acknowledgement of pluralistic perspectives on risk and uncertainty, as well as interpretation of scientific knowledge.	We are well aware of this deficiency and are working on correcting it, by additional efforts of existing chapter authors and by adding expertise on such topics to the team.
11518	2					This figure lacks a caption and is not discussed in the text itself. It is confusing and unnecessarily dichotomizes between natural and social systems. If it is not critical to the chapter, it should be removed.	It is removed.
15740	2					General remark on Chapter 2: In my opinion, this chapter is misplaced in the Assessment Report. It does not address the relevant questions: How should uncertainties affect our policy motives and decisions? (See my general remarks on the WGIII Draft.) Instead, section 2.1 deals with something like the psychology of behavior under risk. This is of minor interest, unless there are hypotheses about how it affects the questions whether and what should be done about climate change (the topic of the Assessment Report). Section 2.3 is a description of different evaluation methods of uncertain events. It is kind of incomplete textbook with critical remarks. Almost no applied study on climate change issues is summarized or even mentioned! (For example, section 2.3.2 discusses the Cost-Benefit Analysis method, but no such study on climate change is referred to.) Neither are the methods tentatively applied by discussing a relevant question of climate policy. If the AR contains such general treatment in WGIII it should also have a physics textbook in WGI – I think both are / would be misplaced in the AR. Similar holds for section 2.4. The exception is section 2.4.4 which is very interesting to read, addressing some real issues of mitigation policies under uncertainty.	We believe the psychology of decision-making as it relates to risk perception and behavior (Sect. 2.2) is central to developing climate change policies in combination with decision tools for improving behavior (Sect. 2.3). The SOD will clarify why it is important to have descriptive and normative analyses for developing climate change policies.
18442	2					view,it is the decisions made which are short term for expedience.	Comment is unclear - no response

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18447	2					and behaviour responses, common mistakes made by decision makers in climate policy issues.	While it is clear that fat tail events are problematic to intuitively deal with, the mathematics of extreme events can be helpful in designing rational responses for a system-2-decision maker. We will highlight this aspect more clearly.
18449	2					need for an elaborate conclusion basing on the content analysis.	While it is clear that fat tail events are problematic to intuitively deal with, the mathematics of extreme events can be helpful in designing rational responses for a system-2-decision maker. We will highlight this aspect more clearly. For the non-formalized aspects of this the literature is not very explicit how to deal with the effects the referee is mentioning.
15456	2					Sociological and anthropological perspective are missing. There has been quite an explosion of theoretical work on risk, and except for a brief mention of the work of Ulrich Beck, many of the other studies (Anthony Giddens, Scott Lash, other studies by Beck) - these need to be added. For a critique of these theoretical / conceptual approaches from a developing country perspective, please also include - D.Parthasarathy,15. “Social and Environmental Insecurities in Mumbai: Towards a sociological perspective on vulnerability”, South African Review of Sociology, 40, 1, 2009.	Thank you for providing us with this paper (there is a strong shortage of work in developing countries!) and for pointing out that sociological and anthropological perspectives are missing. We now cite the paper in our section 2.2.1.3. We agree that a broader range of social science disciplines than just economics needs to be represented in the IPCC, and this point should be made to the IPCC leadership whenever possible.
10161	2					To me it is a bit counterintuitive that the decision to be made affects the uncertainties in themselves (as the figure seems to say) rather than which uncertainties that need to/should be considered. This needs to be clarified in the figure so that a reader intuitively understands what is meant.	Figure 2.1 has been revised in the SOD so the first box is Problem Formulation
6366	2					Unclear what this figure portrays. It resembles a flowchart, but the boxes all identify concepts rather than actions. The meaning of the arrows is unclear, and in any case, they create an endless loop. Bottom line: this does not seem to be a very helpful figure.	Fig. 2.1 has been revised in the SOD so that readers will understand the importance of descriptive and normative analyses for climate change policy

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17138	2					See Adger, N., Barnett, J., Chapin, F., Ellemor, H., (2011) This Must be the Place: Underrepresentation of Identity and Meaning in Climate Change Decision-Making. In Global Environmental Politics 11 (2): 1-25.	Thank you for alerting us to this publication. It argues for a response to climate change based on methods other than economic cost-benefit analysis, based on the fact that some places of immense cultural yet non-market value (areas in the Arctic, Pacific islands) will be lost entirely as a result of climate change. While space is limited, the paper potentially deserves citation in the section on analytic methods, since that is what it primarily addresses.
10481	2					General comments below on this chapter are from Dan Sperling - LA Chapter 8 <dsperling@ucdavis.edu>	Thank you.

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10482	2					Chapter 2 is well written and a good overview of the literature on risk and uncertainty. It would be an excellent resource for a graduate seminar course. But, in the end, the chapter is too theoretical and too abstract to be of much value to decisonmakers in government or business. Even discussions that are a bit more grounded—for instance on price caps and feed-in tariffs—are far too general and insensitive to situational considerations to be useful to decisionmakers. In the end, assessments of risk and uncertainty and related decisionmaking are based on situational considerations specific to that decision. This chapter seems to show no appreciation of that fact, focusing on general theories, concepts and considerations. Some other concerns: • I was as surprised to find almost no insight or attention to business decisionmakers. The chapter is almost totally devoted to individual behavior, and a bit to government agencies. Almost nothing is said about business decisionmaking. In the energy areas, for instance, it did not address decisionmaking by oil, natural gas, electricity, and biofuels companies. It did not address car and truck manufacturing companies. It did not address infrastructure companies. And so on. • The chapter provided minimal insight for government decisionmakers. The design of cap and trade programs entails a large number of decisions about allocating allowances; social, regional, and economic equity; financial integrity; international and national trade laws; trading robustness; and much more. I saw little or no insight into risk and uncertainty for these issues. • The chapter does not address in any way a vast swath of decisions and policies under consideration. In my area of transportation and fuels, I did not see anything on land use changes (a huge issue with biofuels), regulations of vehicles and fuels, urban land use, and much more. • Another citation regarding loss aversion, with respect to purchase of more efficient cars, is: David L. Greene, John German and Mark A. Delucchi, “Fuel Economy: The Case for Market Failure,” Chapter 11 in Daniel Sperling and James Cannon, eds,, Reducing Climate Impacts in the Transportation Sector, Springer, 2009. (I believe there were follow-up journal articles)	We agree that the discussion of the effects of risk and uncertainty on climate change response policies provided by Chapter 2 is general, as Chapter 2 is one of the framework chapters. Situational refinements and qualifications of these more general points are provided by the sectoral chapters later on in the report. ?We have now added mention and discussion of a much broader range of levels of decision makers, including business decision makers, as seen for example in Table 2.1, and at various other parts of the chapter. ?We now also spell out in much more detail the different types of decisions that need to be made (see again Table 2.1) and comment on different sources of uncertainty for those and different implications of how to deal with them as a function of decision maker level and type of decision. Thank you for the Greene & Delucchi reference, it is a nice application of loss aversion that we now cite in Section 2.2.3. However we could not find any peer reviewed follow up articles by those authors on the topic.
7217	2					It is not clear to me to whom this report is addressed. Judged from the writing style, it seems to be by scientists for scientists.	The report is written for everyone. We have rewritten several sections of the report to clearly explain technical terms in simple language. We have also developed a Glossary to further define key technical terminologies.
6784	2					Add content about the risk of adaptation or mitigation policy choice in different sectors,because the risk or uncertainty of adaptation or mitigation policy choice for different sectors may be very different .	Accepted. The text will be modified accordingly.
4611	2		15		17	The meaning of this sentence is not clear as well; what does "greater sensitivity" illustrate: system 1 or system 2 ?	Thanks, Text has changed in SOD

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8115	2					The summary sounds quite similar to the introduction. It should be focused on the main insights.	The Executive Summary in the SOD will provide the main insights of the chapter.
4832	2					The introduction section is in long parts a repetition of the summary (same examples, same arguments). Given that the space is so limited, I strongly advice to reduce this overlap. It is also tiring for the reader.	The introduction has been rewritten.
3314	2					I find the use of the category of "decision tools" narrow and potentially misleading, implying technocratic quick fixes to the considerable issues raised in this chapter. What is at stake, often, are not only "tools," but education, which takes time and more investment, and social or organizational processes, which are not simply tools, but ways of structuring information and decision-making based on information. I understand that you want a relatively streamlined language for policy-makers, but would urge some sort of caveat, at least in a footnote. It is worth flagging the depth of the challenge here, not inadvertantly making the challenge seem superficial simply by the way one frame the kind of response available.	A wise caveat, which we have incorporated into our introduction section 2.1.
8914	2					Section 2.1.1 is virtually identical to the Executive Summary. This is quite tiring - why the redundancy?	The Executive Summary in the SOD will provide the main insights of the chapter.
11481	2					After each of the subheadings in this section, it would be useful to indicate where these topics are discussed in more detail later in the chapter by giving the page number.	The Sect. 2.1.1 would be too long and cumbersome if it specified page numbers for each of the topics in the subheadings.
8233	2				1	Most of Section 2.1.1 is a copy paste of the executive summary. Comments made on the executive summary also apply to this section.	The Executive Summary in the SOD will provide the main insights of the chapter
8124	2					The two modes of thinking are quite reasonable at first glance. However, for further analytical and empirical clarification, this concept is too simplistic.	We agree. In moving towards the Second Order Draft, we are clarifying that the two modes are applicable to thinking about individual decision makers operating in the abstract, and yet the ways in which decision-making patterns can become differentiated becomes much wider when moving into the setting of an organization or political institution.
13825	2					If this report is accepting whole-cloth the hypothesis of Kahneman (2011) with no modification or caveat, that point should be made clear up front. This entire section seems like a review of that one contribution. The remaining references predate Kahneman (2011) and there is no reference to any critical literature citing his work.	The introduction to Section 2.2 which introduces the System 1 and 2 distinction has been rewritten to make it clear that this distinction predates Kahneman (2003 and 2011), and that he only provides the most recent synthesis. It also refers to some criticism of the oversimplification to two systems.

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13826	2					Many statements and claims are not substantiated by reference to literature. It is not clear if these are opinions of the author(s) or conclusions based on actual scientific analysis that has been peer-reviewed. An example is the paragraph beginning on line 30. But this is a common problem.	We tried to provide references to all specific claims.
13827	2					In general, I see no reference to confidence metrics related to any statements.	Confidence metrics are mandatory only for the key findings in the Executive Summary. We comply with this rule in our SOD.
11514	2					This section needs a subsection on indigenous people's behavior and responses under risk and uncertainty because they are already experiencing the impacts of climate change.	We now discuss indigenous people's responses and indigenous knowledge about climate change in Section 2.2.1
8919	2					One aspect that is not discussed in this chapter and that I think should be addressed in Section 2.2 is that people see climate change also as a very moral issue (e.g., Lorenzoni & Pidgeon, 2006). While morality is a different dimension than risk and uncertainty, it is an important aspect of how people perceive the consequences of climate change. Issues of justice, fairness, and responsibility are important in environmental risk perception (e.g., Böhm & Tanner, 2012), they also trigger emotional reactions which then guide behavior such as cooperation (Fehr & Gächter, 2002; Pfister & Böhm, 2008, 2012). Böhm, G., & Tanner, C. (2012). Risk perception. In L. Steg, A. E. van den Berg, & J. I. M. de Groot (Eds.), Environmental psychology: An introduction. New York: Wiley-Blackwell. Pfister, H.-R., & Böhm, G. (2008). The multiplicity of emotions: A framework of emotional functions in decision making. Judgment and Decision Making, 3, 5-17. Pfister, H.-R., & Böhm, G. (2012). Responder feelings in a three-player three-option ultimatum game: Affective determinants of rejection behavior. Games, 3, 1-29. Fehr, E., & Gächter, S. (2002). Altruistic punishment in humans. Nature, 415, 137–140.	We refer to this now in the introduction to Section 2.2, but can do so only in passing, because of space restrictions. The role of ethics and ethical concepts in climate change policy is the topic of Chapter 3.
12520	2					Much of the analysis in this and following sections asserts a variety of phenomena as related to the proposition of “System 1” and “System 2” modes of human cognition. While this may merit a brief discussion, it is a far too simplistic and conjectural application of this particular cognitive model. Among other things, this and similar models ignore communication, interaction and group effects. This section should be rewritten to review a broader range of theories on human cognition, choice and decision-making.	A good point and we tried to do that.
11505	2					This section would benefit from an example from a part of the world where the effects of climate change are more apparent, such as in the Arctic or many mountainous regions. The relationships between expectations and perceptions are quite different in areas where climate change impacts have been acutely observed and adaptation is already occurin.	Some examples of this kind are now provided in Section 2.2.1
8483	2					Again, much of this is framed assuming a deficit model of policy and knowledge transfer, as well as downplaying the relationship(s) between science and politics. Maasen and Weingart "Democratization of Expertise? Exploring Novel Forms of Scientific Advice in Political Decision-Making" (2005) provides some insight/content in this direction	Some of these suggested dynamics are described in Section 2.4.

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4835	2					Another factor which might play a role is that climate change is confused with "local warming". So the effect that the global climate system warms is taken for a sign that also local climate should warm. Together with the climate/weather confusion exceptionally cold winters as experienced in the northern hemisphere in 2010 for example can make people disbelieve in climate change (phrased as "global WARMING"). Unfortunately, I do not have any studies available analysing this effect, only my personal experience reading the letters to the editor in a Norwegian newspaper during winter 2010. Hopefully, there are studies showing this effect. There is however, a reference in the report on page 42, lines 7-9 which seems to go into the same direction.	We report a study that established exactly the phenomenon you describe (Li et al., 2011) in Section 2.2.
4836	2					Social amplification of risk is one possible outcome of constant exposure to climate change communication. Another alternative outcome is that the perceived risk is reduced because of a higher familiarity.	Constant exposure is not a trigger of social amplification and I don't think that Section 2.2.2.1 said that.
10269	2					This section will be valuable, but more descriptions higher relevant to climate policy implications will be expected.	We tried to provide more examples and illustrations from a climate policy context throughout this section.
4043	2					This section is very comprehensive and clear in its aim, to list methods and discuss their merits and shortcomings. However, this may not be enough for the purposes of decision making under uncertainty. A useful addition to this section, and the whole concept of methods more generally, would be a procedural illustration of how to evaluate and assess the tool against the purpose and aim for application. In other words, how do we measure and account for the choice of decision-making approach under undertainty? from an accountability and governance perspective, this would be imperative. Standards and criteria for the evaluation of decision making processes do exist, and this discussion should form of this chapter. For example, Lasswell (1971) validation of decision-making pocesses in policy sciences is a very pertinent source that has been cited in a few climate change adaptation works, and no doubt have applicability in the mitigation context as well. See: Lasswell, H. D. (1971). A Pre-View of Policy Sciences: Elsevier Publishing Company.	Thank you, we have now modified the chapter in order to better link methods to actual examples and in order to contextualize methods under different choices types
3318	2					This entire section suffers from a deficit of attention to deep responses to uncertainty and risk bias. At the deepest level, public education is crucial, yet the section focuses on technocratic tools. This is a serious oversight. In a world where voter and consumer behavior makes a lot of decisions, we need to address deep, underlying ignorance and bias. You should find a way to include this consideration in your report. Allocating funds to climate risk education is very important in the long run, not simply using one of the tools you've described.	We have now made an extensive effort to link the section on behavioral issues and risk perception with the section on economic tools
13859	2					This section fails to discuss 'scenario planning' . An example is Title: Climate change and future energy consumption in UK housing stock Author(s): Collins, Lisa; Natarajan, Sukumar; Levermore, Geoff Source: BUILDING SERVICES ENGINEERING RESEARCH & TECHNOLOGY Volume: 31 Issue: 1 Pages: 75-90 DOI: 10.1177/0143624409354972 Published: FEB 2010 --- OR --- Title: Climate change scenarios and citizen-participation: Mitigation and adaptation perspectives in constructing sustainable futures Author(s): Larsen, Katarina; Gunnarsson-Ostling, Ulrika Source: HABITAT INTERNATIONAL Volume: 33 Issue: 3 Pages: 260-266 DOI: 10.1016/j.habitatint.2008.10.007 Published: JUL 2009 --- OR --- Title: Use of participatory scenario modelling as platforms in stakeholder dialogues Author(s): Andersson, Lotta; Olsson, Johanna Alkan; Arheimer, Berit; et al. Source: WATER SA Volume: 34 Issue: 4 Pages: 439-447 Published: 2008	The two reference do not deal with uncertainty, which is the chief objectinve of this chapter.

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11515	2					The organization of this section is reader-friendly. Each tool is explained, its relevance to climate policy is discussed and advantages as well as limitations are stated. This is a notable improvement from Zero Order Draft.	Thank you
3317	2					You should discuss Gardiner (2011)'s critique of CBA with respect to climate equity.	A larger discussion of CBA and issues related to inequality, representative agent, interteporal equity is undertaken in Chapter 3
12996	2					The claim that the precautionary principle is a version of maximin might be disputed. Although some authors suggest this, it is not clear that all versions of the PP demand it (e.g., the Rio version). Also, theoretical discussion of the foundations of the precautionary principle would be helpful (e.g., Sunstein 2005, Gardiner 2006) This is a topic on which chapter 3 might also touch.	Agreed, Delete text
12523	2					The precautionary principle does not lead only to a worst-case/minimax analysis. Modern approaches can use dynamical models selecting employing stepwise (e.g. annual for a 20-year planning horizon) assessments across multi-dimensional scenarios at each step, and converge on a 2-factor “efficient frontier” analysis using, for example, cost and risk. Northwest Power and Conservation Council, 2011. An Overview of the Council's Power Planning Methods, www.nwcouncil.org/library/2011/2011-02.pdf	Text has been changed
13864	2					Section 2.4 is a marked change in character from earlier sections. It is more literature review of the type typical of AR4 and less text-like teaching a subject noted previously for earlier sections. This change is jarring and suggests that the earlier sections need considerable improvement in style and mode of presentation.	To a large extent the change in style reflects the different functions this chapter is meant to serve, according to the Plenary Approved Outline. On the one hand it is meant to bring the reader up to speed on many of the technical and scientific issues surrounding risk and uncertainty; sections 2.2. and 2.3 do this, and for this reason they can read a bit textbooky, presenting some basic concepts and theories, rather than reviewing specific scientific studies of the past 7 years. On the other hand the chapter is meant to synthesize findings on the importance of particlar risks and uncertainties for climate policy. This happens in 2.4, and here the focus of the chapter is on reviewing recent literature, rather than presenting basic theory. That is the reason for the disjoint.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
3370	2					This section could discuss that the literature on IAMs dealing explicitly with Knightian uncertainty is non-existant. IAMs are portrayed as system 2 frameworks. But what is the use of system 2 decision making under Knightian uncertainty?	The discusson of "Knightian uncertainty" is aided by referring to Frank Knight's book Risk, Uncertainty and Profit (1921). In Part III paragraph VIII.1, Knight says "We can also employ the terms 'objective' and 'subjective' probability to designate the risk and uncertainty respectively, as these expressions are already in general use with a signification akin to that proposed". Subjective probability is amply discussed. If the commmentor meant something other than what Frank Knight meant, then a definition would be most. "Risk proper" for Knight "is measurable by resolving outcomes into equi-probable alternatives" [III.VII.34]. In Knight's day, people did not appreciate the importance of dependence and limitations of the Laplacian definition of probability, to which he refers in this passage. Much has happened since 1921; we've learned that "objective" applications of probability have strong subjective components. The Laplace interpretation of 'objective probability' is thoroughly dead. See also response to comment 14233.
8997	2					T	Comment is unclear - no response
4119	2					Please discuss this section with chapter 13 authors.	Yes. We will do this.
8488	2					Need to clarify scale and typology re: policy vs instruments	We don't understand the comment as applied to this section.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
5321	2					The selection of references rather biased in favor of feed-in-tariffs. The authors focus on the risk reduction for investors but ignore the additional risks shifted to the market and thus to consumers. Increasing capacity in renewable energy with high volatility in sun and wind supply creates a high risk for energy security and thus creates additional cost in assuring secure energy supply. This effect is ignored in the report. For more critical articles on Feed-in tarifs see: del Rio, P., Gual, M. A., 2007. An integrated assessment of the feed-in tari system in Spain. Energy Policy 35:994-1012.K13 del Rio Gonzalez, P., 2008. Ten years of renewable electricity policies in Spain: An analysis of successive feed-in tariff reforms. Energy Policy 36:2917-2929. Mendonca, M., Jacobs, D., Sovacool, B., 2009. Powering the Green Economy: The feed-in tariff handbook. Earthscan, London. Frondel, M., Ritter, N., Schmidt, C. M., 2008. Germanys solar cell promotion: Dark clouds on the horizon. Energy Policy 36:4198-4204. Frondel, M., Ritter, N., Schmidt, C. M., Vance, C., 2010. Economic impacts from the promotion of renewable energy technologies: The German experience. Energy Policy 38:4048-4056. Reichenbach, J. and T. Requate 2011. Subsidies for Renewable Energies in the Presence of Learning Effects and Market Power, Resource and Energy Economics 34 (2012), 236-254.	Thank you very much for these references. As for the insight that, of course, policy instruments that succeed in stimulating investment in intermittent renewables do generate risks associated with supply interuptions, and higher costs associated with the additional average costs compared to existing power sources: we have included this into the introduction for section 4.4, with many of the references that you have suggested here. With respect to the latter, I believe that the sectoral chapter on Energy Systems and the governance chapter on the national scale(Ch 15) are both dealing with these issues. As to the former issue, we will include it.
5322	2					As mentioned already in the remarks to chapter 1: The authors seem to be preoccupied by the concept of systematically bounded rational consumers and ignore switching cost and other hidden cost incurred by the consumers through adopting new technology. (See by contrast chapter 4, where switching cost are addressed, e.g. Farrell and Klemperer (2007), Chapter 31, Coordination and Lock-in: Competition with Switching Costs and Network Effects. Handbook of Industrial Organization).	Noted. Introduction clarified.
3037	2					It is not clear that promoting energy efficiency and removing barriers to its implementation for final consumers will always have the intended effect of reducing energy consumption, owing to rebound effects. For instance, consider compact fluorescent bulbs, which are mentioned here. Despite the seemingly commonsense appeal of such technology for restraining energy use, a Journal of Physics analysis of lighting technologies covering three centuries, six continents, and five technologies shows both very large gains in energy efficiency and essentially 100% rebound [Tsao, J.Y., Saunders, H.D., Creighton, J.R., Coltrin, M.E., Simmons, J.A., 2010. "Solid state lighting: an energy-economics perspective." Journal of Physics D: Applied Physics 43 (35), 354001; also Saunders, H.D. and Tsao, J.Y. "Rebound effects for lighting," Energy Policy, 49(2012): 477-478]. Importantly, note that such efficiency gains increase economic welfare even if they don't reduce energy use. Consumers benefit from efficiency gains, but their behavioral response may be surprising and counter to "one-for-one" energy reduction expectations in the long run.	The literature on the rebound effect is very important, and needs to be taken into account in all discussions of efforts to Improve energy efficiency. It is, however, somewhat tangential to the issue of risk and uncertainty in the area of energy efficiency. Rather, it has to do with the effectiveness of various policies, which are covered in the sectoral chapters on buildings and transportation.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8918	2					The section paints a picture of people being irrational creatures that are driven by emotions and by identity-based aspects such as cultural values. Emotions are an important, maybe the most important, determinant of behavior. But emotions have a cognitive basis and thus reflect a person's understanding of the situation. For example, a factor that has been shown to guide people's support for climate change policies apart from emotions is their understanding of the causes of climate change and which policy measures they judge to be effective (O'Connor et al., 1999, 2002; Bostrom et al., 2012), which is a cognitive and deliberative judgment. Bostrom, A., O'Connor, R. E., Böhm, B., Hanss, D., Bodi, O., Ekström, F., Halder, P., Jeschke, S., Mack, B., Qu, M., Rosentrater, L., Sandve, A., & Sælensminde, I. (2012). Causal thinking and support for climate change policies: International survey findings. Global and Environmental Change: Human and Policy Dimensions, 22, 210-222. O'Connor, R.E., Bord, R.J., Fisher, A. (1999). Risk perceptions, general environmental beliefs, and willingness to address climate change. Risk Analysis 19, 461–471. O'Connor, R.E., Bord, R.J., Yarnal, B., Wiefek, N. (2002). Who wants to reduce greenhouse gas emissions? Social Science Quarterly 83, 1–17.	A useful observation, and one that we have tried to address in the introduction to section 2.2, describing in more detail the wisdom and contributions made by System 1 processes.
16092	2					No clear message in that section	The message -- that perceptions of risks associated with particular technologies, in particular nuclear and CCS, is a major obstacle to development -- could be brought out more strongly in the opening paragraph. We have revised the text accordingly and added references.
16093	2					It is not clear in this section what knowledge is posterior to AR4	This comment raises a fundamental problem with this section, namely that, unlike the rest of Section 2.4, this sub-section fails to focus on the empirical literature in the climate policy arena. We are revising accordingly.
12991	2					The fact that EU theory involves a distinct normative perspective, and indeed is only one way of operationalizing that perspective, is owrth emphasizing and should be addressed in chapter 3.	We agree that E(U) is only one way of highlighting a normative perspective. It is also discussed in Chapter 3
18446	2					Need for conclusion section that brings out key risks and uncertainities, common perceptions	See sections 2.1.1 and 2.1.2 in SOD

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
10267	2	0				Throughout this chapter, there are many general explanations about risk and uncertainty. You should focus on them regarding climate change. Please do not forget that this report is an assessment report on climate change.	Thank you for this comment. The risks and uncertainties associated with climate change are one of the elements that we consider in this chapter. It is important to recognize, however, that this chapter is not about risks and uncertainties in climate change per se, however, but about risks and uncertainties that are relevant to climate change policy responses. We are thus deliberately not focusing on risks and uncertainties associated with climate, but rather seeing these risks and uncertainties as one set among many. Others include risks and uncertainties associated with technologies, economic growth, and the effects of particular regulations.
8783	2	0				The approach is normative in focusing on utility rather than alternative ethical schemes such as rights/ deontological ethical approaches (e.g. right to life) or virtue ethic and epistemological approaches - e.g. (precaution/wisdom and seeing moderation of consumption as good for individuals, societies and the Earth System). One example is the focus of where people act as 'consumers' and have shorter term aims that some economic analysis suggests is wise, ignoring where people act as citizens and would take a longer term view than economics typically does in practice. Charlesworth M & Okereke C (2010, Policy responses to rapid climate change: An epistemological critique of dominant approaches, Global Environ. Change, 20:121-129, doi:10.1016/j.gloenvcha.2009.09.001) suggests that conventional economics cannot respond to the demonstrated level of difficulties in prediction of the climate. It also suggests that the utilitarian ethics of economics may not be K10the starting point of the majority of the global population. That is, economics is both an irrational and undemocratic response to climate change as described by climate science.	This is a very good point, thanks also for the reference, and we make this point now in an expanded introduction to Section 2.2.
12231	2	0				General comment: It seems like most of the litterature and examples in this Chapter is from North America and some from Europe. Please consider some more regional balance, as there might be relative differences between nations and regions.	Has been changed, see specially section 2.1.5 from SOD and FAQ 2.2.
4893	2	0				Excellent arguments, examples, language, however, less attention could be devoted throughout the chapter (actually, in sections 1 and 2) to the heuristic, intuitive or "System 1" approach (its analyses and examples) since the main purpose is to explain the importance and methods of the comprehensive analytic approach to deal with risks and uncertainties in decision-making in relation to climate change (except, e.g., the relation mentioned inter alia on p.16: "These behavioral and cognitive science insights highlight some of the challenges facing scientists and policymakers in their efforts to develop effective climate change risk communication strategies and raise important questions about whether efforts to guide System 1 learning might be used to stimulate System 2 behavior.".	System 1 is important for developing climate change policy along with System 2 tools as noted in Fig. 2.1 and the introduction to Sect. 2.2

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8114	2	0				The chapter attempts to integrate a broad field of disciplines, schools and research perspectives. Furthermore, it attempts to integrate a broad field of implementation (decision) situations. However, the concept used to structure the field seems to be too simplistic for this challenge. I am sorry to sound so harsh, but the chapter reads occasionally as a potpourri of thinkable decision situations and loosely linked tools. I strongly recommend to (1.) reduce the scope of this chapter, (2.) be more precise about what kind of decision situation at what kind of decision-phase is actually addressed (and what not), and (3.) assess the tools more carefully and balance the options and threats more clearly. In my perspective, the work of the International Risk Governance Council (IRGC) is most instructive for this challenge. It structures the problem-situation threefold in complexity, scientific uncertainty and ambiguity. Since climate change impact is a combination of all three, this structure helps to characterize which tool or procedure has its strengths in which problem-situation challenge. Furthermore, the IRGC has developed a Risk Governance procedure structuring the risk assessment process. They distinguish five phases: pre-assessment, appraisal, characterization/evaluation, management and communication. In each phase the handling of risk and uncertainty needs a specific strategy. Evidence of the usefulness of this IRGC approach is published in several peer-review journals. Some sources: www.irgc.org. Van Asselt, M. B. A.; Renn, O. (2011): Risk governance, in Journal of Risk Research, 14 (4), S. 431-449. Atkinson, R.; Klausen, J. E. (2011): Understanding sustainability policy: governance, knowledge and the search for integration, in Journal of Environmental Policy & Planning, 13 (3), S. 231-251. Aven, T.; Renn, O. (2010): Risk Management and Governance, Technology, Risk, and Society, Berlin Heidelberg, Springer. Cope, S.; Frewer, L. J.; Renn, O.; Dreyer, M. (2009): Potential methods and approaches to assess social impacts associated with food safety issues, in Food Control. Renn, Ortwin; Dreyer, Marion: Food Safety Governance, Technology, Risk, and Society, Berlin Heidelberg, Springer. Renn, O. (2008): Risk Governace. Coping with Uncertainty in a Complex World, Earthscan Risk in Society Series, London, earthscan. Paper by IRGC: IRGC, International Risk Governance Council, (2005): White Paper on Risk Governance. Towards an Integrative Approach, Geneva. IRGC, International Risk Governance Council, (2008): An introduction to the IRGC Risk Governance Framework, Geneva. IRGC, International Risk Governance Council, (2009): Risk Governance Deficits. An analysis and illustration of the most common deficits in risk governance, Geneva. Klinke, A.; Renn, O. (2012): Adaptive and integrative governance on risk and uncertainty, in Journal of Risk Research, 15 (3), S. 273-292.	Regarding (1) the scope of the chapter is as decided by IPCC at its plenary session October 26-29, 2009 (please see approved chapter outline on WG III site). Regarding (2) a new table (Table 2.1) develops a taxonomy of different types of decision-makers and the choices they face. Comment 3 and the suggested approach for assessing tools for decision-making as used by IRGC is accepted and the text will be modified accordingly and the 10 references mentioned will be included.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
16916	2	0				This is a good chapter and has potential to be extremely valuable, but to do so I think it needs to be clearer in structural approach towards different types of decisionmakers, and needs further development in two main directions: • The concepts of risk and uncertainty are applied almost entirely to climate impacts ("the nature of the problem") rather than aspects of mitigation – which is rather odd for a report on Mitigation: in more than 40 pages, for example, there is less than a page on energy efficiency despite the fact that the energy efficiency is central and the literature identifies perceptions of uncertainty, risk aversion and other behavioural dimensions as crucial to understanding; • Whilst the chapter gives intellectual clarity over "System 1 behaviour", and its distinction between that and "System 2", it then addresses a range of other issues with implication that they are hard to fit into "System 2" decision framework, but without this ever really pinned down. I think the chapter would be far clearer if it acknowledged the existence of "System 3" processes around strategic risks and deep uncertainty, including the role of security, strategic judgement, innovation and systems transformation. It would then help to clarify the boundary between these, and System 2 processes which generally aspire to quantification and work best under conditions of limited uncertainty and trade-offs at the margin. I would also suggest value in trying to find another term, since the word "System" is hugely used through the Mitigation report for many different purposes (Energy System, Economic system, Systems Transformation, Innovation Systems, etc etc). The term I have found most useful is "domain". The chapter also needs at minimum to say a bit more about the role of inertia at many levels of decisionmaking and the (physical and social) systems involved. Inertia in its broadest sense is what renders "wait and see" untenable in the face of uncertainties. □	We will respond to the reviewer's two bullets separately. Bullet 1: In its revision, Chapter 2 now offers far more coverage on uncertainty in climate change mitigation, starting with a list of multiple sources of uncertainty, of which climate impacts are only one among many. Bullet 2: chapter 2 has been extensively revised and now mentions many of the aspects the reviewer found missing. However, we did not add a "System 3" as Systems 1 and 2 refer to two different processing systems, rather than types of uncertainty. We also did not switch to a different terminology for System 1 and 2, because this is the way in which both academic publications and the more popular press refer to those types of psychological processes, but now frequently define what these "systems" stand for, as in "intuitive System 1 processes," or "analytic System 2 processes."
7300	2	0				Chapter 2 concentrates on qualitative (textual) description of risks and uncertainties relevant to climate change response policies. The quantitative assessments are almost missing. It would help, if the quatitative assessments of the relevanr risks and uncertainties are included in the chapter, wherever possible.	Thanks for this comment, I assume you want inclusion of quaNtitative assessments?:-). There is much experience with (quantitative uncertainty analysis (QNUA) in engineering and science based policy, but not much yet in climate change. An overview for integrasted assessment models is appearing in Cooke, Roger. M. (2012) "Uncertainty Analysis Comes to Integrated Assessment Models for Climate Change…and Conversely Climatic Change. DOI: 10.1007/s10584-012-0634-y, free online access: http://dx.doi.org/10.1007/s10584-012-0634-y, and a new study on sea level rise is appearing in Nature and will be cited.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4255	2	0				The current draft of chapter 2 ends rather inconclusively and its difficult to see the practical implications of the various approaches to decision making. It would benefit from a few illustrative examples. I wasn't convinced that devoting the second chapter to this topic was appropriate - it might be better to give the reader a better idea of mitigation options first. There is no discussion of the use of macroeconomic modelling including the co-benefits of mitigation strategies eg.CGE models	Regarding the sequence and scope of the chapter this is as decided by IPCC at its plenary session October 26-29, 2009 (please see approved chapter outline on WG III site). Co-benefits at the sectoral level are addressed in sector-specific chapters such as those on energy, transport, buildings, industry and agriculture (Chapters 7 to 11). Macroeconomic models (including CGE models) are not in the scope of this chapter, but IAMs and how they deal with uncertainty are discussed in section 2.4.2.
13793	2	0				This chapter is relevant to both WGIII and WGII. Integration, consistency, and cross-referencing will be challenging.	In the SOD we will devote particular effort in improving on the aspects that you highlighted.
13871	2	0				This chapter fails to identify any 'key findings' and fails to assign any metrics of confidence or uncertainty to statements. This is not appropriate. There are many places where useful ideas are made that rise close to the level of a recommendation and that should be presented as a key finding. These would be particularly valuable to a policy maker who wishes to draw from the useful material in this chapter.	Summary and Executive Summary will be augmented accordingly.
4515	2	0				The discussion of risk in this chapter seems inconsistent with the glossary definition of risk which focuses only on hazards (presumably associated with changing climate). It should be made clear that/if risk is being considered more broadly. For example, there are a wide risks to investments that are not caused by climate hazards but are relevant to climate policy. Suggest that the glossary definition be changed to be consistent with this chapter.	The mutual relation of definitions of risk in the Glossary and in our Chapter will be made clear in the SOD. Ideally, both can be made identical.
4831	2	0				In general a nice and interesting chapter covering the necessary basics in risk psychology. However, parts of the summary and introduction overlap massivly (even down to paragraphs that have just been copied and pasted).	This comment is absolutely right. We are completely revising the introduction and the executive summary, among other things to make them different from each other.
9139	2	0				Biases of perception might be explained by biological evolution. It might be a good idea to employ this viewpoint in the discussion part. (cf. Haselton, M. G., Nettle, D. & Andrews, P.W. (2005) . The evolution of cognitive bias. In D. M. Buss (Ed.) , Handbook of Evolutionary Psychology, (pp. 724-746).) Slovic has started this kind of discussion too. (cf. Slovic, P. (2007) If I look at the mass I will never act: Psychic numbing and genocide. Judgment and Decision Making, 2, 1-17. Retrieved April 24, 2007 from http://journal.sjdm.org/vol2.2.htm)	Because of space constraints, we don't think that such a discussion can be included, even though it would be interesting.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
14522	2	0				This draft offers an excellent survey of how individuals interpret and deal with risk and uncertainty. But it could benefit from placing these discussions in a broader context. For instance, the chapter never makes the argumen or even a statement, that addressing climate change in a challenge of risk management. The chapter largely focuses on individual decision making, and could benefit from placing its discussions in a risk governance (Orwin Renn) and/or decision support framework that would capture some of the important institutional and social contexts, and associated decision processes, in which these individuals reside. This chapter's current themese are clearly vital to understanding climate change as a risk management challenge, but it is at least as important to situate these ideas in the broader contexts since most important climate-related decisions (and the associated formation of risk perceptions) will be made by individuals acting within society, rather than as individuals acting along. These contexts will have an important influence on how people perceive and manage risk, and how they can best interact with the information provided in the rest of this IPCC WGIII report.	Excellent points. The SOD highlight the issues of risk governance as discussed by Ortwin Renn and indicate climate policy is an exercise in risk management.
4693	2	0				Surprising that you discuss climate change communication but then don't follow up with strategies for doing it well and having it contribute to improved responses	Good point, and in good part because of space constraints, as the chapter is charged to do so much with such a small page allocation. We do, however, provide at least a brief discussion and a reference to Susie Moser's 2010 WIRE article on climate risk communication in Section 2.2.2.
4701	2	0				Somewhere in this chapter, the problems of moral hazard from risk reduction should be addressed. For example, the US helped people rebuild in New Orleans, directly in the path of more frequent hurricanes.	The issues of rebuilding New Orleans falls more in the domain of WGII on Adaptation. The SOD will discuss insurance and note the importance of risk-based rates to address moral hazard problems.
4709	2	0				For the whole chapter, I would suggest more use of Nudge-theory policies which suggest the best approach to the obstacles posed by System 1 thinking is to accept those as "givens" and design decision architectures that lead to the "socially desired" outcomes while allowing people to make System 1 "cognitive errors." Much more could be made of this.	Yes, thank you, we tried to do that.
18582	2	0				What is the intention? To give advice on how to handle risk and uncertainty? If so, to whom? To explain behavioural aspects? To discuss/inform about apropriate decision tools and their capability to cope with uncertainty? To present some sort of general reasoning on risk/cost strategy seen from a mankind/society perspective?	The intention of Chap 2 is to indicate why climate change is a challenge for risk management and suggest how to address this issue
18583	2	0				Gives an overview but no/little advise. Relevance for policymaking? Directly, no or highly questionable. Indirectly, maybe but I guess the audience is limited.	(See response to Comment 49)
18584	2	0				The chapter is incomplete.	Thank you, we have extensively worked on improving the status of the chapter
18585	2	0				More of an annex?	Comment is unclear - no response

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8994	2	0				To be comprehensive and accurate treatment of the subject, it will be important for the chapter to recognize that different societies can have different ways of managing and sharing risk. Individuals reduce their vulnerabilities to rsk by having broader social networks, for example. The chapter places too much emphasis on price-based, insurance market approaches.	Yes, an excellent point that we now make in a new Section 2.2.4.5 on Risk diversification by formal and informal institution, with social networks that cushion individual risks as an example of the informal institutions.
8995	2	0				It is important to recognize that what is involved in climate change choices is that it is collective, not individual, decisions that are the most important. It is more important to highlight how people make collective choices under uncertainty than how individuals make these decisions under uncertainty. Because of this, ten pages of treatment of micro-based approaches, which applies most directly to choices made by individuals, raises the question of emphasis. The tools emphasized by the chapter, such as cost-benefit analysis, are mainly applicable to "bounded" problems. Climate change, which is a cumulative process, is by nature an unbounded problem for which prices and costs are often not well defined. For these kind of problems, other methods, such as expert assessment, might be more appropriate.	We have refocused the emphasis of the chapter, and now acknowledge the wide range of levels of decision making, from the individual to collectives and to policy makers at different levels, as shown in Table 2.1. We also point out the connections between responses to uncertainty at these different levels far more than in the previous version.
8996	2	0				The Chapter privileges the Kahnemann System 1 and System 2 approaches to characterizing decision-making under incomplete information. Care should be taken to emphasize that what is at stake are effective and timely decisions. In the case of climate change, these decisions are made in a highly charged political context, with large gaps in power and capability among the parties involved. If the question is one of arriving at effective collective political decisions – whose appropriateness cannot be fully judged at decision-time, the System 1 approach, associated with intuition, perception, less analysis, and more myopic, is not necessarily an inferior one.	We are now more careful to point out that System 1 responses are not necessarily inferior to System 2 responses, but that good judgment involves knowing when to supplement System 1 rapid responses with more effortful and analytic System 2 deliberation.
5426	2	0				The Chapter promotes the view, that perceived risks are always inferiour to "expert judgement", presumable meaning risk=probability times damage, but there are many examples that the perceived risk can be more realistic. In any case, the literature is full of much deeper discussions of the different tisk concepts (for example my book, Sørensen: Life-cycle analysis of energy systems, RSC Press, Cambridge)	We certainly do not want to say that perceived risks are always inferior. We will describe the model of social planner/ behavioral interaction that we have in mind more carefully. In fact, acording to our interpretation, both levels of aggregation have to learn from each other. We will also consult your book.
18396	2	0				Chapter 2 is well written and a good overview of the literature on risk and uncertainty. It would be an excellent resource for a graduate seminar course. But, in the end, the chapter is too theoretical and too abstract to be of much value to decisonmakers in government or business. Even discussions that are a bit more grounded—for instance on price caps and feed-in tariffs—are far too general and insensitive to situational considerations to be useful to decisionmakers. In the end, assessments of risk and uncertainty and related decisionmaking are based on situational considerations specific to that decision. This chapter seems to show no appreciation of that fact, focusing on general theories, concepts and considerations.	In the SOD we will make a severe attempt to better link concepts and applications.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
18397	2	0				I was as surprised to find almost no insight or attention to business decisionmakers. The chapter is almost totally devoted to individual behavior, and a bit to government agencies. Almost nothing is said about business decisionmaking. In the energy areas, for instance, it did not address decisionmaking by oil, natural gas, electricity, and biofuels companies. It did not address car and truck manufacturing companies. It did not address infrastructure companies. And so on.	Good point. The SOD will examine the impact of risk and uncertainty on business and organizational decision making
18398	2	0				The chapter provided minimal insight for government decisionmakers. The design of cap and trade programs entails a large number of decisions about allocating allowances; social, regional, and economic equity; financial integrity; international and national trade laws; trading robustness; and much more. I saw little or no insight into risk and uncertainty for these issues.	This is a very important comment, and one that we are trying to address. What we are doing in the Second Order Draft is being much clearer about the diversity of choice types and actor levels, and doing our best to identify the most important risks and uncertainties across these types and levels. In so doing we hope to make it clearer for government decision-makers which risks and uncertainties matter for them. But we are constrained in two ways. First, we are constrained by the existence (or lack) of peer reviewed literature specifically addressing the impacts of particular risks and uncertainties in particular policy contexts. Second we are constrained by space limitations. We have reached out to the sectoral and governance chapters, that they will deal with the studies that are particularly relevant to their subject area.
18399	2	0				The chapter does not address in any way a vast swath of decisions and policies under consideration. In my area of transportation and fuels, I did not see anything on land use changes (a huge issue with biofuels), regulations of vehicles and fuels, urban land use, and much more.	Thank you for this comment. We are doing our best in the Second Order Draft to be more specific about the impacts of particular risks and uncertainties in particular contexts. But to some extent a full treatment of, say transportation issues, has to come in the transportation chapter. We are forwarding this comment on to them.
18400	2	0				Another citation regarding loss aversion, with respect to purchase of more efficient cars, is: David L. Greene, John German and Mark A. Delucchi, “Fuel Economy: The Case for Market Failure,” Chapter 11 in Daniel Sperling and James Cannon, eds,, Reducing Climate Impacts in the Transportation Sector, Springer, 2009. (I believe there were follow-up journal articles)	Yes, we now mention it in Section 2.2.3

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9218	2	0				Through the chapter, the technical terms "system 1" and "system 2" are used very frequently. Although they are concisely explained on Page 11 based on Kahneman (2011), many readers may not read the paragraph and move on to other parts of the chapter. In such a case, the concept of "dual process thoery" and the meaning of "system 1/2" might not be understood properly by general readers of the chapter, who are not an expert of psychology (like me). Furthermore, I am concerned that specific decision-making styles/processes which the chapter authors don't valuate highly (i.e. subjective expert view) are possible to be classified into "system 1" in an arbitrary or ambiguous manner. From the reasons above, though I like the concept of system 1/2 is mentioned in the chapter, I think it should not be used too intensively as a backbone concept of the chapter.	The role of Systems 1 and 2 for climate change policy will be more clearly defined in the SOD
14231	2	0				The chapter is a well-organized, clearly structured, and ties the conceptual approaches in risk and uncertainty analysis nicely to the relevant climate change applications. It performs well in covering a wide array of approaches, and trading-off between comprehensiveness, relevance, and length.	Thank you! Positive comments are very helpful in achieving balance.
3137	2	0				This chapter has improved massively since the ZOD. This chapter has a very different feel from WG1 and WG2 chapters and much of WG3. there is little/no discussion of "what's happened since AR4." I don't have a problem with that, but perhaps it is useful to have some text at the outset indicating that the kinds of issues addressed here haven't in past had much attention in IPCC. Thus most of this is "new." Some of the most interesting parts of this chapter relate to risk perception. Shouldn't that be in the title? At present, the title refers to "integrated" yet much of the chapter is actually about how risk analysis isn't integrated. This chapter is really about "Uncertainty, Risk Perception and Implications for Climate Change Response Policies." This chapter needs cross references to other chapters. For example, the discussion of uncertainty and risk has big implications for policy design and choice. That's taken up in lots of other chapters. It would be helpful if the executive summary indicated more of the key substance of what the chapter finds and argues—such as on risk perception; social planner vs other decision making perspectives; evaluation frameworks; etc.	We will relate our Chapter to AR4 in our new Intro.
10375	2	0				There are several kinds of risks, including risks with definite distributions, random risks and chaos risks. Maybe researches about risks should be focused on in the future.	Thanks. These issues are bound up with the representation of uncertainty (2.3), but the emphasis on the future pervades the entire chapter.
2333	2	0				The risk and uncertainty are main technical terms in this chapter. Having baseline on these terms, comprehensive definitions on “Risk” and “Uncertainty” cannot be notified in the chapter. By quoting, UN World Water Assessment Report Volume 1, Managing Water under Uncertainty and Risk, “Risk commonly refers to an adverse event or the con-sequence of a decision. (see Section 8.1.2; see also Aven 2003; Bedfore and Cooke, 2001; Cooke, 2009; Covello and Mumpower, 2001; Kaplan and Garrick, 1981; Kasperson et al., 1988; Mays, 1996; Slovic, 1992; Yoe, 1996). Uncertainty is often used in connection with the term risk (sometimes even interchangeably). The most widely held meaning of uncertainty refers to a state of mind characterized by doubt, based on a lack of knowledge about what currently exists or what will or will not happen in the future. It is the opposite of cer-tainty, which is a conviction about a particular situation (Bogardi and Kundzewicz, 2002; Morgan and Henrion, 1990; Pindyk, 2007).” Thus, I would like to suggest above UN World Water Assessment Report Volume 1, Managing Water under Uncertainty and Risk and inter quotation as main sources for this chapter when 2nd revision.	Thanks for pointing us to this reference. However, we rely on the definitions of risk and uncertainty as spelled out in the IPCC-AR5's uncertainty guidance notes. The link to those as well as the definitions we are using will be explained clearer in the SOD.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6056	2	0				Thorughout this chapter, there are so many textbook style explanation about risk and uncertainty especially 2.1, 2.2 and 2.3. What really matters with respcet to climate policy and uncertainties are, for example, how to manage the risk and uncertainty of fat tail issue of catastrophic damages when deciding/agreeing global target concentration, how to evaluate the role of bio-CCS and food security, how to invite all the countries to an international framework (immediate participation) in order that mitigation effort will not become too late. In contrast, concrete examples in this chapter very often start with uncertainty with farmers or carbon tax. I think these uncertainties are so well known and not appropriate to be cited so frequently. These may make the chapter feel rather redundant. Another point on this chapter is that cited concrete examples are heavily biased to US and European examples. Examples from other regions will add value to this chapter. The last point is that there are certain duplication among chapter 2 and 3. Chapter 2 should focus on risks and uncertainty aspect.	Thanks for the comment. The initial sections review standard material and are by their nature more text book style. Refracting risk as you suggest now plays a large role in Ch. 2 and the polity of risk management has become a unifying theme.
16079	2	0	0			In the whole chapter -otherwise very interesting and pedagogic- it is difficult to distinguish between existing knowledge and new science. There could be also a benefit in mentioning more where this knowledge has been improved through climate policy (UNFCC bodies, spectific programs or policies...).	Thank you, we will stress more the difference between new science and existing knowledge
18448	2	0				A clearly structured content, balanced discussion with case scenario analysis, however, there is	Thank you, unfortunately the last part of the comment was truncated
7894	2	0				If it is true that different agents can choose different tools for risk assessment the questions occurs what combination of tools the benevolent social planner should choose. In fig. 2.2 it looks as if the identification of stabilization targets using CBA in combination with adaptation planning is the most reasonable tool for the social planner. This judgment, however, does not follow from the reasoning in section 2.3. If our observation is correct, the chapter adopts Nordhaus' approach that faces massive criticism. Subsequent comments are related to this general remark.	The social planner's choice of assessment method should be the result of a society's debate, as it is a deeply normative issue. CBA is just one option. We will modify Fig2.2 to further reduce the risk of mis-interpretation.
3366	2	1				This is an excellent chapter. Others chapters should learn from it, such that uncertainty discussion within all chapters is put on a high level.	Thank you! Positive comments are very helpful in achieving balance.
4892	2	1				Ch.2 Integrated Risk and Uncertainty Assessment ..	Comment is unclear - no response
13828	2	1		end		In general, use of the term myopic (implying myopia) is not advisable. It has a specific scientific meaning that is not intended here. What is implied by its use is a perjorative (i.e. ascientific judgemental statement unfounded by citation of literature). Sometimes the use of system 1 leads to survival. This is not a myopic choice. Use a term from the scientific literature that conveys the point of interest and we may find better success reaching the intended audience. Page 18, line 7 is an appropriate use of the term as it refers to a professionally-defined concept (cognitive myopia).	We did not intend to use the term in a pejorative way, but instead as describing an attentional focus on objects and concerns closer by that are therefore getting privileged by actions taken. We have tried to be more careful in any unintended connotations throughout the paper and also emphasize much more the adaptive function of such a focus and more generally System 1 processes, see introduction to Section 2.2..
2593	2	1	1	74	21	This chapter is very knowledgeable, like a textbook. If possible, lots of examples or study cases might enrich its content, and would be attractive.	Table 2.1 provides an opportunity for Chapter 2 and other chapters to provide more examples in the SOD
11476	2	1	74			While there is an improvement over the previous daft, overall the whole chapter is not tightly integrated among different sections, resulting in some sections being well developed while others are not. In addition, there is some overlap, making the whole chapter a little repetitive.	We will address these issues in the SOD. Our aim is a qualitative improvement of the level of integration across our chapter.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4902	2	1-				MISPRINTS etc.	This comment is ambiguous. However, the entire section has been edited.
6065	2	10	1	10	2	Please explain why the investment that may result in a small loss to investors be justified.	Such investments may be justified on account of risk aversion or risk loving. The rank ordering of expected utilities associated with different options may differ from the rank ordering of their expected net costs or benefits expressed in financial terms.
7693	2	10	10			Please clarify: "[…] the right-hand tail the distribution of climate never diminishes to zero[…]". Assuming that the distribution refers to damages, could this be rephrased as "there is a non-zero possibility that climate damages can be infinitely large", or some other expression that does not explicitly mention distributions. The text would be then be more accessible.	Thank you. Correction has been made.
11495	2	10	10	10	10	Grammar: "the right-hand tail the distribution" - needs correction.	Thank you. Correction has been made.
7227	2	10	10			tail the distribution -> tail of the distribution	Thank you. Correction has been made.
7228	2	10	10			It is not clear what is intended to say with this? What is a climate distribution? What does "right hand" mean in this context?	Point taken. We have changed the phrase to "the right-hand tail the probability distribution of climate sensitivity or impacts" to make this clearer to a more general audience.
3189	2	10	10			"distribution of climate only slowly changes"	Thanks. We have changed the text as suggested in the working draft.
7229	2	10	14		16	the sentence does not parse. Maybe "adapting" -> "be adapted"	Thanks. We have changed to "guide the targets for greenhouse gas emissions, and suggest the need to adapt to a wider possible range of climate impacts than had been previously considered" in the working draft.
13802	2	10	15			Remove first 'possible' from this sentence	Done! Thanks.
13803	2	10	16			Remove 'may not have been'	Done. Thanks.
6369	2	10	17		26	The uncertain GHG mitigation effect of some proposed mitigation measures creates a risk of increasing GHG emissions in the name of reducing them. More broadly, our methods for assessing these reductions (e.g., life cycle assessment, approved CDM methodologies) include many data, model, and scenario uncertainties. This is most famously the case for biofuels, but is true even for fuel switching from coal to natural gas, given uncertainty about NG leakage rates and the increasing trade in coal. It's important to compare both the mean and variance/uncertainty of the GHG reduction benefits of different strategies so these risks can enter into the discussion.	The point raised here is absolutely valid, but is tangential to this particular paragraph, which was written mainly to clarify the types of systems and unceratinties that matter for policy development. Hopefully the issues that the reviewer raises will be addressed in the sectoral chapters.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9114	2	10	18	10	20	Do the figures include embodied energy in the goods that are importetd? In developed countries cities tend to outsource heavy industries but import a large proportion all the utilized goods.	I don't understand the comment, because we do not provide any figures at this point in the chapter.
13804	2	10	19			Change 'can' to 'might'	Thanks, but we will stick with "can." Both words work. Levies can protect people. Levies might protect people. The former word is a bit more theoretical and abstract, the latter a bit more practical. This paragraph is written at the more theoretical and abstract level, while section 2.4 of this chapter is where the practical details enter in.
11723	2	10	20	20	24	Already established technologies like energy transmission in Japan, USC for power generation have great potential to reduce CO2 in the world. Original sentences could make readers misunderstand that available technologies doesn't have much potential. It would be apropriate [...technologies for energy transmission, storge, and greater energy efficiency which are new or in stages of rapid improvement can reduce furtehr carbon emissions. It is however ....].	Good point. We have changed "Many of these technologies" to "Some of these technologies," which carries less of a connotation about relative numbers.
13805	2	10	20			Change 'can' to 'might'	Thanks, but we will stick with "can." Both words work. "Can" is a bit more theoretical and abstract, "might" a bit more practical. This paragraph is written at the more theoretical and abstract level, while section 2.4 of this chapter is where the practical details enter in.
13806	2	10	21			Change 'can' to 'might'	Thanks, but we will stick with "can." Both words work. "Can" is a bit more theoretical and abstract, "might" a bit more practical. This paragraph is written at the more theoretical and abstract level, while section 2.4 of this chapter is where the practical details enter in.
4908	2	10	27		38	some hint on the uncertainties related to the new SSPs would also be in line with the purpose of this listing	As far as we are aware the SSPs are in too preliminary a stage of development for the uncertainties to have become evident.
13807	2	10	28			Make it clear that you mean AR3 and AR4. Right now it reads as if there have only been two previous assessment reports.	Thanks. We have changed it to "The most recent two assessment reports…" in the working draft.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12233	2	10	29	10	29	SRES should be explained, as it is introduced for the first time in WGIII report.	If the SRES scenarios were to be discussed at length in this report, we would do so. But they now belong to the dustbin of history, and so given space limitations we will allow interested readers to explore them on their own, given the reference we provide at the end of this sentence.
8123	2	10	4	10	5	The kind of policy choices and the phase during the policy cycle (or risk assessment) should be characterized.	We agree. We are revising the introduction substantially in order to do so.
9791	2	10	4	11	13	The five distinct areas can be referred to as PESTE(L) or STEEP-analysis (political, ecological, social, technological, economic and legal environment) and thus build on a framework widely used in organizations.	Thank you for bringing this analysis (known variously as PEST, PESTEL, PESTLE, STEEPLE, and STEEPLED) to our attention. We believe that the ideas we present here match that quite closely. We do not suplicate the PESTLE format, because as far as we understand that format is one designed primarily for use by private sector firms, across a wide range of choices or problems. We instead are focusing on a narrower range of choices or problems, but a wider range of actors.
13801	2	10	4			Change 'policy choices' to 'policy choices concerning climate change'	Good suggestion. We have incorporated it in the working draft.
9115	2	10	42	10	43	A reference would be needed here in my opinion. I would anticipate that in these cities especially the differences between a consumption-based and a production-based assessment results would be very different.	Thank you. The text has been revised accordingly.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
10268	2	10	43	10	47	Keynesian models are minor for analyses of global warming mitigation. The limitations of the assessments by Keynesian models particularly for long-term analyses of global warming mitigations should be discussed. The explanations regarding these points are required.	The point is well taken. Our point in this chapter is not to appraise the relative merits of the two models, but rather to suggest the fact that their presence introduces an aspect of uncertainty. What we have done is to change the sentence to make it clear that the Keynesian approach is the minority view: "As Knopf and Edenhofer (2010) report, for example, the majority of energy models, based on a Ramsey (1926) full employment growth model of the economy, predict net reductions in global economic activity as a result of market-based policy interventions to achieve a 2°C target, while a model that relies on Keynesian principles predicts net increases in global economic activity as a result of the same set of interventions."
4702	2	10	43	10	48	Environmental Kuznets curves might also be mentioned here.	We don't understand what environmental kuznets curves have to do with uncertainties associated with future regulations and their effects, if the line numbers for this comment are correct.
3190	2	10	43			"Ramsey(1926) full-employment growth model"	Done. Thanks.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
14369	2	10	45			It is misguided to give the impression that abatement will be cost-free because of Keynesian considerations. Keynesian unemployment is a temporary issue, not a persistent phenomenon for half a century.	The point is well taken. Our point in this chapter is not to appraise the relative merits of the two models, but rather to suggest the fact that their presence introduces an aspect of uncertainty. What we have done is to change the sentence to make it clear that the Keynesian approach is the minority view: "As Knopf and Edenhofer (2010) report, for example, the majority of energy models, based on a Ramsey (1926) full employment growth model of the economy, predict net reductions in global economic activity as a result of market-based policy interventions to achieve a 2°C target, while a model that relies on Keynesian principles predicts net increases in global economic activity as a result of the same set of interventions."
5320	2	10	45	10	47	There is no reference in the chapter proving that in Keynesian models the increase of mitigation increases economic activity. This claim is also not quite true in general. A Keynesian model based on production functions and a budget constraints on inputs, say capital, does not make this prediction. Even if investment in abatement is treated as a “normal investment”, there is the concept of “crowding out” in Keynesian models which can be up to 100%. Third, a Keynesian model may predict increase of economic activity in the short run. However, a deficit financed increase without productivity investment may have contracting effects in the long run, also in a dynamic Keynesian model. In my view Keynesian model are often abused to prove that abatement investment (which may be well justified by environmental reasons) has a second dividend, which it usually does not have.	The point is well taken. Our point in this chapter is not to appraise the relative merits of the two models, but rather to suggest the fact that their presence introduces an aspect of uncertainty. What we have done is to change the sentence to make it clear that the Keynesian approach is the minority view: "As Knopf and Edenhofer (2010) report, for example, the majority of energy models, based on a Ramsey (1926) full employment growth model of the economy, predict net reductions in global economic activity as a result of market-based policy interventions to achieve a 2°C target, while a model that relies on Keynesian principles predicts net increases in global economic activity as a result of the same set of interventions."
6066	2	10	45	10	47	Need citation for net increases in global economic activity	The result appears in Knopf and Edenhofer (2010), which as been cited.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
3191	2	10	46			"Keynesian model of an unemplooyment economy"	I put in the "full employment" part before the Ramsey model. But as far as I know the Keyensian model differs in that it does not assume full employment. Hence, it could be full employment, or could be partial employment. So I will leave this particular phrasing satand, and not include your suggestion.
9116	2	10	48	10	49	One potential density effect is an increase in overall consumption leading to higher emissions. This perspective should not be totally omitted.	This is a good point, and I trust that it will be covered in another chapter. Here it is quite tangential.
13808	2	10	48			Change 'actor' to 'actors'	Done. Thanks.
13809	2	10	49	11	1	Change 'as to what future climate policy will be' to 'about what climate policies will be adopted in the future'	I am going to leave it as it stands. The version you suggest implies that climate policies are things that need formally to be adopted. The more expansive definition of policy, which we use in this chapter, equates policies with strategies, which can often be implictly applied, even if not formally adopted.
3188	2	10	5			"five broad areas" ["distinct" too strong]	Good suggestion. We have incorporated it in the working draft.
8234	2	10	6	10	16	Another aspect of low-probability high-impact events and tipping points raised by Weitzman (2009b) is that they may also be irreversible, which strenghtens the argument for including a precautionary effect in climate change decision-making.	Thank you for this reference. It has been inserted in the text.
11494	2	10	9	10	10	The description of "fat tails" is misleading. Both tails can be fat, depending on the climate variable under consideration - not just the right-hand tail, as indicated in the text. This is important because in many cases, communities need to simultaneously prepare for precisely opposite extreme events , e.g. both floods and droughts	Thank you. The sentence is not a description of 'fat tails,' rather, it is just an instance of the tails as you have correctly highlighted.
10163	2	10	9	10	12	This sentence is unclear. First an explanation/definition of "fat tail" is needed, secondly it is not clear what is not diminishing to zero.	Thank you. We have included a description/definition of fat tails. The sentence has been clarified.
6883	2	10	7	10	7	Proper reference needed to WGI AR5.	Ultimately yes. I don't think we know what that reference is yet, in terms of title, publisher, exact author list.
13810	2	11	1			Change 'as to' to 'about'	Thank you. Correction has been made.
13813	2	11	10			Clarify 'they' and 'them'	Thank you. Correction has been made.
9117	2	11	14	11	18	There is relatively little research on how the lifestyles change in overall when coming from e.g. dense downtown area or other dense agglomeration and moving towards the outskirts. The assessments tend to concentrate on changes in transport related emissions and housing, but omit the possibility that other consumption may change significantly as well.	yes, a good point.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
11496	2	11	14	11	21	What is the definition of "social systems" in this paragraph? What does it include/exclude? Is it the same or different from "human systems" (see Ellis, 2009 "Earth science in the Anthropocene")	the term is used in contrast to natural systems, so is meant to be very broad and inclusive. To be more precise, we changed it to "socio-economic system"
6067	2	11	14	11	15	"Social system" should be changed to "socio economic system".	Thank you. Correction has been made.
13814	2	11	17		18	You are mixing ideas. I think the parallel issue is the impact of uncertainty in social system dynamics upon decision making.	thanks, we reworded this statement.
6068	2	11	20	11	20	"Social system" should be changed to "socio economic system".	Thank you. Correction has been made.
7231	2	11	22ff			Put the storyline at the beginning of each subsection? Write more in a newspaper style: Important information at the beginning, fillers towards the end.	Will consider this point in writing the SOD
11497	2	11	24	11	26	What does 'natural system' refer to? Is there on system or are there many? Is it the same as or different from "Earth system" (see Ellis, 2009 "Earth sciences in the Anthropocene")	Thank you. We have replaced 'natural' with 'earth'
4910	2	11	25			{Add} associated with {}the changes of the natural system	Thank you. Correction has been made.
13815	2	11	25			Strike 'and need to be made given'. This is opinion, not science and is not needed to make the point. The point is stronger without it. Instead say 'and that are affected by'	Thank you. Correction has been made.
14529	2	11	27		28	The chapter should be careful with phrases such as “misperceive the risks.” Sometimes expert and lay perceptions of risk differ because the experts have better information and are thinking more carefully. But sometimes expert and lay perceptions differ because the two groups value different things. Chapter 1 of the IPCC SREX report tried to use language that captured the full range of possibilities. Language along those lines might be useful here.	yes, thank you, we have tried to be more careful.
13811	2	11	3			Change 'to' to 'of'	Thank you. Correction has been made.
13816	2	11	32			Change 'influences' to 'influence'	Thank you. Correction has been made.
13817	2	11	34			Strike 'key' - an evaluation best left for the reader	Thank you. Correction has been made.
8125	2	11	37	11	41	The two modes of thinking are quite reasonable at first glance. However, for further analytical and empirical clarification, this concept is too simplistic. Furthermore, it should not only focus on the limitation of the decision maker but in the same extent, on the limitation of the decisions' support tools.	We discuss the distinction in a more critical fashion now. Section 2.3 is explicitly addressing your second concern.
13818	2	11	37			Strike 'key' - an evaluation best left for the reader	done.
16080	2	11	39			Extensive quote could be simplified	The bullets are not a quote but a summary of research.
13819	2	11	39	11	40	Reference to Kahneman (2011) seems inappropriate. This is not peer-reviewed literature. Dr. Kahneman has published multiple peer-reviewed articles containing his ideas that would be more appropriate to cite.	thank you and we now also quote his nobel address in a peer reviewed econ journal.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
16920	2	11	4		21	Probably should note that perceptions (I assume) is partly with reference to perceptions of climate change; and that extreme weather events may have disproportionate impact on these. Its hard to be definitive about a list of uncertainties but I'd make a case for at least one more than the five listed: the state of international negotiations and of international relations more broadly, and the role of governments vis-à-vis other actors within this. The social science literature seems to have retreated somewhat from proclaiming either the death of the nation-state as dominant actor, or the demise of an international order – but there are quite major uncertainties, associated not least with the shift in centre of gravity to the emerging economies.	Thank you, we have added a section on "International Relations and Negotiations".
8235	2	11	4	11	21	An example of how people's preferences impact decisions when facing risk could be given using two agents with different profiles for risk aversion.	good point, though risk aversion is not the only and perhaps not even the most important difference in preference when it comes to climate-related decisions. We added an example on differences in time preference/discounting.
4909	2	11	6			The anticipated impacts and costs of climate change	done, thanks.
12234	2	11	8	11	10	It's not clear what the reference is for this statement. We'd expect the negotiators to rely on their mandate from the government they represent, rather than depending on their perception of the preferences of the parties across the table.	We have added a reference to what Plous had labelled "perceptual dilemmas". In addition to following instructions on preferred actions from their government, international negotiators also need to infer what the preferences of the other parties are, a task on which there is uncertainty and frequent error, which has consequences for socially optimal settlements.
13812	2	11	8			Change 'outcome' to 'outcomes'	Thank you. Correction has been made.
7230	2	11	8			depend -> depends	Thank you. Once we change 'outcome' to 'outcomes,' then 'depend' is just appropriate.
8784	2	11	36	20	22	Section 2.2 is insightful and helpful; however, much of the broad thrust of the analysis and more concrete discussions of how to address the issues raised are implicit in Aristotle's Nicomachean Ethics and subsequent virtue epistemology and ethics literature. I have completed an unpublished book manuscript that applies these insights directly to sustainable development and climate change. This includes questioning needing control for happiness - important given that humans cannot control the Earth System. It also includes discussion of how 'System 1 behaviour impacts on particular policy instruments [and] on ways to encourage System 2 behaviour.' the latter being more direct.	thank you. We now discuss the antecedents of the System 1 and 2 distinction in as much detail as space constraints allow.
7694	2	11	36			Can "System 1" and "System 2" have more descriptive names, although these would not be from Kahneman's book? "System X" can mean virtually anything, and the terms are used often in later subsection without reference to the source. (Not a big issue, but would improve readability.)	We are probably stuck with these labels, given that they have been popularized by Kahneman. We tried to add clarifying adjectives to the two labels every once in a while.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4704	2	11	36			Section 2.2 could benefit by a summary at the end of the overall view that there is a significant disconnect between homo economicus and real people and that this disconnect creates a clear set of specific obstacles to understanding risk AND responding to it.	Excellent point which we have implemented, both for Section 2.2 and especially for the Executive Summary.
6069	2	11	36			Although the classification of two models of thinking is meaningful in dealing with behavioral responses, real problem with respect of uncertainties and risks exists in the field of System 2. It is better if this kind of explanation will be added here.	Good point, and many of the discussions of tools in Section 2.3 address this.
16921	2	12		13		This is, or should be, the intellectual heart of the chapter. My sense is it needs attention to a few things to play this role well: * It is hard to follow – having mentioned associative and affective processes, one assumes they have some link to the material that follows but its not obvious; cant eg the subsection titles that follow reflect these processes? * I think the System 1 and System 2 are defined too narrowly at the outset broadly in terms of cognitive processes. The concepts are of far wider application. The First really could usefully span the realm of instinctive or embedded psychology and behavioural characteristics of both individual and organisational short-term responses. The latter is concerned with considered, “rational” evaluation generally based on attempts to quantify and trade-off costs and benefits. To an important degree – and highly relevant in a chapter of this nature - this is the domain of most economic theory. * As indicated, I just don’t think these two actually capture the span of issues. I think this section needs to introduce a third ‘Strategic’ decision-system/domain approaches in the face of deep uncertainty, objectives of security, and analytic traditions around innovation and transformation. This should include reference to the importance of “Black Swan” (Taleb, 2008) events in real-world developments, and might also include learnings from the financial crises (eg. Rajan, 2010). For an analysis of “Third Domain” issues in relation to energy and climate see Grubb, Hourcade and Neuhoff (Chapter 2 (completed) and Chapters 9-11 (in preparation). This would then provide an intellectual framework within which, for example, the later Precautionary / “Robust Decision-making” discussion can be located by readers.N.N. Taleb (2007), The Black Swan: the Impact of the Highly Improbable, Pearson, 2007. F.G.Rajan (2010), Fault Lines: how hidden fractures still threaten the world economy, Princeton University Press, 2010. Somewhere in this section, I’d suggest reference also to herd behaviour (including corporates, as in stock and financial markets). These systems can create strong tendencies to “self-fulfilling prophesies” for a duration, and also boom-and-bust cycles.	Thank you for the useful feedback. We do frame the System 1 and 2 distinction more broadly now, though not as far you suggest. We don't quite see it as Psychology vs. Economics. We also think that the third strategic system you propose can be thought of as a System 2 response. Finally, we do now talk far more broadly about decisions at different levels, including organizational decision makers, see for example the new Table 2.1.
7233	2	12				Talking about myopic: It might be better to demonstrate everyone's myopicity by an example policy makers can relate to. When reading about myopic views, one is quick to apply this label to others, but not to one self. Hence the need to drive home this point to EVERYONE.	A really nice point, which we have implemented in Section 2.2, using the example that policy makers who are focusing too much on political feasibility and not enough on long-term public welfare-enhancement of policies.
7234	2	12				try to phrase things in a way that makes use of modern psychology: people are much more afraid of losing something they have than of not getting something (or the other way around, I'm not sure). If one phrases key aspects of this report appropriately, this might influence decision makers	done, thanks.
13822	2	12	10			Change 'not only … choices by' to 'found in decision-making by the general public," [The problem is endemic!]	done, thanks.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4610	2	12	11	12	14	This is supposed to illustrate how exports also use System 2; however, I do not understand how the use of frequent and timely feedbacks illustrate System 2 use	We changed that statement to better describe what it was meant to show, namely that experts only make good predictions using System 1 processes when their evidence base matches objective reality (which happens with quick and frequent feedback).
13823	2	12	11			Refeences seem dated given the objective of AR5	that may be true, but these are classic references. We made an effort to also add references to more recent work, though there has not been a lot of either theoretical or empirical work in this area.
13824	2	12	13			Change 'namely' to 'such as'	done, thanks.
8482	2	12	15		17	Note the concept of "intuitive toxicology" here, and the variation of expert and lay assessments of risk	good point, thanks, done.
11498	2	12	27	12	29	The implication that social planners are inherently more thoughtful than individual decision makers appears unfounded.	We changed "can" to "may be" to make this an aspiration rather than description.
8126	2	12	3	12	7	In contrast to this statement, the two modes of thinking are used in this chapter as analytical, clear reasoning for behavior. In my perspective, the use of the two modes of thinking in this chapter is not in line with the work and evidence of Kahnemann, 2011. See also: p. 13, line 4-7.	We are using the two modes of thinking as a useful organizing principle, and in a necessarily simplifying fashion that does not always do justice to all qualifications and complexities that a detailed psychological analysis of specific instances or phenomena would provide. The paragraph you refer to is meant to tell the reader that.
14530	2	12	3		7	I very much like organizing this discussion around System 1 and System 2. But this chapter needs to do more to put its discussions of individual decision making into the context of the group decisions that will be crucial in addressing climate change. Towards the end of his wonderful “Think Fast, Think Slow” book, Kahneman notes “organizations are better than individuals when it comes to avoiding errors, because they think more slowly and have the power to impose orderly procedures….Whatever else it produces, an organization is a factory that manufactures judgments and decisions…The corresponding stages in the production of decisions are the framing of the problem that is to be solved, the collection of relevant information leading up to the decision, and reflection and review.” Given its topic is climate change, the chapter could do much more to place its discussions in a broader institutional and organizational context, because organizations such as businesses, governments, NGOs,churches, and political groups will be the focus of many if not virtually all impactful climate decisions. In this vein, the chapter should really draw more heavily on concepts such as risk governance (Renn) and the concepts of decision support. Both these frameworks emphasize just the steps laid out by Kahneman, in particular processes that organizations use to frame problems and use in the generation, transmission, and interpretation of information about risk.	We now address decisions across the whole spectrum of decision makers, including the organizational and policy levels, much more explicitly, see the new Table 2.1.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9792	2	12	30	12	36	Moreover planning horizons in companies are short-term, family businesses think more long-term. The literature on incentive systems, e.g. Ibrahim, S.; Lloyd, S. The association between non-financial performance measures in executive compensation contracts and earnings management. In: J. Account. Public Policy 30 (2011) 256–274 might add additional value.	An interesting reference, thank you.
13829	2	12	30			delete "and be myopic." It is redundant here at the least.	done, thanks.
11499	2	12	30	12	36	What does 'System 1' say about 'strategic behavior'? When people make choices about future their behavior can be strategic on the time frame that they choose. This paragraph, however, makes a case for 'human tendency to be myopic' that can mean it is a human condition. Is it really?	Research suggests that System 2 processes are required for strategic thinking and planning, which involves abstractions at multiple levels and processes. This is not to say that System 1 processes do not get recruited in the process.
8127	2	12	39	12	39	The author should be careful to claim an ‘objective reality’. At least it should be clarified to whom ‘objective reality’ is meant.	Thank you, a loaded term, we changed it to "external" reality.
11500	2	12	39	12	39	What is "objective reality"? This term is contentious.	Thank you, a loaded term, we changed it to "external" reality.
13830	2	12	45			why it is 'relevant' here is not explained.	now explained better
8128	2	12	47	12	48	Quite a few terms have to be defined. Here, as an example: what is ‘second-order’ uncertainty?	The sentence has been reworded.
13831	2	12	48	13	2	This sentence is convoluted and may be hard for a reader to decipher unambiguously.	The sentence has been reworded.
13820	2	12	5			Strike 'convincingly' - an evaluation best left for the reader	done.
10164	2	12	8	12	23	References that possibly can illustrate the outcomes/effects of using system 1 vs system 2 in decision making: Shenhav, Rand & Greene (2011) Divine Intuition: Cognitive Style Influences Belief in God. Journal of Experimental Phsychology: General, 141: 423-428; Gervais & Norenzayan (2012) Analytic Thinking Promotes Religious Disbelief. Science, 336: 493-496.	We added the second reference, thank you.
4911	2	12	9			{Add: t} reflect the more	done, thanks.
13821	2	12	9			Change 'he' to 'the'	done, thanks.
7232	2	12	9			he -> the	done, thanks.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6302	2	13		41		The chapter as a whole is sound, persuasive and well documented. It raises issues of critical importance and it does so well, on the whole. However, I have some concerns about the way in which System 1 and System 2 thinking guide the discussion. System 1 thinking is described as somewhat simplistic, uninformed, affective and biased thinking, with System 2 thinking described as analytical and informed. However, it is vital to recognize that often, pre-thematic (what the IPCC authors recognize as System 1 thinking) can also be extremely well-informed. For instance, I quote from my recent article to provide an example, which reads: "In an incident during Operation Desert Storm, when American Marines were to liberate Kuwait from Iraqi invaders, a fleet of coalition aircraft carriers were stationed twenty miles off the coast as backup for the ground troops. They were also thereby positioned in close proximity to potential Iraqi missile fire. Lieutenant Commander Michael Riley was responsible for protecting the Allied fleet by monitoring the radar screens onboard a British destroyer. He came on duty at midnight. In the early morning, one blip on the screen began to cause him consternation even though, from all available evidence, there was no reason to doubt that the blip was simply another American A-6 fighter jet. However, Riley became increasingly concerned that it could be a Silkworm missile headed for the USS Missouri. If that ship were hit, hundreds of U.S. sailors could die. There was no clear way to figure out from the radar screen what the blip was, and because the object was moving quickly, a decision had to be made right away. Riley gave the order to fire even though he had no rational evidence for his concern and despite the fact that if the blip really was an allied fighter jet, two innocent American pilots would die. Four hours later, the results were reported: the blip was indeed a Silkworm missile, and Riley had saved hundreds of American lives. Why did Riley experience this reaction to a blip on a radar screen that was indistinguishable from the other blips that indicated American jets? Riley himself could not explain his anxiety, and others concluded that his decision had simply been a lucky guess. However, a cognitive psychologist decided to investigate Riley's decision-making process and revealed that the answer lay in the timing of the appearance of the radar blip on the screen. It had appeared eight seconds earlier than the average A-6 fighter jet. Somehow, Riley had picked up on this minimal, almost unnoticeable time discrepancy. The point of the story for me is that lived experience teaches us in ways that we are often unaware of. Sometimes, we are able to know and to understand without explicitly recognizing and following a set of rational rules and procedures. Riley himself was unable to give a logical explanation of his fears, even though he had intuitively recognized that something was wrong. In fact, knowledge and reason do not consist only of explicitly acknowledged facts and values. Often, we operate with a non-calculative, pre-thematic understanding of the world. The notion of a sense of place, for instance, often is formed pre-linguistically and pre-reflectively." See Stefanovic, Ingrid Leman (2012), Honoring the Landscape through Thoughtful Decision Making", Minding Nature, May 2012, Vol. 5, Issue 1, 12-18.	This is a beautiful example of the wisdom of intuition, which we now describe far better in Section 2.2.
8129	2	13	12	13	14	Imprecise language. This sentence clarifies a general critique I have to the overall chapter. Of course, there are much more than two psychological risk dimensions! Especially Solvic would agree to that. What might be meant by the text is: there are two _most relevant_ psychological risk dimensions. This kind of imprecise language makes is difficult to grasp the right conclusion of the chapter.	wording has been changed.
8130	2	13	28	13	28	What is the meaning and relevance in this context of this paragraph?	this paragraph has been deleted to make room for other material

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4833	2	13	35	13	44	Another factor which might play in here is that the manifestations of climate change are all known events to humans (humans have seen storms, floodings, draughts, etc. before). Following the psychometric paradigm, this should lead to lower risk perception. This possible effect is discussed in Klöckner, C. A. (2011). Towards a Psychology of Climate Change. In W. Leal Filho (ed). The Economic, Social and Political Elements of Climate Change. Climate Change Management (pp. 153-173). Berlin: Springer Verlag.	thank you, we added this reference.
11501	2	13	36	13	38	In some cases, isn't it possible that if a hazard is not observed over a long period of time, we can conclude that the likelihood of that hazard is reduced?	When there is evidence that the probability might have changed/decreased, increased periods of time without any incident do provide Bayesian evidence about a potential decrease in odds. But with small probabilities, one needs a lot of evidence for that.
11502	2	13	40	13	43	It seems that options such as moving to a different part of the country are written with mid to higher socioeconomic classes in mind. People with lower incomes may not find this to be an option, even if they have several years notice. Perhaps suggest that the non-immediate nature of the change allows time for planning of alternatives and strategies.	Yes, thank you, that is a better illustration.
8131	2	14	1	14	48	On this page there are quite a lot of repetitions. The relevance of some paragraphs remains unclear (line 13-21). Again, imprecise language: The statement from line 10 remains in contrast to line 13/14. People are almost always exposed to weather since climate change is a phenomenon over decades. A few local storms and flooding are not 'physical evidence of climate change'.	This section has been revised and shortened, thanks.
11504	2	14	13	14	13	The claim that "most people consider themselves expert on the weather" is unfounded and highly unlikely in many cultural contexts where weather is regarded as highly unpredictable.	This section has been revised.
7235	2	14	13			define climate vs. weather	This section has been revised.
14232	2	14	14			I think "Loss Aversion" should be formatted non-italic bold	This section has been revised.
11503	2	14	3	14	4	It is important to acknowledge that statistical analysis are not the only way to engage in System 2 processes. Many societies without a tradition of statistical description nevertheless maintain nuanced and highly-effective decision-making systems.	It would be very helpful to have specific examples of what these decision making systems entail. Please provide us with more detail and references.
4912	2	14	30			{Add} A recent study of a representative sample {Add}of the in Britain ..	This section has been revised.
11506	2	14	30	14	30	There seems to be a word missing between 'the' and 'in'	This section has been revised.
7236	2	14	30			sample of the in Britain public	This section has been revised.
13832	2	14	36	14	39	This statement is not substantiated by reference to literature. It is not clear if these are opinions of the author(s) or conclusions based on actual scientific analysis that has been peer-reviewed.	Statement has been taken out
16081	2	14	40	15	6	Paragraph made of too long sentences with alternate propositions. It could gain by shorter sentences (i.e. less that two lines) with references at the end.	Paragraph has been revised accordingly.
3192	2	14	6		9	confusing sentence: "highly unlikely"[?]	This section has been revised.
8236	2	14	17	14	21	It is not necessarily true that the colonist continued to clung to their expectation based on latitude, I think it was because the benefits of settling overrode the expected loss or damage from colder temperature. I do not think this is good example. There are better examples given later in the chapter.	These two explanations are not mutually exclusive. In the interest of space for other content, we eliminated the example.
6884	2	14	22	14	23	A reference from 1997 is not a "recent example". Suggest to rephrase.	done, thanks.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
16922	2	15				"Other factors". Is the chapter too polite to mention lobbying? It is estimated that US industry spent $500m on lobbying on climate change in 2010 and presumably much of this was targeted a public opinion.	We now discuss such vested interest campaigns in Section 2.2.1.3.
16923	2	15				Section 2.2 overall might benefit from cross-check against literature in the most recent (June 2012) Special Issue of Risk Assessment which is on climate change (eg. Spence et al., 2012).	Good suggestion, thanks.
7237	2	15				talk only about "people's" reluctance to deal with climate change. Maybe explicitly mention politicians as well? Or will this antagonize too much? rewrite it less abstractly. Say that people don't like to deal with negative things or things that they are not in control of as the first sentence.	Nice suggestion, done.
8132	2	15	1	15	16	What are the conclusions from these findings?	This section will be revised with better content and conclusions.
11507	2	15	1	15	6	The distinction between weather and climate is more subjective than one might think, particularly as the rate and magnitude of changes increase. Climate is described by long-term trends and parameters, but extreme events are increasingly likely (i.e. fat tails). As abnormalities (as described here) are observed more frequently, so-called extreme weather may be increasingly indicative of climate. Furthermore, many people have acquired transgenerational knowledge of climate that enables them to be keenly aware of long-term climate changes, so the claim that people are generally unfamiliar with climate rings false.	All valid points. We have toned down our statements on this issue.
10165	2	15	14	15	16	It is unclear what "similar results" refer to here. Is it that there is higher concern amongst scientists than non-scientist? But the levels of concern in both groups are higher than in the US.	it refers to similar variability in concern over time, which we now say more clearly.
14370	2	15	17			Sad that a chapter would have to be written explaining climate change denial	yes, indeed.
4834	2	15	19	15	20	"people with finite processing capacity" is an unfortunate phrase since all humans have finite processing capacity.	fixed, thanks.
16082	2	15	29	15	35	Paragraph short and to the point, focused on knowledge useful for policymakers, not too many references.	thank you.
8133	2	15	31	15	31	Definition: systemic uncertainty?; what is meant by: expert disagreement about many forecasts?	both have been reworded
13833	2	15	36	15	38	Please provide a reference for this sentence. It is not demonstrated by the reference given on line 41.	This is not an empirical statement, but a simple logical fact. Any mitigation or adaptation policy intervention may solve a climate problem but in doing so will create individual or social costs. There are no free lunches.
12519	2	15	42			The sentence is: "The cognitive demand of a calculated response to climate risks normally loses out to behavior that satisfies emotional needs and minimizes tradeoffs." Is there a citation for this assertion, and are there other views?	We took this statement out, since it was a conjecture.
4629	2	15	44	15	47	"Motivated reasoning, as 44 exhibited by the confirmation bias (i.e., a tendency to attend to evidence confirming favored beliefs) 45 tends to steer individuals to System 1 behavior. More specifically, wishful thinking and motivated 46 cognition in the face of growing evidence of climate risks helps explain increased polarization in 47 attitudes and beliefs about climate change over the past two decades . . ." Even scientists who know the theories of Karl Popper still focus on confirming evidence for a theory, when they should of course look for disconfirming evidence. I think these sentences are speculative and unsupported – you might say an example of motivated reasoning. Is there increased polarization, or is there, as in most things, a distribution of beliefs? Is there more polarization or just more awareness among the general public of the issue?	Yes, there is increased polarization, now documented with a reference, Pew (2010).
13834	2	15	47	15	48	Please document this 'increased polarization'	Done, Pew (2010).

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4256	2	15	35			This discussion does not place enough emphasis on the role of organised climate change denialism see for example 'The Merchants of Doubt' by Naomi Oreskes which shows how powerful interests are funding denialist activities in the USA	We discuss the book and argument in Section 2.4.3.5, but have also added a reference to it here.
4249	2	15	47	15	48	This discussion does not place enough emphasis on the role of organised climate change denialism see for example 'The Merchants of Doubt' by Naomi Oreskes which shows how powerful interests are funding denialist activities in the USA	We discuss the book and argument in Section 2.4.3.5, but have also added a reference to it here.
17326	2	15	7	15	16	This session brings about the question "how does concern over climate change relates to specific individual/collective action? In this session and the previous one the discussion makes no allusion to what if anything happens after raising "concern" about an issue such as climate. The specific example here used considering the study made after people who had seen the movie "The Day After Tomorrow" seems very particular singular to stand as the marker of this session on its own. Is it possible to find studies that inform on the effects of how climate is discussed in the media and its effects?	This is a very good question and we will try and find such studies for the SOD.
8134	2	16	1	16	40	Again, repetitions and unclear conclusions.	Section has been revised.
13837	2	16	10			The inference ("therefore") is not clearly based on a logical syllogism. I am not convinced it follows from the evidence cited.	Has been reworded.
7238	2	16	10			are -> is	done.
13838	2	16	12	16	17	The first sentence refers to a different point than the remaining sentences in the paragraph.	This section has been revised.
13839	2	16	15	16	17	The example is not appropriate for the preceeding sentence.	This section has been revised.
11508	2	16	18	16	24	This paragraph is miselading because it does not address the many regions of the world where people are already observing and responding to climate change, and therefore recognize climate change as both local and immediate.	This section has been revised.
16083	2	16	19	16	22	Odd sentence (lacking a verb?), too long	This section has been revised.
13840	2	16	21			"to that" … missing a word? "to conclude that" ??	This section has been revised.
11509	2	16	21	16	22	This part of the sentense is not clear. Perhaps a missing word: "Americans to … that"	This section has been revised.
7239	2	16	21			a verb is missing in the sentence, maybe "believe"?	This section has been revised.
13835	2	16	4			Delete "with respect to the future." It is redundant.	done, thanks.
3193	2	16	4		6	sentence unclear, convoluted	Has been reworded.
16925	2	16	41			Shouldn't the title be something like "Social amplification and attention of risk perception"? It seems to cut both ways, particularly if industry spends $500m convincing publics that there is not a problem	Section has been revised.
11510	2	16	41			Why is there is only one subheading 2.2.2.1, what sense does such subtitle make?	We added another subsection on Individual differences in numeracy.
16084	2	16	47	17	6	The example given is probably specific to North America (?), maybe too local.	This section has been revised and made more general.
11511	2	16	47	17	6	The purpose of this example is not clear, and needs to be elaborated. The implication seems to be that most people quickly forget their concerns about climate change, but this is not particularly strong evidence. Why not look at examples from indigenous communites?	This example has been removed and the section made more general.
13836	2	16	6	16	9	This sentence seems out of place here. The idea is not clearly related to the preceeding or following sentence.	Section has been revised.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4042	2	16				This section should also include a discussion on values-based approaches to the characterisation of climate change cognition. In the field of adaptation, that has largely been discussed in terms of (non-monetary) values associated with preferred outcomes. However, this is just as pertinent for mitigation as well. Suggested published literature includes: O'Brien, K. (2009). Do values subjectively define the limits to climate change adaptation? In W. N. Adger, I. Lorenzoni & K. O'Brien (Eds.), Adapting to climate change: Thresholds, values, governance: Cambridge University Press. and O'Brien, K. L., & Wolf, J. (2010). A values-based approach to vulnerability and adaptation to climate change. Wiley Interdisciplinary Reviews: Climate Change, doi: 10.1002/wcc.30.	This is more of a topic for Chapter 3, and space constraints prevent us from addressing it in Chapter 2.
6885	2	16	29	16	29	Refer to Mastrandrea et al. 2011, IPCC AR5 Guidance Note on the treatment of Uncertainty.	done.
4631	2	17				, time discounting. There is a large literature on the apparently large discount rate used by most people in making decisions about future events, e.g., not investing in insulation or fluorescent light bulbs despite their clear economic benefits. It's either that or a budget constraint (possible for some investments, especially by local government decision-makers) or inertia in the face of too many competing decisions (otherwise known as procrastination). (There is a substantial section in chapter 3 on this topic which should be referenced.)	We now refer to Chapter 3 for its treatment of discounting.
8135	2	17	1	17	6	What is the conclusion of this statement?	This section has been revised.
11512	2	17	14	17	33	The concepts of loss aversion and status quo bias appear to be interrelated. It is not clear how they can be considered separately.	yes, correct, and the sections have now been combined
7240	2	17	14			loss aversion: Say one clear sentence, e.g. "People are more afraid of losses than they are keen on winnings."	a better definition has been provided.
7241	2	17	15		16	Too abstract. People who read this probably won't know what a slope is!	a clearer definition of loss aversion has been provided.
3194	2	17	15			define or describe "expected utility theory" first time term is used.	It is defined in Section 2.3, to which we now point.
4630	2	17	26	17	28	"The crop 26 allocation decision will also be influenced by degree of risk aversion and the magnitude of loss 27 aversion." This throwaway sentence ("also be influenced") is the entire behavioral side of the decision under uncertainty.	We are not quite sure what you mean by this comment. All of Section 2.2 and large parts of Section 2.4 address the behavioral side of decisions under uncertainty, and the Behavioral X-cut of WGIII is designed to ensure that all sectoral chapters will do so, as well.
8136	2	17	29	17	33	What is the conclusion?	A better take away has been added.
16085	2	17	34	17	48	Interesting example and quote, but is it so new? Could you precise?	We are not sure what example and quote you refer to in this section on hyperbolic time discounting?
9793	2	17	34	17	48	Please sound this paragraph with the corresponding deliberations in chapter 3.	All the x-cuts are designed to connect themes across chapters. We also now refer to Chapter 3 for its treatment on discounting.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4837	2	17	34	17	48	The comparison between the hurricane on the next day and the potential flooding 5-20 years from now is a bit confound because it does not only vary the time perspective but also the certainty. Whereas the forcast of a hurricane coming through the next day is relatively certain, is the forcast of flood some day in 5-20 years necessarily uncertain.	We are not sure what comparison on p. 17 you are referring to or anywhere else in that vicinity. Though much of that discussion has been revised and your concern hopefully addressed. We agree that those two events are on different time scales and have different degrees of uncertainty.
7242	2	17	35			Scientists know what "exponential" means and have certain connotations. Policy makers don't!	We now define exponential and hyperbolic discounting in accessible ways.
4703	2	17	7			This section should be a comprehensive list of these factors but does not appear to be. Alternatively, ensure these are the "most important" factors and note that this was the basis for inclusion here. Loss aversion should be the same run-in format as the other headings as well, of course.	thanks, we added the fact that this is not an exhaustie list and fixed the formatting.
6070	2	17	7			This subsection seems to discuss phenomena in "people's decisions" under risk and uncertainty. What I am wondering is where we can find discussions of phenomiena in "policy-makers' decision"? The latter is more relevant to policy makers.	We now address decisions made at all levels, from individuals and households to company and policy maker decisions throughout the chapter, see new Table 2.1.
3067	2	18		20		2.2.4 has a strong undertone of political advocacy, as if the task of IPCC is to change the political choices people and society make. That is not a proper role of IPCC, which is to review and evaluate the science, and discredits IPCC in the eyes of much of the public. It is possible that continuing to increase emissions is a rational decision.	The purpose of Sect. 2.2.4 is to document the biases and heuristics that characterize behavior with respect to risk and uncertainty as it affects climate change decisions. To the extent research reveals there are ways of improving individual and societal decisions by understanding behavior then we feel it is appropriate to discuss this without politically advocating this strategy.
4913	2	18	10			{Add} consider themselves to {}be experts in	done, thanks.
13841	2	18	10			"to experts" … missing a word? "to be experts" ??	done, thanks.
7243	2	18	14			Section heading 2.2.4 should be renamed: maybe "Improving decision making: counteracting the prevalence of system 1"	Sect. 2.2.4 is not about improving decision making but the biases and heuristics that individuals use in making choices.
12235	2	18	27	18	27	In which country was the Program - or was it an international Program?	the United States (have added in the SOD)

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
11513	2	18	27	18	30	The discussion of NFIP needs to recognize the issue of 'moral hazard' as well, i.e. those who have insurance and are compensated frequently because they live in flood zones, and they are reluctant to relocate because of incentives inherent in the insurance schemes, e.g. almost every year they upgrade their furniture. In addition, post-disaster relief grants by the federal government creates further incentives not to buy insurance and not to relocate.	The new NFIP legislation stresses the importance of risk-based rates so this will incentivize individuals to invest in adaptation measures. There is little empirical evidence that individuals are not willing to relocate because of insurance. Rather they don't want to leave their current location.
16924	2	18	31	34		This is almost the first mention of energy-related decisions (notably energy efficiency) in the chapter, and it is not a strong one – I note, with no reference. It reads as a theoretical assumption, not evidence-based: actually over most of the range, efficient fridges are not more expensive than less efficient ones, and the evidence is that labelling has had a huge effect - though probably because of branding concerns of manufacturers as well as actual rational choice by customers. See the Buildings chapter of this (AR5 FOD) report, and also Grubb, Hourcade and Neuhoff, Chapters 4 and 5. Grubb M., Hourcade J.C., Neuhoff K, Planetary Economics and the Three Domains of Sustainable Energy Development, Taylor & Francis, forthcoming (chapters 1-5 submitted and available on request. Chapter 4: "Why so wasteful"; Chapter 5 "Tried and tested: three decades of energy efficiency policy").	we changed the example to lighting technology, and are now referring to Chapter 5, as well as providing a reference.
13842	2	18	31	18	41	These paragraphcs come across as unsubstantiated opinions. This is not appropriate for AR5. Please provide professional citatoins and/or identify these sentences as 'findings' and state your level of confidence.	These findings are document in the SOD
13843	2	18	46	18	48	This sentence is not documented and comes across as unsubstantiated opinion.	This sentence is revised and document in the SOD
11516	2	18	46	18	48	While long term planning is essential for climate change, we cannot disregard the fact that immediate survival is still on the minds of many people who live day to day with war, food shortages, contaminated water etc.	Short-term concerns are important to consider. The challenge is how to address these short-term constraints while at the same time developing longer-term strategies.
8484	2	19	1		6	Note the emerging literature on adaptive policymaking (Swanson and Dhandal 2009)	Good point. This is a solution that has generally not been reflected in the behavioral literature, because it concerns governance strategies rather than individuals, and yet deserves mentioning
7244	2	19	22		24	The sentence does not parse. Maybe "will obtain" -> "will be obtained"?	Thank you. Correction has been made.
13844	2	19	39			Change 'There' to 'They'	Thank you. Correction has been made.
7245	2	19	40			inability -> difficulty	Thank you. Correction has been made.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
2334	2	19	44	20	22	When applying the game theory within Prison Dilemma, the key question can be raised that under which circumstances or conditions will an international climate agreements be signed or ratified? . Michael Finus (2000) concern about criticism against game theoretical analysis on international environmental problems with realistic ground issues (Finus 2000:1). I would like to suggest this highlight for this argument to gain robustness for the argument in this paragraph. Finus, Michael.,(2000) Game Theory and International Environmental Co-operation: A Survey with an Application to the Kyoto-Protocol, NOTA DI LAVORO 86. Fondazione Eni Enrico Mattei □	Text has been modified
7246	2	19	45		46	either probabilistic or uncertain -> either probabilistic or deterministic	I left this comment unaddressed, because I believe that there is a difference between probabilistic and uncertainty. The notion the reviewer is conveying does not clarify the sentence, because it has a completely different meaning
3195	2	19	46			explain distinction between "probabilistic" and "uncertain"	Probability is (nowadays) a formal mathematical concept, uncertainty is not. Probability is a positive normed measure, and is operationalized as limiting relative frequencies in random sequences, or as partial belief of a rational actor. The usual formulation is that under appropriate conditions, uncertainty is represented as probabiity.
13259	2	19	39	19	39	"They have (…)" instead of "There have (…)"	Thank you. Correction has been made.
6071	2	19	43			Several theories are explained here, including prisoners' dillemma. What is really policy relevant is not just the explanation of theories but assessment of literatures. Especially in 2.2.4.5, impact of coordination and cooperatio is the main theme. In this respect, what policy makers wish to know is the analysis of impact of uncertainty on coordination and coopration. If this subsection include the assessment of literatures discussing barriers to cooperate under uncertainty and any idea to overcome these barriers, this chapter will add value.	The purpose of this section is to discuss research that examine how uncertainty impacts on cooperation and coordination
16926	2	20				end of section 2.2 The section could do with a conclusion. In relation to energy-related decisions, there is a clear implication about the non-optimality of energy decisions which is backed strongly by empirical data. Since most choices on energy consumption are taken by private decision-makers strongly influenced by “System 1” processes, whereas most supply investments are by big companies using “System 2” processes, there is an intrinsic bias towards supply-side investments in the energy system. Within supply-side (at least for electricity), the influence of risk aversion and uncertainty in energy markets further biases investments towards established fossil fuels rather than the more capital intensive low carbon options. See Grubb, Hourcade and Neuhoff (2012), Chapters 4 and 7.	Text has been changed
13845	2	20	11	20	15	This inference should be couched in some uncertainty. It seems to be based on a single study that did not even study this particular situation. Can we be certain it is fully robust? Or are you suffering from an 'availability bias?'	This sentence will either be defended with a citation or revised in the SOD

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8485	2	20	16		22	This is an important element that would benefit from greater explanation, either in terms of informational cascades (Suzanne Lohmann in particular) or collective action more generally (Axelrod, Ostrom, etc)	This paragraph will be clarified in the SOD
9794	2	20	23			I really enjoyed reading this section from a scholars point of view. For decision makers each models should end with a section on the implications for decision makers.	We have now made an extensive effort to link this section with that on behavioral issues and risk perception. In addition we are working with other chapters to include salient examples coming from sectorial studies and similar.
9795	2	20	23			As mentionned above resilience management should be integrated either as a separate chapter or together with adaptive management	Thank you, we are restructuring the chapter
14531	2	20	23		24	I like the format of this section. The description of methods and tools, followed by advantages and limitations, is nice.	Thank you
7247	2	20	23			Maybe merge 2.2.4 and 2.3?	Rejected. We prefer to keep behavioral responses as parts of the Tools section.
10418	2	20	25	26	32	This entire section has too much theory. There is no need to go into utility theorem. You can represent uncertainty using percentages	Noted. The authors stand by the theoretical angle, on the ground that it is a framing chapter and that Summary for Policy Makers are available for less technical reading.
14532	2	20	28			It would be useful to say more about how these tools can facilitate system 2 behavior, in particular by providing more of a sense of who would use these tools, how, for what ends, and by what means and processes (in the sense of risk governance and decision support).	We have now made an extensive effort to link the section on behavioral issues and risk perception with the section on economic tools
6370	2	20	28			Include a reference to the definition of System 2.	Accepted.
8785	2	20	29	27	23	A useful discussion of the issues in using utilitarian ethics to address climate change, including trying theorise the precautionary principle through this lens and apply optimality and 'management'; however, Charlesworth M & Okereke C (2010, Policy responses to rapid climate change: An epistemological critique of dominant approaches Global Environ. Change, 20:121-129, doi:10.1016/j.gloenvcha.2009.09.001) illustrates the more fundamental issue of using consequential managerial approaches when consequences cannot be predicted in a meaningful way, thus cost estimation and optimality are chimera.	Thanks to the reference. Forwarded to Chapter 3 dealing with Economic, and Ethical Concepts and Methods
7248	2	20	34		37	Add an example: e.g. buying flood insurance. Maybe it's worth sticking with a single example for each level of decision making (individual, group, government) and clearly state so at the beginning of the Chapter. Maybe along the following lines: For the sake of clarity, we will make repeated use of the following examples of decision making under uncertainty on the level of individuals, groups, and governments.	Thanks for the suggestion. The writing team will consider it collectively.
7249	2	20	40			list all/ some axioms mentioned	Noted. Some axioms listed.
13846	2	20	41			Changed abbreviation to EU from E(U). Please check for consistency.	Done.
13847	2	20	41	21	3	Citations are needed in multiple places in this paragraph.	Agreed. References to up to date and comprehensive sources on the economics of risk added.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
12521	2	20	5			Add after "2009" -- "Building on work by Perlo-Freeman (2006) and others, DeCanio and Fremstad examine the entire 2x2 possibility space and informally assess elements of climate policy and negotiations dynamics, concluding that no single game fully describes the state of play and suggesting that assessment of alternative game outcomes can shape evolution of an effective policy regime for climate response." Stephen J. DeCanio and Anders Fremstad, 2010. Game Theory and Climate Diplomacy, www.e3network.org/papers/Basic_Game_Anlaysis.pdf	Will consider adding the proposed sentence related to the De Canio-Fremsted paper in the SOD
4612	2	20		30		Generally, irreversibility, especially the one for climate change, has been given short shrift in this chapter; a good source on irreversibility is Ch. Perrings and W. Brock, Irreversibility in Economics, Annu.Rev. Res.Econ. 2009, 1: 219-38	Noted. Option values are mentioned in 2.4.2.1 (p26 l12) and the main result on irreversibility effects summarized in 2.4.2..
14830	2	20				The phrase "political and societal negotiation processes" is used (p. 24 line 17). It should be elaborated as one way of making decisions under uncertainty. Negotiated decisions (especially when characterized by procedural equity) can be an important way of dealing with decision-making under uncertainty, especially deep uncertainty involving value judgements. Another subsection should be added to include negotiated decisions as one tool for decisino-making under uncertainty.	Noted, agreed. New material on risk and society will be added.
14238	2	20				The authors might want to consider a brief dicussion of robust control theory and ambiguity theory as well. While, e.g., the less wide-spread approach of RDM is discussed at some extent, the more common economic decision theories of robust control theory, and decision making under ambiguity are not discussed.	Text has been modified
4705	2	20	23			This is a well-structured delineation of ECONOMIC strategies for improving risk perception and decision-making but appears to be written in complete isolation from the insights of the prior section. If many of the obstacles to people understanding and responding to climate change are psychological in nature (as per section 2.2), then the strategies in section 2.3 all suggest that if people will just become homo economicus, it will all work out just fine. Put differently, if the problems laid out in section 2.2 really ARE the problems (and I think they are), then these solutions are irrelevant to addressing those problems. This is a crucial part of this chapter that should be addressed. This surely reflects that psychologists wrote 2.2 and economists wrote 2.3 but, now, those two groups have to sit down and make a coherent argument to each other. More broadly, this also suggests that there may be some important economic obstacles to decision-making and responses to climate change that could be better addressed in section 2.2 (e.g., the economic argument involved in my moral hazard point above -- if you take away the costs/risks of something, then people will rationally do more of it).	We have now made an extensive effort to link the section on behavioral issues and risk perception with the section on economic tools
4706	2	20	23			Structurally, this section has relatively parallel headings -- they should be identical if you are going to go that way not halfway similar.	We have made an effort to cover in a symmetric way different tools, but only when possible
9219	2	20	23	30	11	I appreciate that tools (thories) for improving decisions related to uncertainty and risk in climate change are summarized efficiently in Section 2.3. However, it is rather textbookish and lacking in concrete examples of climate risk analyses which applied those tools and theories.	We have now made an extensive effort to link this section with that on behavioral issues and risk perception. In addition we are working with other chapters to include salient examples coming from sectorial studies and similar.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6304	2	20	34	20	37	Once again, in describing expected utility theory, anyone wisely employing that decision making model should recognize that before one "defines a possible set of alternatives," the problem has to be explicitly defined, scoped and justified.	Thanks. That's true; much effort goes into the formulation of alternative courses of action. The same also holds for 'quantifying uncertainties…' and 'valuing possible outcomes'. Nowhere is it suggested that these steps are perfunctory.
18445	2	20-30				Simple, clear and thoroughly discussed tools with illustrative scenario analysis, pros and cons.Good.	Thank you! Positive comments are very helpful in achieving balance.
4632	2	21				. In the section on the expected utility hypothesis, I am surprised that no mention is made of the method of certainty equivalents, in fact CE are not mentioned anywhere in the chapter.	CE's play a role in the operationalization of partial belief as subjective probability, esp in von Neumann and Morgenstgern (1944), who (unwittingly) follow Ramsey (1926). However, it is not essential in the more modern account of Savage. To recall, event A is qualitatively more probable than event B for a subject if (s)he prefers a lottery giving a Good consequence if A and a Bad consequence if not-A to a similar lottery involving event B. Under (mild) restrictions, this qualitative ordering is necessary and sufficient to determine a unique probability measure. The idea is that we can construct 'almost uniform partitions' of arbitrary size in which no partition element is qualitatively more likely than the union of any two elements, and then compare events to unions of partition elements. The strongest restriction (the sure thing principle) says that if "Good if A, Bad else" is preferred to "Good if B, Bad else", and if event C is disjunct from A and from B, then "Good if A or C, Bad else" is preferred to Good if B or C, Bad else". Thus, to determine a subjective probability representing degree of belief, it is sufficient to have a qualitative probability ordering satisfying the restrictions , CE's don't play a role. This is well known to specialists. I'd be happy to include this and I think it worthwhile, but its not my call. Glossary?

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
14233	2	21	13	21	19	The paragraph on "Subjective versus objective probability" does not contain a definition or discussion of objective probabilities. The usual objective probability definition is based on the relative frequencies referred to in the pragraph (e.g. van Mises R. von Mises [1928 German](1954 English translation), Probability, Statistics and Truth. New York: Macmillan), or symmetry arguments (or Popper's (1959) [The propensity interpretation of probability, British Journal for the Philosophy of Science, Vol. 10, p.25-42.] notion of propensity). Two secondary sources discussion objective versus subjective probabilities are Kyburg, Henry E. Jr. und Howard E. Smokler (1964), Studies in Subjective Probability, John Wiley & Sons: New York. and Eisenführ, Franz und Martin Weber (2010), Rational Decision Making, Springer: Heidelberg. It might be worthwhile to explicitly address the issue prevalent in climatic change evaluation that objective probabilities are rarely given and purely subjective probabilities only help for individual decision making, but not for guiding institutional analysis. This problem naturally leads to the discussion in the chapter's appendix on trying to find different, partly new wordings to describe uncertainty in the IPCC process.	Thanks for this comment, which is spot on. The literature on the objectivist interpretation is well known to us. The best modern renderings (IMO) of the frequentist interpretion are based on the definition of a random sequence as those which pass all 'recursive tests', i.e. avoids recursive null sets (as in Martin Lof and Schnorr). The discussion is rather technical, but it does enter the vernacular through the notions of probabilistic explanation in Hempel and others. In climate change, this is related to the problem of deciding what is 'natural variability' and testing that all 'secular trends' have been accounted for. Earlier drafts contained some text on this. I would be happy to (re-) include this discussion but the decision to allocate space is above my pay grade. (1)Schnorr, C.P. (1971) Zufa”llighekt und Wahrscheinlichkeit Lecture notes in Mathematics, 281, Springer?Verlag. (2) Schnorr, C.P.(1973) “Process complexity and effective random tests” J. Comp. Syst. Sc. 7, 376?388. (3) Martin?Lof, P. (1970) On the notion of randomness, in A. Kino, J. Myhilol, R.E. Vesley (eds) Intuitionism and Proof Theory, North Holland 73?78. (4) Martin?Lof, P. (1966) The definition of random sequences, Inf. And Control 9, 602?619. (5) Kolmogorov, A.N. (1968) Three approaches to the definition of the concept of ‘amount of information’ Sel. Transl. Math. Stat. and Prob. 7, AMS, Providence R.I. (6) Chaitin, G.J. (1975) A theory of
7250	2	21	3			it -> they	Thank you. Correction has been made.
14533	2	21	30		31	This is the first mention of Chapter 3. There might be a discussion early on about how this chapter’s focus on individual decision making links with Chapter 3’s focus on Social, Economic and Ethical Concepts and Methods.	Thanks, we could add a link to chapter 3. ***
13848	2	21	4	21	31	Citations are needed in multiple places in these paragraphs. It comes across as a discourse from a textbook.	See reply to #13847
7251	2	21	7			behavior described in Sect. 2.2 -> behavior, based on System 1, described in Sect. 2.2.	Noted, Text changed.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
2156	2	22				The section on cost-benefit analysis and uncertainty (Section 2.3.2) provides an appropriate coverage for the purposes of the report once expanded to clarify how uncertainty is accounted for in cost-benefit computations. Ayyub (2003) offers a fundamental and simple model based on the moments of underlying random variables to compute the probability of not realizing benefits, i.e., P(B<C) where B=benefit and C=cost. Such an approach enables users to account for both B/C ratio and the uncertainties in B and C. Reference: Ayyub, B. M., Risk Analysis in Engineering and Economics, Chapman and Hall/CRC, 2003.	Thank you
14534	2	22	1		11	This box on the Condorcet voting paradox is interesting, but from what little I understand about social choice theory (which largely comes from Amartya Sen's The Idea of Justice) most of these voting paradoxes depend on assumptions about well-characterized uncertainties and stable individual rankings, and thus aren't particularly relevant for vast societal issues such as climate change. Such issues involve large groups of individuals grappling with complex ethical considerations and economic tradeoffs where the consequences of actions are poorly understood; the fit with existing moral traditions is still unsettled; and debates are subject to strong filtering by existing values, information networks, and economic interests. The space used by this box might be better spent on topics more relevant to these issues.	Thanks, its all true. However the discussion in ch 2 focuses on foundational issues, and shows that the concepts of subjective probabiity and utility are meaningful for individual choice, but there is no straightforward way to generalize them to social choice. The factors you mention reinforce this conclusion, but on the abstract level of this chapter, the point is already made. Ch 3 is the proper locus for these elaborations.
14535	2	22	14			It might be useful to say how cost-benefit analysis relates to expected utility theory.	Thank you, text has been revised
7252	2	22	14			Cost Benefit Analysis -> Cost Benefit Analysis (CBA)	Thank you, text has been revised
6072	2	22	15	22	17	The text says "CBA does not address the challenges in achieving agreement across countries with respect to strategies for mitigating the impacts of climate change". It is difficult to understand why. Citation please. In page 24 line 14, there is description that the target can be defined through a CBA, through the application of a principle. Those two sentences are not consistent each other.	Text has been modified
16086	2	22	17	22	22	Does it mean a treaty or a global policy cannot be assessed by CBA? Whant about global equilibrium modelling by economists? Does it mean it is worthless in assessing possible path of policy? Maybe it is contradictory with the next paragraphs.	Text has been clarified
12992	2	22	17	22	18	The claim that CBA should be used only at the national or subnational level is interesting, but seems out of step with much work in contemporary climate economics, which is focused at the global level. More explanation or defense would be helpful.	Text has been clarified
7253	2	22	17			to utilize -> to be utilized	Thank you, text has been revised
14824	2	22	21			I don't it is justified to claim that "CBA can still provide useful insights when applied to the global problem of climate mitigation". A strong case can be made that it is not suited to the problem. Please see Ch 6, where, among other observations, they state "no cost-benefit study finds an optimal level of mitigation that stabilizes atmospheric concentrations. Instead, conc entrations continue to rise throughout the modeling period. " (p.26)	Text has been clarified
4633	2	22	23			Why the highest social net present value? Referring to the levee example in the previous paragraph, what would be the social benefits? Lower government payments to owners of previously flooded land? It seems to me that a lot of the benefits are captured by individuals, not society in general, while the costs of flood control are almost always borne by taxpayers, or society in general.	Thank you, text has been modified

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6073	2	22	25	22	25	In CBA applied to climate change issues, private and social cost are compared with benefits (refer to, for example, many literatures by William Nordhaus and other schelars.	A more complete discussion on social versus individual costs and benefits is reported in Chapter 3. We are only refering here to CBA under uncertainty
13849	2	22	33			Change 'numbers' to 'number'	Thank you, text has been revised
7254	2	22	33			numbers -> number	Thank you, text has been revised
7255	2	22	33			as -> e.g.	Thank you, text has been revised
14825	2	23	1			"… by encouraging System 2 behavior." Can this be substantiated?	We will modify this sentence to read "… and in this can encourage System 2 behavior.
7257	2	23	16			funded -> founded	Done.
9140	2	23	26	23	30	Of course I agree that CBA is a useful tool for decision making process. However, many researches dealing with biases of perception suggest humans are not good at understanding the concept of probability correctly, meanwhile CBA highly relys on System 2 process. Thus I don't think CBA plays a "critical" role to overcome System 1 of all humans. I would suggest that you would soften the tone of the words.	Yes, good point, done.
7258	2	23	29			want -> wants	Done.
7259	2	23	30			greenhouse gas emissions know -> ..greenhouse gas emissions. It knows there	Done.
12993	2	23	32	23	33	This claim about the status of CBA may mislead. Many normative perspectives are internally coherent and claim to be either based on or consistent with rational norms. Moreover, the norms associated with CBA are often claimed to be very weak, and so to do little in themselves to guide action (e.g., without stronger and more contentious value assumptions). See, e.g., Daniel Hausman and Michael McPherson, Economic Analysis and Moral Philosophy (Cambridge, 2006).	Text revised to acknowledge the scope of the debates on CBA, focus on risk and uncertainty and refer to 3.5.2 for more detailed discussion.
13850	2	23	32			Is this the advantage over all other methods? Over system one methods? This does little to recommend CBA. Is not an advantage that it has a record of success? Success in comparable situations?	See reply to #12993
8237	2	23	36	23	37	While it is noted that some impacts are hard to measure in monetary terms which may lead to their omission, it should also be noted that there are tools available in environmental economics to value these impacts such as the contingent valuation and the avoided cost methods.	Text added.
16087	2	23	41	23	46	Excellent paragraph, but maybe you fail to remark that many events described with IPCC vocabulary as "low probability" would be highly probable by your local insurer if compared with his trade made of grave injuries or fires. This gap shows that what laks is not a "new psychological frame" in the decisionmakers, but often just a fair description of the risk.	Noted.
12994	2	23	41	23	43	This may be the most prominent objection amongst economists, but I doubt that it is the most common more generally. More importantly, other major objections should at least be mentioned, and especially the ethical ones. See, for example, Mark Sagoff, The Economy of the Earth (Cambridge, 2008) and Stephen Gardiner, 'Cost-Benefit Paralysis', chapter 8 in A Perfect Moral Storm (Oxford, 2011).	See reply to #12993

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7895	2	23	41	23	43	You write: "The strongest and recurrent argument against CBA (Azar and Lindgren, 2003; Tol, 2003; Weitzman, 2009b, 2011; Nordhaus, 2011) is related to its failure to deal with low probability, catastrophic events that might lead to unbounded measures of either costs and/or benefits." This is not the strongest argument against CBA. One oof the main challenges is that CBA entails several normative and empirical assumptions (the rate of discount, the curving of the damage function, aggregation of impacts in a single welfare function, the marginal value of future consumption units, the assumed value of a statistical life, technological innovation as either exogenous or endogenous to climate change, monetary value of environmental change and loss of biodiversity, shifts in transaction costs, control costs, and search costs, etc.) that are not dealt with appropriatly by existing CBAs on climate change - and that are hard to deal with in general. The argument mentioned in the quote only deals with one of these many aspects, namely with how the damage function is curved. It is somewhat funny that only proponents of CBA are quoted at this point. See also comment 36.	Thank you, we now have emphasized more other challenged to CBA
4512	2	23	43	23	45	Here and perhaps elsewhere, reference should be made here to the work of Chichilnisky on the incorporation of catastrophic possibilities into expected utility analysis. A recent example is her paper with Chanel in the forthcoming special issue of Ecological Economics.	Thanks for the suggestion. Reference added in 2.3.1.1 when discussing research on EU theory alternatives.
9141	2	23	43	23	45	As well, I think it's more important to consider how we human systematically fail to estimate fat tails events from the viewpoint of biological evolution than just constructing robust techniques. Such a viewpoint might consequently provide countermearures to systematic failures of our decision making. The countermeasures might be simply how calculation results should be shown or something, rather than novel methods of calculation.	Thanks, good point. Its true that fat tails can frustrate standard statistical methods. A discussion of fat tails is submitted to the Glossary. Space constraints have kept it out of our chapter
2964	2	23	46		23	leaving off extremes seems irrational and likely to lead to disaster -- consider the decision of planners to consider only the past century of experience with tsunamis in designng the Fukushima facility, excluding earlier more severe events.	see response to comment 9141
8238	2	23	47	24	10	The paragraph notes that one way to get around the fat tail issue in a CBA is to "leave off extremes when the consequences from these 47 outcomes do not demand serious consideration now". The text should specify under which circumstances extremes do not demand serious consideration and how this may relate to the degree of risk aversion of decision makers.	We have now specified this better
14826	2	23	48			"to leave off extremes…" This sentence is unclear.	We have now specified this better
14234	2	23	8	23	9	"In either case the decision maker is assumed to be maximizing expected utility". The formulation is unfortunate because what is usually referred to as Monte-Carlo analysis in the integrated assessment literature only averages deterministic paths. The generated results usually do not reflect the response to uncertainty that an expected utility maximizer would reveal.	Thank you for the comment, we are actually referring to cases where the expected utility framework is actually adopted here. We have now specified this better
7256	2	23	9			how is CBA different from E(U) if both maximize expected utility? Maybe add a table comparing E(U), CBA, CEA?	CBA can be used to maximize net benefit, without uncertainty or utility function. More detailed discussion of decision making belong to chapter 3, here we focus only on risk and uncertainty.
13851	2	24	16			Change 'funded' to 'founded'	Done.
6371	2	24	29		30	Grammatically muddled sentence.	Paragraph rewritten
3196	2	24	29		35	Opaque. Rewrite more clearly.	Paragraph rewritten

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6074	2	24	32	24	33	Pleae explain why CEA could enable the government to assess the "optimal" mitigation policy. In my understandings, CEA could enable governments to assess the cost effective mitigation policy, but not optimal mitigation policy where marginal cost equalizes marginal damage.	Text rephrased without « optimality ».
3197	2	24	42			Here and elsewhere, use "discount rate" for "pure rate of time preference"	We eliminated the whole discussion as it seemed that it belonged more to Chapter 3.
12995	2	24	44	24	46	This claim should be more balanced. Particular CBAs are not immune to politics, and are often thought to be hostage to the particular ethical assumptions and other preferences of the analyst. The latter is one of the major objections to CBA in public policy.	Text rephrased.
12522	2	24	44	25	2	With over 30 years of experience in cost-effectiveness analysis (CEA) applied to integrated resource planning of power systems at the utility and region level, I presume perhaps the literal wording of this paragraph does not convey the author's intention clearly. But given that experience, it is simply incorrect to say “A drawback of CEA relative to CBA is that it does not enable one to undertake an integrated valuation and comparison of benefits and costs.” The following sentences basically read as non sequitur.	Text rephrased.
14827	2	24	44			This would make more sense: "An advantage of CEA relative to CBA is that it does not force one to undertake an integrated valuation and comparison of benefits and costs. The choice of the target could instead be addressed by a political decision reflecting people's preferences."	Text rephrased.
14235	2	24	11			It might be useful to point out that CEA is a special case of CBA that replaces benefits from emissions and optimization over the emission level with an exogenously emission trajectory, but keeps the optimization over costs. Making part of the policy analyzed in CBA exogenous directly implies the discussed advantages and disadvantages. Similarly, CCP and CRA (methods the reviewer is less familiar with) seem to be special cases of CBA that replace the emission benefits with some exogenously defined objective instead.	Thanks. Text added.
8239	2	24		24		The explanation around when and how to conduct cost-effectiveness analysis should be explained more clearly. "Cost-effectiveness analysis is useful when benefits cannot be expressed in monetary values in a meaningful way. In this case, it can ensure technical efficiency in the process of achieving a desired outcome. A CEA calculates cost-effectiveness ratios of different alternative policy options and then compares the resulting ratios so that the most efficient option is chosen. The pure cost-effectiveness of a policy option is calculated by dividing the present value of total costs of the option by the present value of a non-monetary quantitative measure of the benefits it generates. The ratio is an estimate of the amount of costs incurred to achieve a unit of the outcome from a policy option. The cost-effectiveness analysis does not evaluate benefits in monetized terms but is an attempt to find the least-cost option to achieve a desired quantitative outcome". (Canadian Cost-Benefit Analysis Guide, p. 29, retrieved at www.tbs-sct.gc.ca/ri-qr/documents/gl-ld/analys/analys-eng.pdf)	Thanks. The 2.3.3.2 has been rewritten. In part, we quoted the definition of CEA as to be found in the Canadian CBA-Guide. However we do not follow the definition to the point where ratios are to be taken. So far the climate community has avoided taking ratios and left the assessment of how to balance mitigation costs and avoided non-monetary damages to society.
8240	2	24		24		The section should add that another drawback of CEA is that it usually does not account for the timing of emission reductions compared to the CBA framework. CEA assists in determining the most effective way of reducing emissions but does not account for when reductions will occur over time. The CBA framework will capture when emissions are reduced and their associated benefits (discounted), while the CEA framework informs of the reductions achieved (in physical units) and their associated costs achieved without specifying when they occur.	This is not correct. Indeed CEA has been extensively performed using a cap on temperature or radiative forcing allowing for full flexibility in the timing of the emission abatement
14236	2	25	16			Might the authors have intended to write "CEA" instead of "CRA"?	Thanks. Text corrected.
7260	2	25	29			What is EUmax?	Clarified.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7695	2	25	3		8	The text should be clarified on what "target can only be observed probabilistically" refers to. I assume that it means that the temperature response resulting from an emission pathway is not known with certainty ex-ante. This does not yet necessitate CCP if the prevailing temperature can be observed. The emission pathway doesn't have to be decided at one instant. We can observe the realization of temperature increase later during the century, and adjust the emission pathway recurrently so that the temperature target will be ultimately met (with certainty, if the amount of emission reductions are sufficiently large). Scenarios with a temperature target and risk-hedging through sequential decision making include: * Syri, S., Lehtilä, A., Ekholm, T., Savolainen, I., Holttinen, H. & Peltola, E. (2008), 'Global energy and emissions scenarios for effective climate change mitigation - deterministic and stochastic scenarios with the TIAM model', International Journal of Greenhouse Gas Control 2(2), 274–285. * Webster, M., Jakobovits, L. & Norton, J. (2008), 'Learning about climate change and implications for near-term policy', Climatic Change 89(1-2), 67–85. * Johansson, D. J. A., Persson, U. M. & Azar, C. (2008), 'Uncertainty and learning: Implications for the trade-off between short-lived and long-lived greenhouse gases', Climatic Change 88(3-4), 293–308. * Ekholm, T. (submitted), Hedging the climate sensitivity risks of a temperature target. Submitted to Resource and Energy Economics in Feb. 2012.	We agree with the referee that decisions can be corrected for in the course of time. This is what we refer to as 'learning'. We introduce our terminology more carefully in the SOD. However we disagree with the referee that learning opens the ex ante perception to be able to observe the target with certainty. An infinity-tailed climate sensitivity distribution opens the chance that the target cannot be observed any more, no matter when and how much we learn, simply because of the stock of carbon already in the atmosphere and limited carbon sinks.
14828	2	25	3		21	These three paragraphs are not clear. It is in particular not clear what is said here that is not also a drawback of CBA.	Thank you, we have now changed the text.
6372	2	25	32			Should say "likelihood .. is ", not "likelihood … are"	Done.
14237	2	25	32			check use of noun versus adjective	Thank you, text has been edited
12236	2	25	34	25	34	"minimax regret", "maximin" and "maximax" should be explained, if used.	Thank you, text has been edited
8241	2	25	34	25	34	Minimax regret, maximin, and maximax approaches should be defined.	Thank you, text has been edited
6075	2	25	34	25	34	For reader friendliness, short explanation is necessary for words such as minimax regret, maxmin and maximax.	Thank you, text has been edited
14239	2	25	38	25	40	Note that the United Nations Framework Convention on Climate Change Article 3.3 contains a very similar formulation of the precautionary princinple (http://unfccc.int/resource/docs/convkp/conveng.pdf).	Definition has been edited
12997	2	25	41	25	43	Not all versions of the PP give discretion to the decision-maker. For example, Soule 2003 contrasts strong and weak versions of the PP, and calls the discretionary ones "weak". (See Gardiner 2006.)	A more critical discussion of PP has now been introduced
3198	2	25	41		46	Point out that PP is highly subjective and pays ZERO attention to probabilities	A more critical discussion of PP has now been introduced
18450	2	25	22	26	32	As part of the robust decision making approach specific approaches deserve a much broader discussion. This concerns especially the rich literature on the "tolerable windows approach" (guard rail approach) or the safe landing approach. For the probabilistic extension of the guard-rail approach please refer to "T. Bruckner, K. Zickfeld: Inverse Integrated Assessment of Climate Change: the Guard-rail Approach, International Conference on Policy Modeling (EcoMod2008), July 2-4, 2008, Berlin" and the references therein. The deterministic version is described in "T. Bruckner, K. Zickfeld: Emissions Corridors for Reducing the Risk of a Collapse of the Atlantic Thermohaline Circulation, in: Mitigation and Adaptation Strategies for Global Change 14, 61-83, 2008".	Thanks for the references. Forwarded to chapter 3 where this literature is reviewed (3.9.2.1). Furthermore we add a hint in our PP-section.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
14536	2	26	1		7	RDM can use an objective function that interpolates between a minimize maximum regret criteria and an expected utility criteria. In these contexts, RDM provides decision makers tradeoff curves that allow them to debate how much expected performance they are willing to sacrifice in order to improve performance in worst cases. This is offered as a more systematic means of capturing the spirit of the precautionary principle in a way that illuminates the tradeoffs being made. That said, it is important to regard various decision support methodologies as more than just decision criteria. In a recent paper, we used three criteria to compare alternative robust decision approaches: 1) their decision criteria, 2) their representation of uncertainty, and 3) the information presented to decision makers. (See Hall, J. M., R. Lempert, K. Keller, A. Hackbarth, C. Mijere and D. McInerney (2012). "Robust Climate Policies under uncertainty: A comparison of Info-Gap and RDM methods." Risk Analysis. Another article offers a related set of criteria for comparing decision support methodologies: Lempert, R. J. and S. C. McKay (2011). "Some thoughts on the role of robust control theory in climate-related decision support." Climatic Change.) You might find such a set of criteria useful for your comparisons here.	We will discuss RDMs tools more explicitly in the SOD, in particular the role of trade-off curves.
6373	2	26	1		3	Cite Lempert et al. 2006.	Thank you, we have improved the text
4613	2	26	12	26	13	There is here an allusion to irreversibility through real options theory; this is the only place where the fundamental irreversibility result is indirectly mentionned: in general, the irreversibility effect does not exist.	This issue is actually discussed in details in 2.4.2, from page 32 line 19 onwards. Text updated to this end. We have weakened our statement here and left this discussion for the more general overview on numerical results in the IAM section.
10683	2	26	12	26	13	"cannot" is a very strong term - surely the point is that the precautionary effect/principle does not automatically dictate a reduction in greenhouse gas emissions solely on the basis of uncertainty in climate projections.	We have weakened our statement here and left this discussion for the more general overview on numerical results in the IAM section.
17137	2	26	15			There are documented cases in the literature of adaptive management to climate change - see for example: Berkes, F., Colding, J., and Folke, C. (2000) Rediscovery of Traditional Ecological Knowledge as Adaptive Management. In Ecological Applications 19: 1251-1262. See also Berkes, F. and Armitage, D. (2010) Co Management institutions, knowledge and learning: adapting to change int he Arctic. In Inuit Studies 24(1) 109-131	Thank you for for these references, especially the latter one with special reference to climate adaptation in the arctic. We have included them in the text as examples of passive adaptive mangement.
7261	2	26	33			Mention problems due to local differences (in culture, circumstances, values) that make AAM somewhat challenging on global scales.	I don't think that we are making any argument that adaptive management could possibly be implemented on a global scale. We have revised to clarify that.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
3199	2	26	33			Section 2.3.5 on adaptive management is perhaps tangential. Maybe omit?	I am puzzled as to why it would be viewed as tangiential. Adaptive management is an approach to governance, coming out of the ecological research community, that precisely deals with uncertainties and the potential for learning, and hence fits squarely with the remit of this chapter. Of course it is not an approach that has been embraced by economists or even decision-theorists, and we will consider inserting a sentence to note that point.
17394	2	26	34	26	35	The definition of AM is a bit awkward since AM rests on the recognition that knowledge will never be adequate. Given inadequate knowledge and continued uncertainty, perhaps the greatest strength of AM is that it specifically aims to increase the resilience of the system involved. This could be added, e.g., “Adaptive management is an approach to governance that explicitly incorporates mechanisms for reducing uncertainty over time and increasing system resilience, growing out of the field of conservation ecology in the 1970’s…”	I am not sure that I agree with this interpretation of AM. My understanding of AM is not that it is intended, per se, to increase system resilience. Rather, it is intended to generate the datathat will lead to needed learning, which in turn will support improved management practices in the future. In applying adaptive management, it is important to understand the existing system resilience, so as not to cause permanent harm to elements of the system in the course of conducting the type of controled policy experiments that adaptive management implies.
6374	2	26	8		18	This paragraph is a non-sequitur that breaks the flow of discussion about RDM.	This § is indeed not about RDM but about another notion of the precautionary principle. This is now made clearer.
6375	2	26				The paragraph/section structure here could be improved. Section 2.3.4.2 starts by describing how RDM can help, but the rest of the paragraph describes a decision not based on RDM. The RDM part is split out into 2.3.4.3. These two sections should be combined, and the text reworked to flow better, and to better describe RDM (e.g., the minimax regret approach). Indeed, this whole section talks more "around" the idea of RDM and never really gets to defining it well. See Lempert et al. 2006 for a concise definition.	Thank you, we have improved the text
17395	2	26	33			A key strength of AM is that it enhances the resilience of socio-ecological systems and strengthens social and ecological capital e.g., by enhancing linkages between system components, building awareness etc. This is perhaps as pertinent to the climate change problem as the other features of AM mentioned here.	To my knowledge this strength has not been demonstrated empirically, and so we will omit it.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
2157	2	27				The coverage of uncertainty types and models is somewhat brief making look deficient – this might be intentional by the authors. I recommend directing readers to an expanded meaning of uncertainty (including evidential reasoning) based on the work of Ayyub and Klir (2006), Klir (2005) and other similar books and papers. Reference: Ayyub, B. M., and Klir, G. J., Uncertainty Modeling and Analysis for Engineers and Scientists, Chapman & Hall/CRC, Press Boca Raton, FL, 2006.	Thanks, these references are known to us, as are the concomitant problems, see Cooke, R.M.,Book Review Elicitaton of expert opinions for uncertainty and risks Elsevier, Fuzzy Sets and Systems 133 (2003), page 267-268, ISBN 0-8493-1087-3. The paradoxes in interpreting "and" and "or" as intersections and unions of fuzzy sets are not discussed in these references. However they lead to conclusions like: IF the uncertainty that Qunicy is a man is 1/2, and the uncertainty that Quincy is a woman is 1/2, THEN the uncertainty that Qunicy is a man AND a woman is also 1/2. This is sometimes (inapprpriately) called the 'truth functionality property' according to which the Uncertainty of event A AND B depens ONLY on the uncertaity of A and the uncertainty of B, and not on A or B themselves.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4690	2	27				in Chapter 2 (p. 27, Box 2.2) treatment of uncertainty needs to be expanded and nuanced a bit further. In particular, targeted use of work from Science and Technology Studies (STS) can help here. For example, in 1992, STS scholar Brian Wynne wrote about the importance of disaggregating these broad-brush considerations of risk and uncertainty in order to more capably consider open and more complex human-environment actions. Wynne unpacked these considerations in the context of what Silvio Funtawicz and Jerry Ravetz characterized during this time as the spaces of 'post-normal science', where "facts are uncertain, values in dispute, stakes high and decisions urgent" (1993, 739). Wynne described 'four kinds of uncertainty' in this way: (1) 'risk' – where we know the odds, system behavior, and outcomes can be defined as well as quantified through probabilities (2) 'uncertainty' – where system parameters are known, but not the odds or probability distributions (3) 'ignorance' – risks that escape recognition (4) 'indeterminacy' – this intersects with the previous three kinds, and captures elements of the conditionality of knowledge and other contextual scientific, social, political factors Considering the well-known utterance from former US Secretary of Defence Donald Rumsfeld can help to make these distinctions (and the importance of doing so) more concrete. In February 2002 – regarding US military risk and uncertainty – Rumsfeld commented, "As we know, there are known knowns. There are things we know we know. We also know there are known unknowns. That is to say there are some things we do not know. But there are also unknown unknowns, the one's we don't know we don't know". These Rumsfeldian distinctions break down quite usefully along the categories defined by Brian Wynne. Funtowicz, Silvio O. and Ravetz, Jerome R. 1993. "Science for the post-normal age," Futures 25: 739-755. Wynne, Brian 1992. "Uncertainty and environmental learning," Global Environmental Change June: 111-127.	Wynne's 4 categories map on our definitions as follows. #1-#2 are in-line with the original definitions as developed within statistics and economics. However in the climate community as somewhat different use of these terms has manifested itself as documented in the IPCC-Uncertainty Guidance Notes Mastrandrea et al., 2011. There, 'uncertainty' is equivalent with a cognitive lack of knowledge that might or might not be expressed by a precise probability measure. Pairing 'uncertainty' with an undesirable outcome then gives 'risk'. Ignorance can in part be captured within subjective uncertainty, or it cannot scientifically be captured at all to our understanding – hence we cannot represent it. Finally the abovementioned conditionality is captured by conditional modeling that IAMs try to mimic, in that sense we do already represent it.
8486	2	27	11		14	This is a particularly illustrative case study in terms of challenges to adaptive policy, and sustainability action more generally. Particularly for smaller communities or political units where resources (ie, capital and capacity) are limited, short term barriers or goals will typically over-ride longer-term goals, objectives and values. See for example Sayer and Campbell 2004 re: Sustainable Development	Thank you for this comment. We will search for the paper you suggest and add as appropriate.
12524	2	27	11	27	14	"Replace sentence "As Lee..." as follows -- "As Lee (1993) documented, policy-makers on the Columbia River employed multiple perspectives to improve protection and recovery of federally listed fish stocks. While progress has been slow, adaptive management based measures slowly gained acceptance and are resulting in improved smolt-to-adult returns. However, current measures remain well short of the levels required for long term viability (Fish Passage Center 2011)." Fish Passage Center, Final 2011 Comparative Survival Study Annual Report, http://www.fpc.org/documents/CSS/2011%20CSS%20Annual%20Report—Final.pdf	This important. Obviously it puts a much more positive spin on the case that Lee documents. My sense is that Lee documented that adaptive management had not been particularly successful at the time, but as you point out, it is a matter of degree. I have revised the sentence accordingly to suggest that AAM had not altogether failed to take hold, but that it had not successed to the extent necessary to preserve fish stocks.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
11517	2	27	12	27	13	In the example about attempts to conduct experiments on salmon in adjacent tributaries, local people are implicated as selfish. It is important to consider whether they were acting to protect their own longer-term interests, ie important local food sources. Ironically, the authors seem to dismiss the risks and uncertainties associated with experimentation on salmon populations.	I am not sure that I understand this comment, but I think that the spirit of it can be captured by deleting the word "immediate."
17396	2	27	15	27	17	AAM is in fact being applied to the area of climate change (although this is of course a work in progress), and some of the relevant studies should be cited, e.g., Lawler, J.J., Tear, T.H., Pyke, C., Shaw, M.R., Gonzales, P., Kareiva, P., Hansen, L., Hannah, L., Klausmeyer, K., Aldous, A., Bienz, C., Pearsall, S., 2010. Resource management in a changing and uncertain climate. Front Ecol Environ 8 (1): 35-43. Littell, J.S., Peterson, D.L., Millar, C.I., O'Halloran, K.A., 2011. US National forests adapt to climate change through science-management partnerships. Climatic change, DOI 10.1007/s10584-011-0066-0.	Thank you for these references. We have included them, and the points they make.
14537	2	27	15			Are energy technology R&D programs an example of AAM? The government invests in a wide range of early-stage technologies, with the explicit expectation that some will be dropped and others move on to latter stages of funding.	That seems right. Adaptive management involves trying out a diversity of approaches, with the explicit expectation that some approaches will work better than others; the successful ones will be retained and improved upon, and the unsuccessful ones dropped. I have added the text almost as you suggested it.
7262	2	27	16			What is UNFCC?	United Nations Framework Convention on Climate Change. We trust it will be in some sort of list of acronyms.
4634	2	27	40	27	41	, I do not understand "If five logically independent statements each hold with probability 0.8, the probability 40 that all of them hold can be anything from 0.8 to 0." Why is the answer not (0.8)5?	Logically independent' means that none of the statements logically implies any of the others. However, they may be probabilistically dependent. The answer 0.8^0.5 holds if the probabilities in question are independent. It can happen that each of five events has probabiity 0.8 but their intersection has probability zero. In this case it is impossible that they all hold. It can also happen that their intersection has probability 0.8, in which case the all differ on a set of probability zero. Since "logically independent" causes confusion, the solution is to remove it.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
13852	2	27	40	27	45	Sentence beginning with 'If five …" through line 45 seems out of place in this box. It would be more appropriate to let the box stand for itself and have this material in the text, referring to the box as needed.	I would disagree. It is essential to understand that attaching probability qualifiers to statements can conceal the problem of propagating uncertainty through a chain of reasoning. This is an essential message of the uncertainty box. The IPCC uncertainty narrative must to recognize this fact.
14240	2	27	40	27	41	The example seems to be at least easily misunderstood, if not wrong. Given independence, the joint probability should be easility calculated and unique. I think the authors have in mind that the formulation would not contain the information whether these events are independent or not. Then indeed the given range seems right.	See response to comment 13852. If 'logically independent' causes confusion, we could just leave it out, the statement in the text remains true.
8391	2	27	46			It is not clear what "uncertainty analysis" is as distinct from everything else in section 2.3. This section seems to be a repository for things that didn't fit in well above. I suggest thinking very carefully about what "uncert analysis' might mean, and how to organize the entire section 2.3 given this.	Thanks for the opportunity to expand on this. Definitions are given, and the meaning of 'uncertainty analysis' is anchored in a long tradition within technical risk analysis. Quantitative uncertainty analysis (QNUA) requires a mathematical model, qualitative uncertainty analysis is a structured narrative. The former has not yet played a large role in the climate debate, which explains its subordinate role in this chapter. See however Cooke, Roger. M. (2012) “Uncertainty Analysis Comes to Integrated Assessment Models for Climate Change…and Conversely Climatic Change. DOI: 10.1007/s10584-012-0634-y, free online access: http://dx.doi.org/10.1007/s10584-012-0634-y
12237	2	27	49	27	49	What is QUA? Both QLUA and QNLA are explained.	QUA is a typo, it should be QLUA
13853	2	27	49			Change QUA to QLUA	see response to comment 12237
6376	2	27	49			Change QUA to QLUA?	see response to comment 12237
7263	2	27	49			What is QUA?	see response to comment 12237
2158	2	28				Section 2.3.6.1: The readers of the report would benefit from additional sources on this subject such as the book by Ayyub (2001) among other books. Reference: Ayyub, B. M., Elicitation of Expert Opinions for Uncertainty and Risks, CRC Press, 2002.	Thanks, see response to comment 2157

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9796	2	28	10	28	14	Combining Delphi-based studies and scenarios is considered a promising approach. In existing Delphi-based scenario studies, the most often used Delphi function is the judgment function. For a comprehensive systematic review on Delphi-based scenarios see: NOWACK, M.; ENDRIKAT, J.; GUENTHER, E. (2011): Review of Delphi-based scenario studies: Quality and design considerations. In: Technological Forecasting and Social Change, Volume 78, Issue 9, November 2011, pp. 1603-1615. doi:10.1016/j.techfore.2011.03.006, online: http://www.sciencedirect.com/science/article/pii/S0040162511000576.	Thanks for the reference, which gives an interesting list of applications and a proposal for combining Delphi and scenario analysis, so as to capture the "genius" of Herman Kahn. In addition to the three critical articles you cite, H. Sackman Delphi critique; expert opinion, forecasting, and group process, Lexington books, 1974, 0669961566, may be of interest. The genius of Herman is very controversial, "thinking the unthinkable" was the biline for his book On Thermonuclear War, see for example J.R.Newman "Thermonuclear War" Scientific American March 1961.
16088	2	28	16	28	29	The example given (Rasmussen and nuclear risk) is now fully obsolete. Nuclear safety relied on a "one in 100 00 reactor years" accident and on a "one in a million reactor years" catastrophy. After 14 000 reactor years, there have been 3 occurrences of catastrophic events and double of accidents, i.e. an error of 20 times the goal. Thus the paragraph should either skip this example, or mention the failure of this approach for large systemic risks.	The Rasmussen report was retracted after critique by the Lewis Commission see US Nuclear Regulatory Commission (1979), Nuclear Regulatory Commission issues policy statement of Reactor Safety Study and Review by the Lewis Panel, NRC press release, no. 79-19, 19 January.. However, the Lewis Commission applauded the methodology, in particular its use of expert subjective probabilities. The Rasmussen report's historical importance is widely recognized, and it is cited for its historical significance.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
13855	2	28	18			Please add reference to some of those 'successive studies'	An overview and reasonably complete set of references is found in Cooke, Roger. M. (2012) “Uncertainty Analysis Comes to Integrated Assessment Models for Climate Change…and Conversely Climatic Change. DOI: 10.1007/s10584-012-0634-y, free online access: http://dx.doi.org/10.1007/s10584-012-0634-y (see esp Supplementary Online Material). An overview and summary appeared in Radiation Protection and Dosimetry Special Issue 90(3), 2000..Important methodological innovations are found in Kraan, B.C.P., and T.J. Bedford. Probabilistic inversion of expert judgements in the quantification of model uncertainty. Management Science 51(6): 995-1006, 2005.
13854	2	28	3			Provide at least one reference for QLUA	I would suggest EPA's Cancer Guidelines for a good discussion of weght of evidence. U.S. EPA. Guidelines for Carcinogen Risk Assessment (2005). U.S. Environmental Protection Agency, Washington, DC, EPA/630/P-03/001F, 2005.
8392	2	28	9			Structured expert judgement is a tool that can be used to populate probabilty distributuions for all the other tools in the chapter, and so it is confusing to have it presented in a parallel manner. Expert judgment should not be used on its own (it is not a good idea to just ask experts what they think we should do), but rather as a way of creating probability distributions. This should be made more clear, both in the writing, and also by the structure of the sections.	Thanks, see response to comment 8786. Note also the distinction between 'expert judgment' and 'structured expert judgment'. Expert judgment tout court can mean anything from blue ribbon panels, Delphi surveys,
14829	2	28				This is a very helpful section, and could even be usefully expanded. It is arguably more useful	Thanks , I agree. Talk to the Page Allocator

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8786	2	28	9	29	24	Again generally good discussion of the approach but no discussion of the fundamental difficulties in using expert opinion in this manner when it is difficult to gauge the impact of the experts ideological and religious positions, ethical, ontological and epistemological assumptions, expertise in philosophy of science, etc.	Thanks, this comment invites a long discussion. Here's a short reply. All experts, like most of us, have biases, predlictions proclivities etc. This is why it is essential to guage expert performance (in terms of statistical accuracy and informativeness) with objective measures - to treat them as statistical hypotheses. Most EJ methods attempt to sensitize experts to biases etc. However, the proof of the pudding is in the eating. The credibility of an EJ study depends on these objective measures, and not on a narrative claiming bias removal. Indeed, 'unbiased' experts can still return poor performance. Many studies have tried to relate expert performance to 'exogenous variables'. Many more have tried this with graduate students in psychology. The short answer is that the best predictor of performance is past performance. Even that isn't as good as we might like, but its better than anything else.
7264	2	29	10		12	How does this number compare with the forecast?	We do not know to which number you are referring.
12525	2	29	20			It is implausible to say that structured expert judgment is “just opinions and not hard facts.” Peer review, to name one salient example, is not “just” opinions.	"just…' is in quotes. Studies have shown that eg citation indices do not predict expert performance. Eg Cooke, R.M., ElSaadany, S., Xinzheng Huang, X. (2008) On the Performance of Social Network and Likelihood Based Expert Weighting Schemes, Special issue on expert judgment Reliability Engineering & System Safety, 93, 745-756, Available online 12 March 2007, Volume 93, Issue 5, May 2008.
13856	2	29	31	29	34	Recommend updating this part to reflect the new 'Representative Concentration Pathways' of WG I	Good idea, will do
7265	2	29	31			May not be the first occurence, but define "emission pathway"	see response t comment 13856

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
14538	2	29	35	30	11	Schoemaker (1993) writes “the multiple scenario method thus differs from traditional planning and risk analysis in its psychological basis,” referring to scenarios attempted role in addressing over-confidence and allowing groups to reach consensus on the need to consider potential risks without first agreeing on their magnitude or precise form. This chapter’s discussion takes a much narrower view of scenarios, essentially focusing on their use in laying out a range of plausible future climate conditions. But the climate community has a much richer view of scenarios, as described, for instance in Parson, E. A., V. Burkett, K. Fischer-Vanden, D. Keith, L. O. Mearns, H. Pitcher, C. Rosenweig and M. Webster (2007). Global-Change Scenarios: Their Development and Use, Synthesis and Assessment Product 2.1b, US Climate Change Science Program and a special issue of Environmental Research Letters (see O'Neill, B. C., S. Pulver, S. D. VanDeveer and Y. Garb (2008). "Editorial - Where next with global environmental scenarios?" Environ. Res. Lett. 3: 1-4.)	This is a very good point, but since Chapter 2 addresses uncertainty and risk, we refer to the aspects of scenario methods related to that. This does not preclude other uses.
7266	2	29	41			What is SRES?	Thank you. SRES is an acronym for Special Report on Emissions Scenarios. We have clarified this.
6076	2	29	41	29	41	Examples of SERES can be replaced by the most recent ones including EMF 27.	see response t comment 13856
13857	2	29	43	29	44	Suggest relating this sentence to previous sentences by noting that the Meehl at al (2007) study involved multiple runs of multiple models.	see response t comment 13856
3897	2	29	47	29	48	Sentence difficult to read and understand -recommend redrafting it.	The last line is number 43??
12526	2	29	48			Add after “change” -- “estimating system boundaries and thresholds”	The last line is number 43??
2965	2	29	1			would it be worth saying something about use of decision markets as a way of aggregating opinions (e.g., intrade)?	Outside the scope of this chapter.
3138	2	29	12			section 2.4.4 might helpfully begin with a macro view of the kinds of "errors" that can be made in policy choice (and remedies for those errors). That larger framework, which might be just a few sentences or such and refer to other chapters, will help readers understand the context for the discussion of instruments that follows. Also, the discussion that follows strikes me as overly weighted on market and technology policies and perhaps underplays the role of regulation. (Later chapters also deal, often, with policy instrument choice and they, too, underplay the role of direct regulation.) Throughout, the stuff on risk perception and decision making is really helpful. fyi, there is some evidence that different types of people make decisions differently—our lab has a big review paper (now accepted at Perspectives on Politics for publication in March 2013) that looks, in particular, at elite vs. non-elite methods for making decisions. Here's a link: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1917037 I have the impression that decision-making strategies that involve "act, observe, learn, and adjust" are under-played in this chapter. Lempert and others, including at EMF, have done a lot in this area and it seems to be a big part of the climate policy analysis literature. Maybe its in the chapter and I missed it. □	This is an interesting comment. With respect to errors, the intention was to cover these, and their effects on policy, in section 2.2. With respect to the decision-making strategies, that is a good point, and is covered in section 2.3 under robust decision-making and adaptive management. The point with respect to regulation is very much right, and yet I see it as more apprpriate in chapter 16, lthough we make note of it now in the introduction to 2.4.4.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
13858	2	30	1			It seems like the term 'optimal signal' is not what you mean here. Do you mean 'optimal method?'	Optimal signal is a technical term, and denotes forming a linear combination of separaste signals in such a was as to minimize the variance of the combined signal. Think weighted least squares, where different variables are combined with weights proportional to their inverse variances. In climate applications the role of variance is played by natural variability. Owing to short observation times, natural variability is often estimated by simulating longer histories than those observed.
10419	2	30	12	33		The uncertainty quantification references are good, but you forget to mention Computable General Equilibrium (CGE) models, where you could incorporate uncertainity inside sector modelling	Thank you. However, we would need references to published literature to add this.
8137	2	30	13	30	17	Evidence? Sources?	I trust that the existence of a literature on policy analysis and implementation is not controversial, just as it would not be controversial to claim the existence of a literature on chemsistry, physics, or economics. The specific references to this literature, numbering into the thousands, are tangential to this chapter, which is why we omitted them, for reasons of space constraints.
3903	2	30	23	30	23	The term 'at all costs' implies that these parties are behaving irrationally. Would a less extreme hypothesis be better?	I am not sure why "at all costs" implies irrationality per se. It is not necessarily irrational, for example, to spend all the money that one has in order to prolong one's own life.
3200	2	30	24		25	What is the fourth reason?	Oops. Change to "for several reasons."
2579	2	30	30	30	30	The role of subnational and local governments in addressing Sustainable Development issues, notably climate change, has been increasingly recognized by the UM System. For instance, the Rio+20 final declaration has 23 matches to "subnationals" (initial draft had just a couple)	Thank you. I believe that the peer reviewed papers we cite make exactly this point.
13860	2	30	35	30	40	Include reference to 'carbon taxes'. It is a major topic of discussion in this context. An example is: Title: Exxon is right: Let us re-examine our choice for a cap-and-trade system over a carbon tax Author(s): Wittneben, Bettina B. F. Source: ENERGY POLICY Volume: 37 Issue: 6 Pages: 2462-2464 DOI: 10.1016/j.enpol.2009.01.029 Published: JUN 2009	Thank you. We have added carbon taxes.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
3368	2	30	4			Epistemological challenges related to scenario analysis and uncertainty should not be ignored. Scenario analysis does not follow the scientific gold standard of falsification and there is risk of systematic bias, e.g. due to herd crowding, in e.g. integrated assessments. Discussion of this point seems to be absolutely crucial. One important study on this issue is: "Betz, G. (2009),Underdetermination,Model-ensemble,andSurprises	Thanks, Scenarios of course do not follow the rule of falsification, they never happen. They are biased by authors' perspective. They only give a path for "what happens if."
3369	2	30	4			An example for this herd crowding are future scenarios on bioenergy deployment. More specifically, top-down studies were reluctant to take up bottom-up insights on the life-cycle assessment of bioenergies, producing a bias in bioenergy scenarios, nearly exclusively portraying bioenergy as "carbon neutral". See: "F. Creutzig, A. Popp, R. Plevin, G. Luderer, J. Minx, O. Edenhofer (2012) Reconciling top-down and bottom-up modeling on future bioenergy deployment. Nature Climate Change 2: 320-327"	Thanks for the helpful suggestion.
6377	2	30	4		11	Another disadvantage of scenario analysis is that the choice of scenarios is somewhat arbitrary. This is one of the issues addressed by RDM, by using large-scale, automated scenario generation. It would be good to discuss this, as RDM has already been presented. (See, e.g., Groves and Lempert 2007, doi:10.1016/j.gloenvcha.2006.11.006)	We have taken this point into account.
8487	2	30	41		46	Note unanticipated costs as well, and may want to note that action across this expanded scope of governance is not only multi-level, but also formal and informal (see Middlemas 1997)	I don't understand this comment in the context of the specified paragraph.
3367	2	30	4	30	11	The paragraph on the limitations of scenario analysis goes to the heart of the AR5 report and should be expanded to allow a more careful interpretation of chapter 6's results. For example, the two following studies detail the limitations of integrated assessment studies with respect to dealing with the uncertainties of future development: A) Ackerman, F., DeCanio, S. J., Howarth, R. B. & Sheeran, K. Limitations of integrated assessment models of climate change. Climatic Change 95, 297–315 (2009). B) Cullenward, D., Schipper, L., Sudarshan, A. & Howarth, R. Psychohistory revisited: fundamental issues in forecasting climate futures. Climatic Change 104, 457–472 (2011).	The section on scenario analysis is not a critical review of IAM's, but a review of scenario analysis. The sec5ion has been expanded. Further, I have re viewed and commented on Ch. 6. Scenarios are not 'predictions' or 'forecasts', they are "projections" the intent of developing scenarios is to cover the range of possibilities. If you will, they attempt to descry be the support of the uncertainty distribution on future paths, not to give a probabilistic assessment of these uncertainties. The cited studies are not really about scenario analysis.
5389	2	30	18	30	46	In line 38 is stated four reasons, but in the same pargraph up to line 25 only three reasons are mentioned… however, there are four reasons mentioned in the following pargraphs …….	The section has been edited.
13260	2	30	18	30	25	The paragraph states four reasons related to risk and uncertainty, but the explanation cover only three	The section has been edited.
8243	2	30	18	30	25	I think also that it also becomes more problematic due to lengthy time taken in policy making.	The section has been edited.
16089	2	31				Not clear what the figure means and what its aim is.	This figure is being dropped for the SOD.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
13261	2	31				Although all actions are directly or indirectly aimed to protect societies and people against adverse effects of climate change, many of them are directly focused on natural systems. The figure has strong presence of action in the upper side, i.e., measures or actions with high sensitivity in social systems. A policy for glacier protection, conservation policies to protect endangered species against climate change threats, etc. could be placed on the lower side, at the right. The only reference to the precautionary principle could be more theoretical that the examples on the upper side of the figure.	This figure is being dropped for the SOD.
13861	2	31				Better to label at least the x axis as low and high rather than + and - which gives the impression of a continuoum that is not reflected by placement of the decisions listed and cannot be justified by the level of analysis represented in the figure.	This figure is being dropped for the SOD.
14831	2	31				This is almost a useful figure. It would perhaps be more useful if it had a single axis showing different types of uncertainty (from deep and unqualtified to straightforward and well-quantified), and types of decisions that characterized those types of uncertainty were above the axis, and apropriate deciison-making tools were below the axis (perhaps with lines connecting decisions and corresponding tools)	This figure is being dropped for the SOD. But I also disagree with the comment. The point of the fgure was not to view uncertainty in terms of its analytic source, but rather in terms of the system to which it applies.
14241	2	31				This is the only figure in the article that I did not find very helpful, ever somewhat confusing. Should the vertical position denote increasing sensitivity? Why is the design of a carbon monitoring system more subject to uncertainty in the climate system than e.g. formation of the national climate policy commitments? I would think it's the other way round. The precautionary principle would make the resulting climate outcome probably less subject to climate uncertainties, but is more responsive to the introduction of uncertainty. While these are just examples of possible misunderstandings, it might be worthwhile to re-think the layout itself.	This figure is being dropped for the SOD. But to answer your example question, the design of a carbon monitoring system is very sensitive to uncertainties in natural systems, such as decomposer food webs in the soil, as well as in social systems, such as non-point emissions sources of black carbon. The formation of national climate policy commitments, in the context of a global target to achieve a particular climate target such as 2°C, would be in theory be sensitive primarily to expectations about the costs to the national economy and particular actors within the economy of reaching various national targets.That is an uncertainty in a social system.
3904	2	31	11	31	17	These lines focus on irrational decision-making, in the sense of someone who is not taking decisions that are clearly optimal in terms of their own preferences. The real problem with public policy is that decision-makers are behaving optimally, but their incentives (political, bureaucratic of whatever) are not well aligned with interests of 'the common person', 'the representative individual', the 'median voter' or whatever other expression is used to represent the (non-partisan) 'public interest'. So bad policies result from the conventional political expediency that magazines like the UK Economist document in every issue. Could the chapter be structured so as to distinguish the problem of failure to optimise (ie irrational behaviour) from the problem of optimising the 'wrong' objective function (eg the imperative to win the next general election)?	Good points that we will address more fully in the SOD
13862	2	31	16			Remove word 'the' since this section cannot discuss ALL examples. OR replace 'the' with 'some'	Good point. Thanks.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
10684	2	31	21	31	22	Why is establishment of a stabilisation target sensitive only to uncertainties in the natural system? Surely the magnitude of many climate change impacts (and thus the level to be avoided) is dependent on vulnerability and exposure of social systems too? Indeed, Article 2 talks about food production and economic development - both strongly socio-economic systems.	The statement was too condensed and will be modified.
9797	2	31	26			What is a "social planner" from your point of view? You furtheron refer to a modelled decision maker. This might work in quantitative models but does not reflect real decision makers. What can they learn from this chapter? I have already raised this issue earlier, that the chapter should address the decision makers perspective more appropriately.	To us, in a nutshell, it describes a perfectly cooperative society - a benchmark how good it could get. The idea is that 'if you maximize the cake to distribute, it is easier to get an agreement afterwards'. Social planner models help to 'maximize the global cake'. We will explain our point of view more carefully.
11519	2	31	26	34	22	The title of section 2.4.2 indicates it is about pathways, but only a small proportion (section 2.4.2.3) address this topic.	If one takes a global mitigation decision to be a pathway, as this Report does, then this section is very much about pathways.
8138	2	31	7	31	19	Evidence? Sources?	This figure is being removed for the SOD.
14242	2	31	9	31	10	Please define System 1 and system 2 or refer to where it was defined.	Done.
7896	2	31				The concept of the social planner should be explained with repsect to utilitarian ethics and economic theory. What kind of knowledge is the social planner supposed to have? Is the social planner a benevolent utilitarian or is she looking for an efficient economic solution or do you consider both to be the same? Is the social planner assumed to have God-like knowledge?	The concept of a social planner, as we understand it for our chapter, shall be made more explicit in the SOD.
4708	2	31	26			This section, as with 2.3, leans excessively on System 2 thinking and assumes that sufficiently good System 2 policies can alter the basic System 1 obstacles.	This is a valid point, and the section has been revised accordingly to deal with this issue.
16090	2	32				Baranzini et al (2003) and Baudry (2000) are not in the reference list	Thank you, a set of references was missing and this has now been corrected
8141	2	32	13	32	13	Again, imprecise language: Actually, you did use only a fraction of existing literature. How was it selected? How was it analyzed?	Authors did their best to include all literature published so far. We may add more literature if it meets the deadline. If referee has any suggestion s/he should provide it
14832	2	32	13			It seems that this is the most important part of the chapter, and should certainly be more of a guiding element of it's structure. The conclusion "There appears to be consensus in the literature that the inclusion of uncertainty implies a more significant short-term response to climate change." is extremely important, and should be highlighted, elaborated significantly, and made a key message.	Thank you, we have now made an extensive work to bring in the introduction some of these conclusions
11520	2	32	13	32	13	Table 1 should be changed to Table 2.1	Thank you text has been edited
7267	2	32	13			Table 1 -> Table 2.1	Thank you text has been edited
7268	2	32	17			What is continuous damage uncertainty?	Thank you text has been edited to be clearer. It refers to continuous climate-feedback damages as opposed as to discontinuous, threshold damages.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4614	2	32	19	32	21	The source of this assertion should be provided or how it is arrived at	We have classified literature reported in the table for the results they report. The source is the aggregate of the literature reported in Table 2.1
7696	2	32	24			Two additional references for the "downstream - continuous" / "accelerates mitigation" box (both deal with uncertainty and learning on climate sensitivity under a temperature target): * Syri, S., Lehtilä, A., Ekholm, T., Savolainen, I., Holttinen, H. & Peltola, E. (2008), 'Global energy and emissions scenarios for effective climate change mitigation - deterministic and stochastic scenarios with the TIAM model', International Journal of Greenhouse Gas Control 2(2), 274–285. * Ekholm, T. (submitted), Hedging the climate sensitivity risks of a temperature target. Submitted to Resource and Energy Economics in Feb. 2012.	Thank you, references have been considered
7269	2	32	24			The Table caption is above the table, but Figure captions are below figures? Also, define up stream, down stream in the caption!	Thank you, text has been edited
13863	2	32	3			IAM refers to models already. Remobe the word 'models' after IAM.	Thank you text has been edited
7270	2	33	10			Table 1 -> Table 2.1	Thank you, text has been edited
7271	2	33	19			Table 1 -> Table 2.1	Thank you, text has been edited
6378	2	33	20			Mangled citation	Thank you, a set of references was missing and this has now been corrected
7272	2	33	24			New paragraph for (iii)	Unfortunately we cannot add paragraphs for each of the uncertainty sources for space concerns, although we do see the referee's point
7273	2	33	28			New paragraph for (iv)	Unfortunately we cannot add paragraphs for each of the uncertainty sources for space concerns, although we do see the referee's point
7274	2	33	48			Table 1 -> Table 2.1	Thank you, text has been edited
14834	2	33				This part of the chapter is important and should be expanded.	The whole chapter is constrained by page limits. However some of the points in this section are now mentioned in the executive summary
4707	2	33	6			The language of this first paragraph is particularly opague.	This section has been extensively revised.
2159	2	34				Forming treaties should consider not only treaty verification but also treaty verifiability. This area is well established and rich with sources based on work in missile defense systems and nuclear armament.	Thank you. The text has been revised accordingly.
4894	2	34	24		29	The 2 sorts of evaluations are not in contradiction. Clarity in this is a crucial issue for the ongoing c.c. negotiations. Actually these effects of uncertainties depend on the nature/type of the uncertainty: i.e. whether it is related to the phenomenon (e.g. ozone layer depl. or to the necessary common mitigation action and its "share" for individual countries e.g. in line with the c.b.d.r.). The latter factors governing the political willingness to agree were clearly demonstrated e.g. for such conventions/protocols a the LRTAP and its protocols, the instruments on ODS or the UNFCCC-KP and their unclear followup.	This is an important point and I have changed the text accordingly.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7275	2	34	28			uncertain as -> uncertain about	Thanks. Have changed it to "uncertain as to"
4895	2	34	32		42	The same as above, however, here: some kind of learning has the reverse effect; namely, learning more on the potential adverse impacts + on the opportunities for some assistance (or lessening uncertainties about such opportunities) had a clear positive impact on the number of "candidates" for the KP, i.e. accelerated the ratification by the developing countries.	This may be, but I don't know of any papers documenting this. I wish the reviewer had provided a reference.
4511	2	34	43	34	48	Reference could be made here to recent work by DeCanio and Fremstad ("Game theory and climate diplomacy," Ecological Economics, in press) showing how recognition of the seriousness of climate catastrophe on the part of leading governments could transform a Prisoner's Dilemma game into a Coordination Game, leading to greater likelihood of reaching an international agreement to limit emissions.	Thank you, references have been considered
4615	2	34	7	34	10	The meaning of this sentence is not clear	Thank you. We changed 'what' to 'which'
14835	2	34				This does not appear sufficiently relevant to this chapter to devote this much text to it.	A decision was made concerning the overall organization of the report that in this chapter we would cover research results concentrating on the issue of uncertainty across a range of policy and governance contexts, rather than having that literature reviewed in the policy and sectoral chapters. That is what is going here, and the reason for so much space.
7897	2	34				The problem of treaty formation is mainly addressed in game theoretical ways. The perspective of institutionalism is marginalized (Oran Young, one of the leading proponents of inst., is mentioned once). If game theory is adopted as genral appraoch for decision making, the prisoners dilemma and the problem of sub-optimal outcomes must be taken into account. Game theory without prisoners dilemma is not state of the art. It neglects the fact that maximising one's own position has highly undesirable consequences: everybody ends up in jail; i.e. humanity will faces "dangerous anthropogenic climate change" and most "players" will be worse off.	This is a very valid comment. At the least, we need to acknowledge that there are other academic approaches to understanding treaty formation than those relying on game theory. At the same time, however, we have struglled to find references in these other literatures focusing on the issue of uncertainty.
7358	2	34				A sub-section addressing "compliance" in addition to MRV is necessary to fully reflect the elements relating to uncertainty and international agreements	This is a good point. We have indicated the connection with compliance.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4710	2	34	18			This whole section seems out of place in this chapter -- shouldn't it be moved wholesale to Chapter 13: International Cooperation: Agreements and Instruments?	The short answer is yes. The longer answer is that a decision was made concerning the organization of the report that Chapter 2 would highlight particular issues of uncertainty, and the relevant research results concentrating on uncertainty, across a wide range of policy and governance contexts. Given that, the maerial fits here, just as later material on national and subntational policy instruments also fits here.
4897	2	35				2.4.3.3 (a) At the outset, industry is also mentioned (together with land use), however, later there is no concrete reference to that sector. (b) In terms of MR(V) regimes in developing countries, besides the referred uncertainties and lack of MR-capacities another essential (and sensitive) point is the "sovereignty" issue (that includes the uncertainties on how other parties may use the information received through the (M)RV channels): it is clearly indicated in course of the negotiations and also in the relevant outcomes of the COPs).	This may be, but I don't know of any peer reviewed sources that say this.
7276	2	35	10			Who is "they"?	Thank you. The text has been revised accordingly.
7277	2	35	21ff			break the sentence in two, e.g. "[...] in time. He found [...]"	I don't understand this comment in the context of the specified page and line number.
12527	2	35	3	37	7	This paragraph cites two slightly varying views on the inefficacy of the multilateral negotiations approach, most notably if indirectly referring to the UNFCCC. This represents a very narrow range of views from a very extensive literature, and this summary should be expanded to include those broader views. From personal experience observing the UNFCCC and related activities for nearly a decade, the UNFCCC process has actually delivered a broad range of innovative results, including the launch in Cancun of an important array of new global delivery mechanisms for climate action, the Green Climate Fund, Adaptation Committee, Climate Technology Center and Network, and progress toward a REDD+ mechanism. Progress is alarmingly slow on core issues in the UNFCCC negotiations, and the Durban Platform is somewhat vague while launching an important new 4-year negotiating round toward a new instrument. But the “death of multilateralism” (or more specifically, the “death of Kyoto” has been pronounced ceaselessly for 20 years, and yet the process continues and makes progress, even if it is slow, uneven and difficult. There are many valid points of view in the debate about how far the multilateralist approach has come and what its prospects are. There is no reason to truncate the range of those views and the vitality of that debate as the cursory summary here now does.	Thank you. The text has been revised accordingly.
4896	2	35	32		34	It would be worth mentioning that it is the "essence" of the EU's ETS. (Personal comment: this was one of the key reasons/goals in 1997 of the "background" agreement between US and RF in the finalization of the KP and the insertion and acceptance of Art 17 during the last days(nights over there.)	Thank you. The text has been revised accordingly.
6077	2	35	33	35	33	The text is correct. The point, however, is that if one country's marginal abatement cost is exceptionally high, the country will never join such treaty.In this sense, this explanation is not relevant.	Thank you. The text has been revised accordingly.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7278	2	35	35			What about remote sensing via satellite?	Alas, people have thought of. There are huge uncertainties in translating satellite measurements of relfected incoming radiation into estimates of things like soil carbon.
7279	2	35	42			What is soil carbon?	Soil carbon is the carbon contained within the soil, typically biomass that has not yet decomposed. It is the largest single stock of carbon on the planet.
11522	2	35	8	35	34	Section 2.4.3.2 is largely based on literature review, but I don't see any summary or explaination regarding to the topic of national commitments.	Thank you. The text has been revised accordingly.
4254	2	35	13			It's not immediately clear why a country with more resource vulnerability would be more averse to a climate change treaty - could this be explained more clearly	Not "resource" but "source." That means that their economic sectors accounting for emissions are not so vulnerable to the burden placed upon them by climate policy. We clarify in the text.
4914	2	36	29			{Add: p} that promote research,	Thanks, done!
13865	2	36	29			change 'romote' to 'promote'	Thanks. Done!
7280	2	36	29			romote -> promote	Thanks, done!
13866	2	36	34			change 'fostering' to 'reducing'	Thanks, done!
16091	2	36	40	37	3	Low prices in ETS has been shown repetitively to be linked to overallocation and low targets, lax banking procedures... This paragraph links the problems mainly with "regulation", certainly a cause of volatility, but of a lower order of magnitude that targets themselves.	Yes. But the overallocation has itself been linked to uncertainties in economic growth and associated emissions, which are factors that influence the relationship between the size of the cap and the market price. We believe that the current wording captures the right emphasis of the relationship between the two sets of sources of uncertainty.
4898	2	36	47	37	3	Three factors mentioned; the high price volatility within the ETS was also due (to large extent) to those uncertainties which have led to significant annual "overallocations".	The overallocation has itself been linked to uncertainties in economic growth and associated emissions, which are factors that influence the relationship between the size of the cap and the market price.
13683	2	36	49	36	49	Add after "Chevallier 2009": "Vasa and Michaelowa (2011) assess the impact of policy uncertainty on carbon markets. They find that the possibility to create and destroy carbon markets with a stroke of a pen leads to extreme short-term orientation, rent seeking behaviour and high volatility in market prices. In their view, these negative effects can be reduced if climate policy decisions have a long-term nature with clear consequences of non-compliance." Reference: Vasa, A.; Michaelowa, A. (2011): Uncertainty in climate policy – impacts on market mechanisms, in: Gramelsberger, G.; Feichter, J. (eds): Climate change and policy, Springer, Heidelberg, p. 127-144	Thank you. This is an extremely valuable point. We have added the proposed text.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
13262	2	36	8	36	12	in 2008, Chile also had tier 2 in their inventories. Chile has done it for the key categoeries of the Agriculture sector	Thank you. That is interesting to know.
17327	2	36	24	39	44	Firms behavior is covered for the most part in this session but there is no transition or highlighting of this fact, only the attentive reader will notice. The behavior of Firms/investors/ institutions, is important to all the sectoral chapters. If it can be explained here in a generic form then the other chapters could pick and cross-reference to this session in Chapter 2. Consider highlighting in the introduction of this session that this session makes specific emphasis on firms behavior.	This is a good suggestion, and I have done this.
4711	2	36	24			This section goes into policy issues in general but should be more closely focused for the purposes of this chapter on how UNCERTAINTY and RISK influence policies.	I wish you had made more specific suggestions as to how. We tried very much to focus on precisely this, concentrating on the literature examining how the performance, and ultimately relative desirability, of different policies and policy instruments to achieve particular objectives are sensitive to risks and uncertainties.
14243	2	36	24			The chapter very much invites a discussion of taxes versus cap and trade, where uncertainty is a major driver of the differences in efficiency. In particular, Weitzman (1974), Prices vs Quantities, The Review of Economic Studies, Vol. 41, No. 4. (Oct., 1974), pp. 477-491, Karp & Hoel (2002), Taxes versus quotas for a stock pollutant, Resource and Energy Economics 24: 367–384, Karp & Hoel (2001), Taxes and quotas for a stock pollutant with multiplicative uncertainty, Journal of Public Economics 82: 91–114. If this impact of uncertainty on the choice of the policy instrument is discuessed elsewhere at length, a reference in this section might be useful.	This is important, and yet was an issue addressed quite extensively in the AR4. We do not repeat it here.
6078	2	36	24			The title of this subsection is "Choice and design of policy instruments under uncertainty". This sebsection consists of two interventions, i.e. market price/tax and RDD&D. In a real would economic incentive is just one of the instruments. For example, direct regulation plays an important role in US climate policy and voluntary initiative do the same in Japan (see Chapter 15). In this sense, it will be better to discuss various instruments rather than focussing on carbon tax in the first category.	This is an important point.We have rewritten the introduction to section 2.4.4 to acknowledge it.
6079	2	36	40			In subsection 2.4.4.1 almost solely discuss about EU ETS (and regulatory uncertainties). The description is quite informative and interesting (such as citation from Blyth et al. 2007 in page 37 line 8). That said, the latter part seems to duplicate with the description of Chapter 14 where EU ETS will be discussed. Coordination between two chapters will be necessary.	This section does not limit itself to the single example of the ETS, although that is the cap and trade system that is the most well developed, and hence can generate the greatest amount of data for empirical analysis. This is being coordinated with chapter 14.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9972	2	36	41			This section should explain 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). These literatures are listed in the No62 line of this table. 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, does not work well, as shown in (Rosendahl, 2011, abstract), (Aichele, 2012, page336), and (Peters, 2011, page1). These literatures are listed in the No50 line of this table.	It is not the purpose of this section to go into all problems, such as leakage. Issues of permit price volatility is something that the section already covers, as the review suggests that it should.
4616	2	37	11	37	13	This is an example where the irreversibility effect and real options work.	Yes.
7282	2	37	18		19	What about the two full stops around Patino-Echeverri et al?	Fixed. Thanks.
12615	2	37	19	37	21	This is a very old reference. Since this time CCS legal and regulatory frameworks have been put in place in Australia and many parts of Europe and USA. I therefore do not feel signling out regulatory uncerntainy as an issue solely for CCS is appropraite. Please see the IEA CCS Model Regulatory Framework and IEA CCS Legal and Regulatory Review for references.	We did not mean to single out CCS, and have nothing in particular about the technology. It is just that Reinelt and Keith happened to study the impact of regulatory uncertainty (i.e. carbon price fluctuations) in the context of investment into one low carbon technology, i.e. CCS. The presence of a legal framework for CCS (covering, for example, legal liability for leakage), which you are right exists now to an extent that it did not in 2007, does not influence the effects of uncertainties in carbon markets, which is what Reinelt and Kieth were examining.
12658	2	37	19	37	21	This is a very old reference. Since this time CCS legal and regulatory frameworks have been put in place in Australia and many parts of Europe and USA. I therefore do not feel signling out regulatory uncerntainy as an issue solely for CCS is appropraite. Please see the IEA CCS Model Regulatory Framework and IEA CCS Legal and Regulatory Review for references.	We did not mean to single out CCS, and have nothing in particular about the technology. It is just that Reinelt and Keith happened to study the impact of regulatory uncertainty (i.e. carbon price fluctuations) in the context of investment into one low carbon technology, i.e. CCS. The presence of a legal framework for CCS (covering, for example, legal liability for leakage), which you are right exists now to an extent that it did not in 2007, does not influence the effects of uncertainties in carbon markets, which is what Reinelt and Kieth were examining.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
7281	2	37	2			not-infrequent -> frequent	Hmm. My sense, as a native English speaker, is that "frequent" has a slightly different connotation from "not-infrequent." The latter does not clearly state that the events could be labeled as frequent, but does suggest that they were regular enough to make the label "infrequent" innapropriate.
7283	2	37	27			What is a risk neutral investor?	A risk neutral investor is one for whom the ranking of alternatives follows their ranking according to expected payoffs.
12911	2	37	36	37	36	reference Fuss et al 2012 does not exist. Either it should read Fuss el al (2009) or the reference is missing.	Thank you. We have added the reference.
7284	2	37	36			What is "their paper"? Whose paper? Fan (2010)?	That's right. We clarify.
7285	2	37	50			What is the conclusion by Burtraw et at (2010) for a comparison of a symmetric valve with no cap?	I don't think he made that comparison.
2966	2	37	11			this is the first mention of real options -- an explanation would be helpful.	Real options were explained in section 2.3.
4915	2	38	10			[Del] (CERs) that can be accounted [sold] for .. OR: that can be acquired from [sold for]	Thanks. I have made the change.
4899	2	38	14		15	Actually, the long-term price uncertainty was also the consequence of the relatively short period of the ETS (phase2, 2008-12) and the relevant (1st) commitment period under the KP (i.e. the uncertainties about the "continuation" beyond 2012 ..)	Yes, that is right. But this had the effect of increasing the uncertainty with respect to the longer term price of carbon.
4916	2	38	20			[Del] document the analysis the analysis underlying	Thanks. Made the change.
13867	2	38	20			remove repeated 'the analysis'	Thanks. Made the change.
13868	2	38	32			The literature already reviewed' … does this refer to section 2.4.4.1? If so, mention that specifically.	Thanks. Made the change.
7286	2	38	33			giving risk -> giving rise?	Right. Thanks!
3201	2	38	45			Define "feed-in tariffs"	Thnks for noting this. I do so very breifly here, matching the brevity of description of othr instruments, such as cap and trade. I assume that the policy chapters, and the glossary, give a more complete definition. I have done this up above, in terms of writing: There are a number of instruments that focus on this directly, by either supporting RDD&D with public funds, by mandating particular technologies, or by guaranteeing the market for, often at a fixed price (as in the case of a feed-in tariff), for energy that comes from renewable sources.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9495	2	39	3	39	20	in addition to the good influence for TIF in Germany, add the bad influence (Economic impacts from the promotion of renewable energies: The German experience/page 6 lines 3-6)(attached on email)	This is a good point, but tangential to our chapter.
9973	2	39	3	39	20	This part should explain that FIT in Germany had several problems. For example, FIT policy did not lead technological innovation and caused increase of electricity price, as described in (Manuel, 2010, page6 and 13), (Marc, 2006, page 9 and 11), and (Batlle, 2011, page15). <Reference> [1] Manuel Frondel, Christoph M. Schmidt, Nolan Ritter and Colin Vance (2010). Economic Impacts from the Promotion of Renewable Energy Technologies: The German Experience. Ruhr Economic Paper #156(Energy Policy 38 : 4048-4056) . Available at: http://repec.rwi-essen.de/files/REP_09_156.pdf#search='Economic%20Impacts%20from%20the%20Promotion%20of%20Renewable%20Energy%20Technologies' [2] Marc Ringel (2006). Fostering the use of renewable energies in the European Union: the race between feed-in tariffs and green certificates. Renewable Energy Volume 31, Issue 1, January 2006, Pages 1-17 [3] C. Batlle, I.J. Perez-Arriaga, P. Zambrano-Barragan (2011). Regulatory Design for RES-E Support Mechanisms: Learning Curves, Market Structure, and Burden-Sharing, MIT CEEPR WP 2011-011. Available at: http://www.iit.upcomillas.es/batlle/Publications/MIT%20CEEPR%202011-011%20Regulatory%20design%20of%20RES-E%20support%20mechanisms%20v3%20_%20Batlle%20et%20al.pdf	These are good points, but thery are tangential to our chapter. I presume that the chapter on national climate policies will evaluate the overall effectiveness of different instruments, including FITs. Here, we are merely highlighting how different instruments behave differently with respect to uncertainty. The literature is fairly clear that uncertainty has a negative effect on the performance of cap and trade, but less of an effect on the performance of the FIT.
13869	2	39	32			to be most important' … compared to what else?	Thanks. I have added "of those for which there was reason to be concerned."
7287	2	39	42		43	substitution of domestically produced renewable energy for imported fossil fuels -> substitution of imported fossil fuels by domestically produced renewable energy	Thanks.
9798	2	39	45			Behavior is often based on shortterm calculations not taking into consideration a lifecycle perspective.	That is right. For that we need a reference.
9186	2	39	45	40	43	good text. I will refer to this in my chapter 15.	Thanks.
4900	2	39				2.4.4.3 There are also various buyers'/consumers' (mis)perceptions on the durability (lifetime of efficient operation) of new energy-efficient household equipments (like compact fluorescent bulbs) that also motivates the (un)willingness to replace the existing "old" ones.	Perhaps, although I don't see this as an issue having to do with uncertainty.
6080	2	39	45			I wonder whether the descriptions of this subsection (energy efficiency and behavioral change) have anything to do with uncertainty. The main issue is lack of information. In this sense, this subsection may not be necessary for this chapter. Also double checking with Chapter 10 (Industry) will be necessary.	I think that this section could probably focus more in uncertainty issues.
16917	2	4		5		At the moment this has strong overlap (and considerable duplication) with the Introductory section. My sense is that it works better in the latter role, and that the authors might consider a largely fresh approach to Exec Sum in the Second Order Draft. For IPCC Audience, the present Exec Sum does induce a slight reaction of “so what?” from a policy perspective.	The Executive Summary in the SOD will provide the main insights of the chapter
6367	2	4				Througout the executive summary and introduction, the phrase "risk and uncertainty" is used, but neither term is defined. Definitions of these vary, so it's important to identify what is meant herein. I see a definition of "risk" finally appears on p. 47, line 32.	The terms risk and uncertainty are defined at the beginning of the Introduction of the SOD
7218	2	4		6		The executive summary does not contain any results, but only talks about what questions will be addressed. The summary should contain the important meat! Maybe have a science journalist reword it so that it reaches its intended audience (the decision makers?)	The Executive Summary in the SOD will provide the main insights of the chapter

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
2176	2	4	1	30	11	I wonder if we need to incoporate some additonal analysis on value/benefits along side risk/uncertainty in this chapter. If we are talking about policy measures to encourage certain kind of environmental or sustainable behavioral change, then we need to factor in that risk/uncertainty make sense in the context of certain value/benefits. For instance, some recent research published on clean cookstoves show that end users may understand the risks of indoor air pollution associated with traditional cookstoves, but the	Thank you, we now have xpanded the section on risk perception and integrated it more with the methods section
2177	2	4	1	30	11	but the value/benefits of using the newer, cleaner cookstoves do not outweigh the risk/uncertainty of switching to the newer cleaner models.	Thank you, we now have xpanded the section on risk perception
7837	2	4	1	6	5	There is a lot of repetition in these paragraphs. It is suggested to merge paragraphs and to avoid any repetition.	Sect. 2.1.1 is being rewritten for the SOD and has taken this point into account
7838	2	4	1	6	5	It is suggested to avoid terms that are not really common but are used only in a specific context such as "myopic" or "heuristics" as such language would significantly reduce the readability.	These two terms have been entering public and policy discourse, and we have added more references to their use in such contexts, e.g., Sunstein, 2011).
7840	2	4	1	6	5	This executive summary reads more like an introduction but not like a summary of the finding of the assessmernt ogf literature. An indication for that finding is that the executive summary does not include any reference to the underlying sections of the report.	The Executive Summary in the SOD will provide the main insights of the chapter
3894	2	4	1	6	5	A key criticism of this chapter is that it does not address the problems that (1) there are different views about how the future might unfold, and no objective basis for resolving all those differences, (2) people have different attitudes to risk and so would not all agree about the best course of action even if they had exactly the same expectations for the future and (3) politicans and advisers are self-interested parties with their own agendas. Those who feel most strongly about climate change will take the strongest action, individually, or collectively, but the social planner has no objective basis in this chapter for imposing the preferences on that group on dissenting individuals and groups. What is needed is a discussion of decision-making under uncertainty when information is dispersed, costly to collect, individuals differ, and politicians behave like politicians anywhere. Poor policy advice will result if the problem is posited instead as "assume that there is a social welfare function, assume that all useful knowledge about ways and means and incentives can be collected together by a central planner, and assume that politicians will follow the central planner's sage and altruistic advice". None of these assumptions are valid, yet this chapter (eg on page 5) seems to assume that they are valid and that the real problem is that real people don't behave as they 'should'.	Thanks for this comment. Factors (1) and (2) are amply addressed, albeit in somewhat different terms. The discussion of expert judgment emphasizes that experts don't - and shouldn't - agree on future scenarios, and points to methods for validating and synthesizing divergent opinions. 2.3 emphasizes that utility is specific to an individual, which is to say, different people have different utilities and therefore different attitudes towards risks. Re (3), we may presume that almost all parties are self-interested. The problem of balancing diverse and diverging stakeholder interests is at the core of moving from the individual choice paradigm to social choice. Re the social planer, the drift of this chapter is entirely in line with your remarks. Not clear what the 'assumptions on p 5' are, but the introduction is re-written.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8479	2	4	13		19	Importance to consider risk perception in the context of risk assessment, perception and communication (all of which together compose risk management) See for example Guehlstorf "Political Theories of Risk Analysis" Spring 2005	We agree. The chapter addresses how risk assessment, risk perception and communication impact on risk management
7834	2	4	15	4	16	Substitute "choice process" by "decision making process".	Text changed.
4740	2	4	20	4	24	Proposition to replace those 5 sentences by a picture/grapf	Thanks for the suggestion, Text will be rewritten, using a table.
10782	2	4	20		24	subject in line 20 seems to be the same as the one in line 24.	Thanks for the suggestion, Text will be rewritten, using a table.
10162	2	4	20	6	5	Much of this text is repeated almost word for word under Introduction (2.1.1). It seems a bit unnecessary to repeat the same thing twice, in addition it would make more interesting reading if the executive summary was rewritten using its own words.	The Executive Summary in the SOD will provide the main insights of the chapter.
4741	2	4	25	4	36	For the farmer wetness/flood should also be mentioned (not only drought). Furthermore the choice of the crops by the farmer could be lead by market prices (forward, etc.). Regarding the carbon tax, I agree with the statement, however such a tax may create a market distorsion if not implemented in all countries.	The points on the farmer's crop decision and the carbon tax will be taken into account if we use these examples in the SOD.
4695	2	4	25	4	37	Seems like these two sections could be combined and are a bit redundant.	Sect. 2.1.1 has been revised in the FOD so the point is not relevant
7835	2	4	26	4	27	The following langauge is suggested: .. A faremr making decisions on what crops to plant should consider the likelihood …	Sect. 2.1.1 has been revised in the FOD so the point is not relevant
13778	2	4	27			Change 'himself' to a gender neutral term.	Accepted.
4694	2	4	31	4	33	"A government implementing a carbon tax needs to be concerned with the uncertainties associated with its ability to monitor firms' activities and the impact of a specific penalty on firms' actions." It also needs to be concerned particularly with the likelihood that larger level economic forces will lead to the tax not leading to the desired reductions in emissions.	Accepted. The text will be modified accordingly.
6058	2	4	31	4	33	This example is not necessarily relevant. Major uncertainty in introducing carbon tax is the uncertainty of its effec as governments do not exactly know the shape of marginal abatement cost curbe.	Noted. We think the reviewer is saying the same thing as we do, only in technical terms.
7836	2	4	33	4	36	Language is much too prescriptive. A less prescriptive wording is sugegsted, e.g.: National governments might consider climate change scenarios and their associated costs and benefits in terms of investments in mitigation and adaptation.	Good suggestion taken into account in the SOD
8229	2	4	37	4	37	At first reading I thought this is going to talk about the key uncertainties (the nature). I think this paragraph could be clearer. It should clearly state that the stakeholders, policy makers need to understand the key uncertainties in the absence of any policies and how different policies could reduce these uncertainties. The authors cited evidence from studies on cognitive, social, and clinical psychology on risk perceptions of uncertain events (Hume, 2000; 6 Weber, 2006). Are any of these studies related to climate shocks? Or are there any studies based on climate events which can be used to draw lessons in the natural system risk context. How do the hypothetical results of Leiserowitz (2006) (cited in page 13, line 28, chapter 2) compare with studies involving people who have experienced or exposed to climate shocks such as hurricanes? Are there some studies those can be compared to make the argument in the paper? □	Very useful observations. We are not aware of studies of specific climate shocks that use the methodology in the Leiserowitz et al. 2006 paper, but added a suggestion that such studies would be useful in our Future Research section.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6059	2	4	37	5	4	Examples cited as "Key uncertainties and risks that matter for climate policy" are not necessarily the proper ones though they deserve important uncertainties. Key uncertainties and risks should be such as 1) fat tail issue of catastophe risks, 2) relationship between bio-CCS and global food security, 3) uncertainty of immediate participation of all the countries into a global framework under which all the countries assume emission reduction/limitation obligation.	Intro is rewritten
2246	2	4	4	52	22	This Chapter fails to admit that there is no evidence that greenhouse gases have any harmful effect on the climate, so at present the risk is negligible.. The measures listed here are all unnecessary	It is true that we fail to address this issue an omission due to two reasons. First, it is the task of IPCC WG1 to assess the evidence for greenhouse gases having a harmful effect on the climate, and we defer to their judgment. Second, our chapter concerns the effects of a wide range of risks and uncertainties on decisions and policy. Many of these risks and uncertainties concern systems other than the climate, such as technological or governance systems.
8228	2	4	4	4	5	I think there is something missing. Risk and uncertainty of what? Word missing - Earth's climate system? Or the authors intend to say "Risk and uncertainty at various levels – starting from earth's climate system and the effect of GHG emissions to how people react …."	The omission was intentional. Coping with risk and uncertainty in the process of policy-making is an issue that transcends the particular risks or the uncertainties associated with particular systems, such as technological systems or the climate system. In the SOD we are revising the introduction to make this point more clearly.
7833	2	4	4			The following language is suggested: This chapter addresses how to interpret ….	The section has been reworded.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
3187	2	4	4	54	23	The words "risk" and "uncertainty" are used throughout. Give a definition early on, so readers understand what you have in mind.	Good point, Informal definitjions have been established. Following the glossary of the Society for Risk Analysis, "Risk" is gliossed as "The potential for realization of unwanted, adverse consequences to human life, health, property, or the environment;", It can be elaborated ain the fashion of Kaplan and Garrick (1981) in the first article of the first issue of RISK ANALYSIS."uncertainty was defined as "a subjective state of 'partial belief' (i.e. incomplete knowledge)" . Some people objected to "subjective state" and "cognitive state" was an accepltable alternative. -
13779	2	4	44			change 'impact' to 'affect' [in general, the word 'impact' is improperly used in many cases throughout.]	Wording change made in the SOD
13780	2	4	44			remove word 'on'	Wording change made in the SOD
12517	2	4	7			The discussion does not make clear the difference between “risk” and “uncertainty.” Neither does the glossary. It is evident, reading through the draft, that the intended perspective is not the traditional (“Knightian”) distinction between event likelihoods where outcomes can be assessed based on previous experience vs. those where that is less or not possible. But it is unclear what other conceptual view is intended. This should be made explicit so that these terms are understood properly in reading the text.	Thanks, according to Frank Knight (1921) "uncertainty" is subjective probability, and this is amply discussed. Please refer to the response to #3370.
11477	2	4	7	4	9	Circular logic, lack of clarity in the sentence, "risk and uncertainty" is unnecessarily repeated.	Intro is rewritten
13777	2	4	8			remove 'under conditions of uncertainty' which is repeated from the beginning of the sentence.	Intro is rewritten
11478	2	4	4	6	5	The executive summary matches the introduction almost word-for-word. It provides no benefit to the reader because it does not provide alternative explanations for key concepts. The executive summary should be revised to be a more effective summary of the key points of the chapter.	The Executive Summary in the SOD will provide the main insights of the chapter
8913	2	4		9		I find the proposed framework (Section 2.1.1 including Figure 2.1 plus Executive Summary) quite confusing; maybe it is just a matter of the labeling of the various elements. The first element is 'The decision to be made'. This sounds like the decision is at the beginning of the process. Shouldn't the decision be the outcome at the end of all these evaluations? I would as a first step expect the definition of the decision situation and the selection / construction of decision alternatives. Furthermore, it is difficult to understand the differences between the elements. The descriptions for Element 1 (The decision to be made) and Element 2 (Key uncertainties ...) on page 4f and page 7f sound very much alike, both focus on the risks that are associated with a decision alternative. Again, I would expect that Element 1 focuses more on the alternatives and how they are brought into the decision situation rather than specifically on the risks. Further, the labels for Element 2 (Key uncertainties and risks that matter for climate policy) and Element 5 (Risk and uncertainty in climate change policy issues) are almost identical. What is the difference? Element 5 is at the end of the evaluation process. Thus, I would expect that Element 5 captures the result of the evaluation, for example the decision or a rank ordering of the decision alternatives.	The chapter authors have also come to the conclusion that xection 2.1.1, as written in the FOD, was not the most productive. We are reframing it around a number of very different decision-environments, and likely leaving out the figure that you found so difficult.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
4516	2	4				Suggest that the chapter assess the topic of uncertainty and risk associated with climate policies, their testing and maturity, and how such risks factor into investment decisions. This application is relevant to discussions in a range of chapters in this report on Mitigation, whereas the current examples give, e.g., in this chapter's executive summary (what farmers might plant) would be more relevant to a discussion of adaptation in the report of Working Group II. This is touched on in 2.4.4.1 but not mentioned in the Executive Summary.	Thank you. The executive summary is re-written and now better reflects these concerns. However, we must be mindful that judgments of 'testing and maturity' come dangerously to the forbdden zone of policy prescription.
4517	2	4				The Executive Summary reads more like an introduction to the chapter than a summary of key findings. Suggest the summary be shortened and focus on key findings supported by assessed literature.	The Executive Summary in the SOD will provide the main insights of the chapter.
13258	2	4	7	4	9	the sentence is self explanatory, it uses "risk and uncertainty" to define risk and uncertainty. I suggest to end the sentence as follows: "(…) and make choice under no completely controlled conditions or under which some probability of fail is always present."	Introduction is rewritten
4697	2	4	1			Executive Summary could be more specific. As is, it's a bit vague, peraticularly with respect to how to foster better decisions in the face of risks and uncertainty and a-rational decision-making by individuals.	The Executive Summary in the SOD will provide the main insights of the chapter.
12232	2	4	1			The Executive Summary should focus on the key findings of the chapter. And perhaps some of the very well written text in the Summary could be captured in the Introduction.	The Executive Summary in the SOD will provide the main insights of the chapter.
6057	2	4	1	6	5	Citation of examples (always farmers, carbontax etc.) are rather redundant.	We are modifying the examples in the SOD and linking them to Table 2.1
13776	2	4	5	4	5	should read 'uncertainty about', not 'uncertainty in'. The system is not uncertain, our knowledge is.	Introduction is rewritten
4838	2	40	11	40	20	The is a paper coming in the International Journal of Environment and Sustainable Development that analysed the factors that impact willingness to invest in Norwegian household which empirically shows many of the described effects. The reference is Klöckner, C. A., Sopha, B. M., Matthies, E., & Bjørnstad, E. (in press). Energy efficiency in Norwegian households - identifying motivators and barriers with a focus group approach. International Journal of Environment and Sustainable Development. I will send a copy of the paper via comments@ipcc-wg3.de	Thanks.
4712	2	40	21	40	34	Cialdini and colleagues have consistently shown that, faced with System 1 type motivations, people are best motivated to conserve energy by being made aware of what descriptive social norms are (ie, what fractions of "similar others" are conserving energy). By contrast, this section again assumes a "knowledge-deficit" explanation of excessive energy consumption which does not accord with much of the social psych literature's insights. Particularly the claim that: "To encourage households to invest in energy efficient measures, programs need to be developed to highlight the benefits from investing in the energy efficient measure in terms that the household can understand and to spread the upfront costs over time so the measures are viewed as economically viable and attractive." This may be part of the solution but is by no means a complete, or the most effective or cost-efficient, approach.	Interesting.
7288	2	40	3			about their effectiveness -> about their effectiveness.	Thanks. Full stop added
7289	2	40	43			Kunreuther et al. is missing the year	Have inserted (2011) in the SOD
6783	2	40	44	41	29	Add some discusstion about investment diaster reduction will improve adaptation capacity .	This is beyond the scope of our chapter.
12238	2	40	7	40	7	It would have been useful to know which nation the survey is from.	It was from the United States, which is now specified.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8244	2	40	1	40	1	Are there similar studies on developing economies?	When focusing on technologies that promote RDD&D for future pathways for emissions reductions, there is no distinction between developed or developing economies. A technology that reduces emissions in a developed economy will not behave differently in a developing economy.
8246	2	40	12	40	13	There are also studies revealing that consumers not necessarily estimates the fuels economy of cars for example Bento Antonio M., Shanjun Li and Kevin Roth (2012), "Is there an energy paradox in fuel economy? A note on the role of consumer heterogeneity and sorting bias?", Economics Letters 115: 44-48, Allcott, Hunt (2011). “Consumers’ Perceptions and Misperceptions of Energy Costs.” American Economic Review, Papers and Proceedings, Vol. 101, No. 3 (May), pages 98-104.	Interesting, and worth including.
17328	2	40	32	40	34	It will be interesting if the results from the "provision of social norm information" will be explained somehow. Is there something in the literature about "perceptions-reactions-uncertainties" that support/explain this results?	What is the provision of social norm information?
8245	2	40	7	40	10	Please specify on which country the study is based.	The study is based on the U.S. However, the findings are applicable to any country with similarly alternative, but different policy instruments.
4713	2	40	44			This section should discuss the fact that an important deterrent to adaptation is government policy that removes the incentives to adapt. Funding reconstruction of homes in areas that will be increasingly prone to hurricanes (e.g., New Orleans, Florida) sends precisely the wrong signal but involves considerable expense. To the extent that government policy provides "levees and bulwarks" against the impacts of climate change, the need to adapt vanishes. A more pedestrian version of the same thing occurs when we realize that we can "adapt" to climate change by turning the air conditioner on higher rather than moving to cooler areas, taking off our sweaters, or simply getting used to higher temperatures.	This is important, but is tangential to our chapter for two reasons. First, it isn't an uncertainty issue. Second, it would take a lot of space, which we have in limited supply for a topic that is covered in much greater detail in WG2.
14371	2	41	12			Could add Cline (2011, pp. 85-86), which broadly supports the $100 billion Copenhagen figure for 2020.	OK. Thanks!
8242	2	41	30	41	42	While one of the possible negative impacts of climate policy is diminished competitiveness for job creation, it should be noted that climate policy may be beneficial in that it may improve efficiency, spur innovation and create jobs in new market niches such as clean technologies.	That is true, but it is beyond the scope of our chapter.
7290	2	41	32			imply -> implies	Thanks! Done.
2967	2	41				more discussion of adaptation would be helpful, particularly the possible use of RDM to deal with uncertainties.	This would be beyond the scope of our chapter.
14836	2	41				It is worth citing Naomi Oreskes here, on the implications of doubt (and the actors introducing doubt)	I don't understand. Wouldn't theoretical stuff on doubt fit better into 2.2?

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6081	2	41	43			I have a difficulty to understand how this subsection has to do with this chapter that discuss "Integrated Risk and Uncertainty Assessment of Climate Change Response Policies".	It is important to the extent that popular support for policies -- which in democratic societiies is important for the policies' continued success -- is often very sensitive to perceptions of uncertainty.
7291	2	42	45		48	This is not necessarily true in Germany. People seem to be opposed to wind power plants in their neighborhood even though they are generally in favor of wind power. Just not where they live. Further on, there is a huge resistance in Germany to additional long distance power transmission lines, which are needed to transfer wind power from northern Germany (windy) to southern Germany. People believe that proximity to power lines has a negative impact on their health. I don't know of any studies, just newspaper reports.	I share your knowledge of the newspaper accounts. It would be very helpful to have a peer reviewed cite; I have tried to cover the citations that do exist.
4901	2	43	1		23	Concerning CCS, safety and liability related issues are extensively discussed within the CCS-regulation (CCS-directive) of the EU.	Certainly the safety issues are dealt with by the directive. But that doesn't put the issue to rest, first because mainy countries (e.g. Germany) have failed to fully implement the directive, and second because the directive may have little effect on perceptions of risk.
12616	2	43	11	43	15	There are many more projects that have had neutral to positive public support than have negative. This section implies that it is 50-50.	Can you provide a reference on this? I would love to be able to write this. We have not tried to suggest anything like 50/50.
12659	2	43	11	43	15	There are many more projects that have had neutral to positive public support than have negative. This section implies that it is 50-50.	Can you provide a reference on this? I would love to be able to write this. We have not tried to suggest anything like 50/50.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9273	2	43	13	43	15	The statement that "No research has been undertaken to date that identifies the drivers of public concern or acceptance" is not correct - please refer to the following publications: • Itaoka, K., Saito, A., Paukovic, M., de Best-Waldhober, M., Dowd, A-M., Jeanneret, T., Ashworth, P. & James, M. 2012. Understanding how individuals perceive carbon dioxide: Implications for acceptance of carbon dioxide capture and storage. CSIRO Report EP 118160, Australia., http://www.globalccsinstitute.com/publications/understanding-how-individuals-perceive-carbon-dioxide-implications-acceptance-carbon o Newly published report from CSIRO which looks at individual perceptions of CO2 in Japan, the Netherlands and Australia and relating understanding of CO2 to people's perceptions of CCS, in order to determine how information provision about the underlying properties and characteristics of CO2 influences individual attitudes towards low-carbon energy options, particularly CCS. • Ashworth, P. Bradbury, J. Feenstra, CFJ. Greenberg, S. Hund, G. Mikunda, T. and Wade, S., 2010, Communication, project planning and management for CCS projects: an international comparison, CSIRO, Australia, www.globalccsinstitute.com/publications/communication-project-planning-and-management-carbon-capture-and-storage-projects-inter o Very large piece of research that we published in 2010 that took 5 detailed research reports into 5 early CCS demonstrations from around the globe looking specifically at their engagement activities, successes and challenges, communication and project management, then did a comparison of the international projects to come up with a set of key recommendations to improve projects handling of public concern and engagement opportunities. • de Best-Waldhober, M., Daamen, D. and Faaij, A. 2008, Informed and uninformed public opinions on CO2 capture and storage technologies in the Netherlands, International Journal of Greenhouse, Gas Control, 3(3): pp. 322-332. o This work is often cited to help explain some of the drivers behind public behaviour. • Wade, S. and Greenberg, S. 2011, Social Site Characterisation: From Concept to Application, A review of relevant social science literature and a toolkit for social site characterization, CSIRO, Australia, www.globalccsinstitute.com/publications/social-site-characterisation-concept-application o This has a really good social science literature review with some interesting work on perceptions of CCS and then provides tools to help projects work out the likely drivers behind their own communities drivers of concern or acceptance.	Thank you. The staement you noted was incorrect, and even contradicted many of the citation in the following sentences: it was left over from the ZOD. I have removed it.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9274	2	43	13	43	15	The statement that "No research has been undertaken to date that identifies … anticipated risk levels associated with CO2 storage" is not representative of the available evidence. For example, there are a number of technical Front End Engineering Design (FEED) studies from demonstration projects that analyse the risks associated with CO2 storage. For example, please refer to: • Bradbury, J. Greenburg, S. and Wade, S. 2011 Communicating the Risks of CCS, Wade LLC, US, www.globalccsinstitute.com/publications/communicating-risks-ccs Further, additional reading on related topics can be found at: • Transalta, 2011, Canadian and Albertan perceptions of carbon capture and storage, Global CCS Institute, Australia, viewed on 09 July 2012: http://cdn.globalccsinstitute.com/sites/default/files/publications/27611/public-perceptions-report-2010-polling-results.pdf o Further discussion of the Transalta results can be found at: http://www.globalccsinstitute.com/community/blogs/authors/staceyhatcher/2012/01/12/insights-public-perceptions-ccs-%E2%80%94-alberta-story • Ashworth, P., Jeanneret, T., Stenner, K. & Hobman, E.V., 2012, International comparison of the large group process. Results from Canada, Netherlands, Scotland and Australia. CSIRO: Pullenvale, http://www.globalccsinstitute.com/publications/international-comparison-large-group-process-results-canada-netherlands-scotland-and o This is a comparison of four more detailed reports which provide a lot of detail on stakeholder drivers • Eurobarometer, 2011, Eurobarometer Survey on Public Awareness and Acceptance of CCS, Special Eurobarometer 364, DG-Research, http://ec.europa.eu/public_opinion/archives/ebs/ebs_364_en.pdf o CCS was included in one of the EC's big societal survey's – this gives some pretty interesting data on public knowledge of CCS that you can extrapolate information on concerns/ acceptance from	Thank you. The text has been revised accordingly.
12617	2	43	2	43	2	This is an extremely old reference. More up to date references for CCS should be used. Since 1997 4 large scale (around 1 million tonnes stored per year) have commenced operation.	Thanks. But I don't see how the existience of storage facilities necessarily changes the validity of the findings of the paper.
12660	2	43	2	43	2	This is an extremely old reference. More up to date references for CCS should be used. Since 1997 4 large scale (around 1 million tonnes stored per year) have commenced operation.	Thanks. But I don't see how the existience of storage facilities necessarily changes the validity of the findings of the paper.
11523	2	43	20	43	21	The use of the phrase "NIMBY" or Not In My BackYard, is politically charged and inappropriate for a scientific publication because it portrays localism as self-serving and parochial, rather than a caring for one's own habitat. A "sense of place" or "homeland" is very strong in many indegenous/local communites and they have prevented environmental degration.	You are right. I have deleted the term NIMBY.
3315	2	43	27	43	27	"Future development pathways" is vague. A more concrete paraphrase to accompany the technicality should be found, if possible.	I can't find the words you are describing.
7292	2	43	28		30	Sentence unclear	Thanks. Added "those people" after "with"

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8414	2	43	41	43	42	“This model … the truth”. This seems to be simplistic: there is not only one reason behind the public refusal to accept a firm scientific consensus. But it is hard to believe that the industry-sponsored mass disinformation campaigns have no effect at all. The text seems to make a caricature of the problem in order to dismiss the importance of the industrial pressure on politics.	Thank you.
11724	2	43	43	43	45	I feel that IPCC itself seems to complain about public opposition by using this citing. It's good to be deleted.	Thank you.
10638	2	43	43	43	45	Public opposition to the IPCC consensus on anthropogenic climate change has been attributed to the fact that IPCC sometimes calused serious misunderstandings among decision makers, climate negotiators and mass media, which may hjave misled climate negotiations, espcially with respect to the target of the response strategies. This is what Yamaguchi et al argues in the chapter 11, Epilogue, IPCC and Communication of Climate Change Mitigation A Balanced Approach to Climate Change	Thank you.
9974	2	43	43	43	45	This part should be deleted completely because the expression of "industry-sponsored scientists" is too subjective and there is no evidence for the fact.	Thank you.
6082	2	43	43	43	43	The citation of Oreskes and Conway 2010 is inappropriate. Firstly the expression "IPCC consensus" is inappropriate and misleading. IPCC's official expression is "Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations. It is likely that there has been significant anthropogenic warming over the past 50 years averaged over each continent (except Antarctica)" (refer to Page 5 of SPM of AR4). Secondly there are literatures that disagree to this citation. If Chapter 2 team wish to hold this citation, the team have to cite literature from other camp for the sake of IPCC's neutrality.	Thank you.
14837	2	43	46			It is not clear why the Oreskes and Conway analysis is equated with a simplistic linear model and then dismissed. It is relevant fron the standpoint of the public opinion and commitment of policy makers, even if it is not the sole determinant.	Thank you.
4917	2	43	6		7	"If storage under the land were prohibited, then the industry would have to 6 turn to the more expensive option of storing under the sea floor." This statement is abs. irrelevant here.	You are right. I am deleting the sentence.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8412	2	43		45		This section fail to consider an important issue, the influence of disinformation campaign organized by industrial lobbies on how uncertainty is considered by policymakers, and how a “manufactured uncertainty” is used as a tol to block or to delay climate mitigation policies. Although it is true that the science-policy interface is indeed complex, many works have highlighted the importance, for the science–policy interface, of the influence of vested interest, and their practice of manufacturing controversy to avoid pro-climate regulations. It is useful that the AR5 and in particular this Chapter describe and underline these tactics, because still today they are important to understand how uncertainty is considered by policymakers, how they shape the debate and how they are effective in slowing new climate legislation.. As an example, some of the deniers’ tactics used are: • manufacturing uncertainty by raising doubts about even the most indisputable scientific evidence. • promoting scientific spokespeople who misrepresent peer-reviewed scientific findings or cherry-pick facts in their attempts to persuade the media and the public that there is still serious debate among scientists that burning fossil fuels contribute to global warming and that human-caused warming will have serious consequences. • attempting to shift the focus away from meaningful action on global warming with misleading charges about the need for “sound science.” Like Big Tobacco before them, many Big Oil lobbies have been enormously successful at influencing governments and Parliaments, thus blocking regulation on climate. Documents highlighted in many reports provide evidence of oil industry corporations’ cozy relationship with government officials, which enable them to work behind the scenes to gain access to key decision makers. In some cases, industrial proxies have directly shaped the global warming message put forth by federal agencies.	These are very good points, which revisions to the section are broadly addressing.
8413	2	43		45		I suggest to rewrite the entire paragraph framing it in a more complete, and to update and broaden the references. I suggest to add the following references. Gelbspan R. (2004) Boiling Point, Basic Books Hansen J. (2010) Storm of my grandchildren. Bloomsbury; see Chapter 1, 2 and 3 Hoggan J., Littlemore R. (2009) Climate Cover-up, Greystones Mann M. (2012) The Hockey Stick and the Climate Wars, Columbia University Press; see Chapter 7 and the following Michaels D. (2005) Scientific evidence and public policy. Am J Public Health, 95, Suppl 1, S5–7. Mooney C. (2005) The Republican war on science. Basic Books Union of Concerned Scientists (2007) Smoke, Mirrors & Hot Air. Union of Concerned Scientists (2012) A Climate of Corporate Control. Other important aspect are discussed in this Nature editorials: Science scorned. Nature editorial, Vol 467, 9 September 2010 Climate of suspicion. Nature editorial. Vol 463, 21 January 2010 Climate of fear. Nature editorial. 464, 11 March 2010.	These are very good points, which revisions to the section are broadly addressing.
3316	2	44	4	44	13	The title -"Preferences and perceptions" here is also vague, and perceptions are not even mentioned in the explanation.	Thank you.
3202	2	45	1		6	"civic epistomologies" and "linear model" too much jargon	Thank you.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8415	2	45	3	45	4	The conclusion of this paragraph is based on the works of only one author (Jasannoff, 2010) and for this reason the conclusion seems again too simplistic; although it could be true that the “linear model” is not adequate, the importance of industry lobbies in confusing policymakers and blocking climate legislation could not be dismissed so easily.	Thank you.
7293	2	45	4			What is linear model?	Thank you.
6886	2	46	1			We'd like to add a word of caution regarding the possible "reinterpretation" agreed Guidance Note on Uncertainty.	We rather refered to some sort of 'spelling-out' for WGIII and will change the wording accordingly.
13870	2	46	11			Jonassen and Pielke (2011) provide a comprehensive survey of disparities in the application of uncertainty metrics in AR4. Jonassen, R.G. and Pielke, Jr., R., 2011, Improving Conveyance of Uncertainties in the Findings of the IPCC, Climatic Change, Special Issue: Guidance for Characterizing and Communicating Uncertainty and Confidence in the Intergovernmental Panel on Climate Change. Volume 108, Number 4 / October 2011 745-753. DOI: 10.1007/s10584-011-0185-7	Thanks for the reference. The uncertainty box is extended a bit to include this information.
6887	2	46	17	46	19	We'd like to add a word of caution regarding the possible "reinterpretation" agreed Guidance Note on Uncertainty.	We rather refered to some sort of 'spelling-out' for WGIII and will change the wording accordingly.
6379	2	46	25			What is M11? Mastrandrea et al. 2011?	yes, indeed; somehow, the definition of the acroynum had been eliminated. It will be re-introduced.
4617	2	47	35	47	35	This is the first time in the chapter that the word irreversibility is mentionned and this in a context which differs from the one for the main argument	We shall refer to it earlier.
7294	2	47	4			Case -> In case	Will be implemented!
7295	2	48	43			Fig. 3 -> Fig. 2.3	Thank you. Correction has been made.
7296	2	48	45			Fig. 3 -> Fig. 2.3	Thank you. Correction has been made.
7297	2	49	14			Fig. 4 -> Fig. 2.4	Thank you. Correction has been made.
7298	2	49	21		22	Fig. 3 -> Fig. 2.4	Thank you. Correction has been made.
3066	2	5				“Myopia” is advocacy, not science, and discredits the report. A serious case has been made (by Lomborg, and others) that the possible benefits of emission reductions are not justified by their costs.	We disagree. The concept of myopic behavior has been shown to characterize decision making under uncertainty as detailed in Sect. 2.2
13781	2	5	10		11	This example mixes reference to 'risk' and to 'probabiliby.' This leaves out the 'consequence' part of risk without explanation.	This § will be re-written and the reviewer's comment be taken into account.
13782	2	5	11		15	A better example is short-term coastal investment that ignores long-term loss of that investment due to sea level rise	This is another nice example that illustrates a focus on short-term horizons that we may consider using in the SOD

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8231	2	5	11	5	15	In the example provided on the coastal village taking the wrong decision, two key components may lead to taking a bad decision: 1) uncertainty and risk about future benefits of protecting against sea level rise, and 2) preference for present vs future welfare and risk aversion, which are determined by the discount rate chosen to discount long term benefits. In this case, it seems like it is discounting (preference for present over future) which impacted their decision rather than uncertainty and risk. If the example is about risk and uncertainty, it should be made clear that the coastal village took a bad decision because of uncertainty and risk over future benefits rather than due to how those were discounted. As such, the sentence "A coastal village may decide not to undertake measures for reducing future flood risks due to sea level rise because they focus on the next few years" could be replaced by "A coastal village may decide not to undertake measures for reducing future flood risks due to sea level rise because most benefits, which occur in the long term, are more uncertain than the required short-term investment costs".	The example in the SOD is revised to reflect these points
3899	2	5	11	5	12	Is the coastal village a real example or a hypothetical one, and what is the basis for assuming that the villagers are using the wrong discount rate and the unamed persons assessing what the 'long-term discounted benefits' really are using the right discount rate?	The example is hypothetical and has been revised so that discount rates are not discussed
3900	2	5	15	5	17	As posited, this would be rational behaviour by firms, being neither myopic normisperceiving risks.	Good point. The example has been moved to the discussion of Decision Tools for Making Better Choices in the Introduction.
6060	2	5	15	5	17	This is not necessarily a proper example. This may not apply to developed countries.	Examples are not direct related to the developed world. Most people live in developing countries. Nevertheless, examples have been reviewed and changes have been introduced.
3901	2	5	17	5	19	Again this would be rational behaviour by governments. The imperative of an incumbent government is to get re-elected. This imperative is illustrated by the common (smug) saying that perceptions are more important than reality in politics.	Government behavior with respect to postponing mitigation measures may be rational for the reason stated due to the wait and see attitude of the public regarding climate change, which is how it is now presented in the SOD.
8230	2	5	2	5	4	The sentence should also note that uncertainty and risk impact policy development also on the adaptation side.	We will augment the text accordingly.
4696	2	5	25	5	41	This section on decision tools basically relies on rational models, failing to pick up on the psychological/not-economically-rational aspects of decision-making that the previous section alludes to.	Intro is rewritten
18444	2	5	25		35	Same text repeated on page 8, from line 34 to line 44	The Executive Summary in the SOD will provide the main insights of the chapter
7839	2	5	27			It is suggested to use throughout the paragraph the same term for the same content. Models and tools are not synonyms; therefore it is suggested to substitute "models" by "tools".	Agreed. We will implement the suggested changes.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
14822	2	5	33			"… while governments debating the merits of a carbon tax may turn to cost-benefit analysis." This implies that CBA can be used to help determine the optimal tax, by optimizing mitigation costs against the benefits of reduced impacts. This is a poor example of trying to match a decision type with its appropriate decision tool. The uncertainties associated with the magnitude of climate impacts, the inherently value-laden judgements, the intergenerational dimension, the fact that this is a commons problem that requries mitigation action with costs exceeding the immediate benefits... all suggest that CBA is an inadequate tool for setting a tax rate. Perhaps CEA, though.	Text has been modified.
12518	2	5	40			Add after “management” -- “game theory, group process,”	Intro is rewritten
3902	2	5	42	5	42	The text should make it clear that its normative proposition applies to policy advisers. Political decision-makers will of course adopt policies that are likely to help them get re-elected.	The text in the Introduction now reads “Policies should be designed…” to reflect this point.
14523	2	5	47			As part of broader treatment of risk management, this chapter might focus more on decision structuring, framing, and the setting of goals and objectives. Towards that end, the authors might use a more general statement of objectives here, rather than a specific set of policy proposals focused on greenhouse gas emissions and concentration targets.	The role of goals and objectives is noted in the Introduction under Problem Formulation and is discussed in more detail in Sect. 2.2 where concepts of decision structure and framing are also introduced.
4742	2	5	5	5	19	Does this paragraph state that politics have too short term vision (as a long term is expected/requested?). The role of decision makers is to reconcialiate short term and long term vision, and have an adequate communication on it. For instance industrial need such a long term vision in order to invest in the most appropriate technology in the industrial process. However most of the time there is a gap between financial viability and economical viability (due to this lack of long-term vision or/and un-match of short-term and long term visions)	Interesting points on short term and long-term vision that will be taken into account in the SOD
18443	2	5	5		19	Same text repeated on page 8, from line 12 to line 26	The Executive Summary in the SOD will provide the main insights of the chapter
3895	2	5	5	5	10	This review of the literature does not establish that it is irrational (ie sub-optimal) for people to use rules of thumb or 'simplistic heuristics in choosing between alternatives. Time is scarce and analytical resources need to be directed at where the costs of being wrong at likely to be the most serious. If there is a literature that purports to establish that people systematically and commonly en masse repeatedly make the same bad decisions, failing to learn from experience or to consult experts, or to use warranties and insurance policies to manager isks, that should be cited here since it is novel and controversial, as far as individuals are concerned. (Such behaviour - the failure to learn from one's own mistakes - is one definition of insanity.) Another difficulty with this theory is that it negates the basis for any public policy based on the assumption that people will respond to it rationally. On the other hand, politicians in democratic socieities have perhaps the strongest incentives to be myopic -as illustrated by the UK Economist magazines famous phrase - a week is a long time in politics and Harold Wilson on a turning circle would rival a London taxi'. It would be odd if the paper discusses short-termism in private behaviour but not in pubic political behaviour.	We could not agree more with all of your comments, and now have much more explicit treatment of the behavioral reality vs. rational-economic fiction of decisions and actions at ALL levels of analysis, from consumers to policy makers. See our new Table 2.1. We also now preview that such arguments will be made in the section you are responding to.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
3896	2	5	7			The representations of individual behaviour in economics (eg welfare economics and public choice theory) are positive, not normative. The Arrow-Debreu model is not a theory of how people should behave.	there are differences in the way these terms are being used by different communities. Normative is defined by wikipedia as follows: Normative - Wikipedia, the free encyclopedia en.wikipedia.org/wiki/NormativeNormative has specialized contextual meanings in several academic disciplines. Generically, it means relating to an ideal standard or model. People often refer to your definition of normative as "prescriptive."
3898	2	5	9	5	10	Farmers who take the wrong decisions (as evaluated by themselves) because they are ill-informed about the risks are not behaving inconsistently with any positive model of optimising behaviour in economics.	Point noted.
18441	2	5	9			TO READ-Decision Makers tend to make myopic action plans that utilize simplified methodologies.	This sentence in the SOD will be modified to reflect this suggested change
17700	2	5	5	5	18	Economic agents tend to use the known Keynes saying…. "In the long run we are all dead"	Point noted.
7299	2	50	3			add exact citation for source of Figure	The section has been edited.
5227	2	52	19			It could be stated that the aim of the metrics is to help the climate policy by providing a clear indicator which measures the greenhouse gas emissions in commesurate units (e.g. CO2 equivalents) for the goal-setting and follow-up of the climate policy. Thus the metrics should be formulated so that it serves the climate policy. The ultimate objective on the UNFCCC (Article 2) is twofold: stabilization of ghg concentrations and limiting the speed of change (sufficient time-frame to adapt). Thus this two goals cause challenges for metrics especially concerning relevant policy time horizon. This discussion could be given here.	The intention of the metrics is stated in the intro of the IPCC Uncertainty Guidance Notes Mastrandrea et al., 2011: 'These guidance notes are intended to assist Lead Authors of the Fifth Assessment Report (AR5) in the consistent treatment of uncertainties across all three Working Groups. These notes define a common approach and calibrated language that can be used broadly for developing expert judgments and for evaluating and communicating the degree of certainty in findings of the assessment process.' We cannot change it for AR5. however we are convinced they will serve their purpose as policy makers need to receive information about the level of confidence in and uncertainty of statements.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
5228	2	53	37			Please add after "approach" the words "and in the case of GTP100 the cost increase is clearly greater" (Ekholm et al.) EKHOLM, T., LINDROOS, T.J., SAVOLAINEN, I. Robustness of climate metrics under climate policy ambiguity. Submitted for publication in Climatic Change.	We will read this paper and decide whether to include it in the next draft.
15470	2	58	22			This section was more technical than the previous sections that described the other tools. This made it harder to understand. Suggest either simplifying or adding more explanations.	This section has now been simplified.
15471	2	59	28			Reading between the lines, it sounds like there is a limited number of studies that use this tool. Also the uncertainities on what it can and can't do are greater. This should be mention in the text.	Thank you. The text has been revised accordingly.
8116	2	6	10	6	15	The phrase suggests a (single) causality of risk and uncertainty on the one hand and choices on the other. It neglected the complexity of choices and the fact that risk and uncertainty play often minor roles in decision making.	We will augment the text to some extent along those lines.
13785	2	6	10			change 'impacts' to 'affects'	Wording change made in the SOD
13786	2	6	10			remove word 'on'	Wording change made in the SOD
11482	2	6	10	6	11	Again, this sentence does not make sense, risk and uncertainty at the end is redundant	Intro is rewritten
13784	2	6	11			remove 'under conditions of uncertainty' which is repeated from the beginning of the sentence.	Intro is rewritten
13787	2	6	12			change 'impact' to 'affect'	Wording change made in the SOD
13788	2	6	12			remove word 'on'	Wording change made in the SOD
10160	2	6	12	6	15	The second sentence is more or less a repetition of the first sentence.	The Introduction in the SOD deals with this comment
11483	2	6	16	6	30	These are all good examples, but perhaps consider including an examples that describe the concerns of indigenous/local communites? The arcitc and alpine regions of the world are places where these impacts are being strongly felt.	Accepted. Appropriate examples will be added as suggested.
14524	2	6	18		19	This chapter uses many examples for climate-related decisions from the IAV community. That is good, but I suppose there should be at least some acknowledgement that these decisions are also addressed in WGII. More interesting would be a discussion of how IAV and decisions focused on limiting the magnitude of climate change are similar and different.	The text will be modified as suggested.
4743	2	6	2	6	2	Not only economical, but also financial is important … as the financial issue is the first indicator for an investor	Financial considerations are subsets of economic considerations. In terms of public policy, the focus of the social planner is on the economics of the policy. We have included the financial as well as economical to appeal to private investors.
4903	2	6	25			{Add} greenhouse gas {}emission reduction goals	Thank you. The word 'emissions' has been included.
4904	2	6	28			{Add} next {}session of the Conference of the Parties	Thank you. We have made the correction accordingly.
4905	2	6	30			National delegates to the COP are negotiation about ??	Thank you. The word 'negatiation' has been changed to 'negaotiating'
11484	2	6	30			Should be negatiating rather than negotiation	Thank you. The correction has been made.
7219	2	6	30			negotiation -> negotiating	Thank you. The correction has been made.
13789	2	6	32			This is not a bullet item. It should be given as a new paragraph	Thank you. The bullet has been deleted.
11485	2	6	32	38		This paragraph should not be a bullet point	Thank you. The bullet has been deleted.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6365	2	6	32	6	38	Final bullet should be unbulleted paragraph as it describes the bulleted points above.	Thank you. The bullet has been deleted.
14525	2	6	33			Are you concerned with “uncertainties associated with climate change” or “uncertainties that affect climate-related decisions”? This chapter text seems to sometimes focus on the former and sometimes on the latter. I think you want to focus on the latter.	We agree with you that we want to focus on the latter. The former, of course, is a subset of the latter, which can make it easy to get confused. We are attempting to avoid such confusion in the SOD.
4609	2	6	6			The Introduction clould be shorter	We have revised the Introduction but given our objectives of highlighting the purpose of this chapter we have not condensed it but tried to make it more relevant to Chap. 2 and the other chapters in the report.
4698	2	6	6			A propos of above, there should be a line between the "Risk perception…" and "Decision tools…" boxes. That is the connection that isn't being made here.	We have kept these two boxed separate to highlight the relevance of both normative and descriptive analysis for risk management where they do come together.
6882	2	6	22	6	23	While this is an example, this is formulated as a projection incl. an attribution to a cause -- Reference to WGI (Chapter 13), WGII and/or SREX needed to provide the necessary evidence supporting this general statement.	Absolutely right. We are removing this and the other examples from the FOD, and instead basing them on actual choices identified by other chapters in the WGIII AR5.
5388	2	6	32	6	38	This part should be not included in the bullets (no bullet for this part)	Not relevant given the revised Introduction of the SOD.
4699	2	6	39			Exec summary should not be cut and paste of this section -- they should differ.	The Executive Summary in the SOD will provide the main insights of the chapter
13783	2	6	8			should read 'uncertainty about', not 'uncertainty in'. The system is not uncertain, our knowledge is.	Intro is rewritten
4041	2	7				The model depicted in Figure 2.1 aims to illustrate the interconnections (broadly speaking) between some of the main elements of decision-making under uncertainty. However, the model appears as uni-directional and too simplistic/reductionist, with no reference(s) or mention of how this model relates to what is now published in the wider literature on decision-making and policy formulation of 'wicked' societal problems such as climate change (highly complex, and hardly ever linear as depicted). Perhaps this section should just discuss these elements in the narrative, rather than illustrating them along a linear progressive axis/proceess (which is misleading).	Both the figure and the chapter have changed a lot in response to this and many other helpful reviewer comments, and now hopefully reflect the complexity of climate mitigations and the literature on complex decisions much better

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
2155	2	7				The approach in this chapter starts with a step (or box in Figure 2.1) of "the decision to be made." I presume that the authors have other steps preceding this step in mind including defining the context or the objective. For the farmer, used as an example in this chapter, an objective might be to maximize yield or return on investment or some other objective. The objective drives the decision to be made and the alternatives requiring consideration. Ayyub (2003) offers several methods to help users, such as the contributing factor diagram method that starts with defining an answer variable. The ISO definition of risk as the "effect of uncertainty on objectives" requires this definition of objectives as a starting point. Reference: Ayyub, B. M., Risk Analysis in Engineering and Economics, Chapman and Hall/CRC, 2003.	Figure 2.1 starts with Problem Formulation where goals and objectives are discussed
8390	2	7				This figure needs to be more clearly explained and defined. What do arrows mean? What is the role of the boxes?	The Problem Formulation box in Fig 2.1 notes the importance of formulating goals and objectives as an input into the descriptive and normative analyses and the risk management process for developing climate policies.
4906	2	7				Fig 2.1: I guess that "(normative analysis)" to be added to the 4th box	Done
16918	2	7		7		I can see the structuring value of Figure 2.1 but it does seem a little odd to have the prime structuring Figure without an obvious specific "place" for the actual decision-maker; also am not clear on relationship of the first two boxes (try running a "shall I insulate my house?" decision through this …). It might be useful to compare against Triandis' theory of decision making, as also elaborated and applied to climate change in DECC (2011). DECC (UK Department of Energy and Climate Change) (2011) An introduction to thinking about 'energy behavior': a multi Model Approach. http://www.decc.gov.uk/assets/decc/11/about-us/economics-social-research/3887-intro-thinking-energy-behaviours.pdf Last Accessed September 4, 2012	Fig 2.1 has been modified so that the Problem Formulation box considers the institutional arrangements and the relevant decision makers noting their goals and objectives.
8480	2	7				What is "better" in this context? Highly ambiguous and political - can imply efficiency, efficacy, political utility or vote maximization - needs more precision.	Intro is rewritten
13790	2	7				Box on 'Decision Tools' could also list 'Normative Analysis' in parentheses in same form as box on 'Risk Perception'	Wording change made in the SOD
7222	2	7				more specific examples, e.g. communities in Japan that built high enough wall against tsunamis vs. those that did not.	This example would fit better in WGII but we will consider it.
8117	2	7	1	7	1	Not only tools but also procedures should be integrated in this framework.	Intro is rewritten
8710	2	7	10	7	30	The preparation of technical manuals containing simple and cheap technologies to be applied as adaptation measures to climate change can help communities to make decisions about the implementation of more efficient strategies. For this, it is necessary that the manual is written in accessible language to people at all levels of schooling. As an example, we can mention the book prepared by the Bank of Brazil Foundation (Fundação Banco do Brasil http://www.fbb.org.br/), with the title Water and Climate Change - Social Technologies and Community Action (the book follows as additional material attached) which contains numerous technologies supported by the founding members and aims to bring these technologies to a greater number of communities in order to make the means of production and consumption of these communities more sustainable and adapted to possible problems caused by climate change.	While this subject is not direclty relevant to the chapter, we are conscious of the need to use language that is accessible to the reader.
7221	2	7	14		17	very similar to lines 20ff	The revised Introduction addresses this point

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
11487	2	7	19	7	19	Change 'Figure 1' to "Figure 2.1'	The Executive Summary in the SOD will provide the main insights of the chapter
4627	2	7	2	7	3	I find figure 1 less than compelling. Any decision made under uncertainty (or risk, the terms are essentially interchangeable) has two components: the technical nature of the risk, and the individual's behavioral response to risk. The technical nature of risk might be determined objectively, as in games of chance, or subjectively as in most other situations. Even when there is a large amount of (objectively agreed on) relevant data, most assessments of technical risk involve subjectivity. This is particularly true when events are in the distant future, when forecasts by their nature are less accurate. Most work on estimating forecast error (which determines technical risk) is based on models that are stochastic and linear-in-parameters. Climate models are nonlinear deterministic models for which estimating the forecast error is usually done by perturbing initial conditions and this is not the only source of forecast error. Behavioral response to risk is innate to the individual and is almost certainly influenced by the nature of the event. For example, a person may be more risk averse in emotional settings than in making business decisions. While it is possible to determine a person's risk preference function, it is not necessary to do so if the individual is simply asked to choose between a pair of risky scenarios. When an individual's risk preference function is established it is possible to determine biases in decision making compared with what a rational decision-maker would do, though for future events the rational decision depends critically on the personal discount rate. The only way there is a feedback loop in this setting is if the decisions made by an individual or an aggregate of individuals do not result in the outcomes desired by policymakers. In other words, when estimates of optimal action based on estimates of technical risk and individuals' response to risk do not actually occur, then a policymaker is likely to change the "rules of the game" e.g., by changing the tax or subsidy structure, or changing the regulatory mix, to push decision-makers in the desired direction.	The rationale for Fig 2.1 is to highlight how behavioral considerations need to be coupled with normative analysis to develop risk management strategies for the problem formulation phase The revised Introduction makes this point clearer. Now that the initial box is labeled Problem Formulation the feedback can come from various inputs to the risk management process.
11479	2	7	2	7	3	Relationships between the elements of in this diagram are not clear. Arrows do not seem to indicate causality, nor do they seem to represent a processes of analysis or decision-making. The figure presents a model which is quite linear, although in reality, different factors will be influencing each other. For instance, Figure 2.1. seems to have a break in its logical flow when it reaches the last element. Facing a decision is to be made, the decision maker evaluates key uncertainties and risks that include, on the one hand, risk perception and behavioral responses, and on the other, decision tools under risk and uncertainty. The logical continuation would be the outcome of this decision making process and that is the decision itself or at least some measure or policy. However, the last element restates risk and uncertainty, and therefore, the diagram resembles a tautology. Furthermore, the chapter does not reveal any additional insights as to relationships between these elements.	Figure 2.1 has been relabeled and revised in the revised Introduction so that the first box is Problem Formulation and it should be clearer to the reader that both Descriptive and Normative analyses feed into the Risk Management process with feedback to the Problem Formulation phase.
11480	2	7	2	7	3	It is unclear why "Risk perception and behavioral responses…" are combined. It would be useful to discuss these topics separately (later in the chapter) and illustrate them as distinct elements here.	This section heading was specified by the IPCC scoping conference. The chapter does discuss them as distinct elements, and perhaps better so in its revision.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
14527	2	7	2		4	Do you want to use the word “climate policy” or “climate-related decision"? The former is much more narrow category than the latter. For instance, the recent increase in U.S. auto fuel-efficiency standards is certainly a climate-related decision, though less often explicitly identified as a “climate policy.”	We focus on climate policy, but the definition of climate policy that we have used so far is the one from the AR4, and is quite expansive. While there is no glossary entry for "climate policy," the Executive Summary of the AR4 WGIII CH3 states: "The literature on climate change continues to reflect the wide variety of national policies and measures that are available to governments to limit or reduce greenhouse gas (GHG) emissions. These include regulations and standards, taxes and charges, tradable permits, voluntary agreements, subsidies, financial incentives, research and development programmes and information instruments." This would then include things like the CAFE standards.
14526	2	7	2 & 7		4 & 19	One of the most important initial steps in a risk management process is identifying and, when possible, agreeing on goals. This figure and text ought to be revised to include this crucial step. A clear statement of goals is important for individual decision-making. It is even more important for climate-related decisions, many of which will be group or organizational decisions.	The Problem Formulation box in Fig 2.1 notes the importance of formulating goals and objectives as an input into the descriptive and normative analyses and the risk management process for developing climate policies.
7220	2	7	3			label the arrows or leave the figure out	We are leaving it out.
7223	2	7	42			What is the difference between cost-effectiveness vs. cost-benefit analysis?	We have two separate sections explaining each of the two concepts. 2.3.2 and 2.3.3. These concepts are also defined within Chapter 3
8118	2	7	7	7	19	Quite a few examples in this chapter are too simplistic and misleading. This is only one example: 1. For farmers it is daily business to make decisions about which plants should be planted next season. 2. The grow conditions of plants on a seasonal basis are most dependent on the weather and almost not dependent on climate change. 3. Other variables like soil quality, marked price and cultivation technique are much more relevant as climate change. So, for an individual farmer, the seasonal planting decision does not have to be influenced by climate change. Only irreversible or long-term decisions like investments or policies are sensitive to climate change. This is only an exemplary comment that all examples have to be proved on their realistic relevance for the scope of this chapter.	Thanks, some examples have been changed or improved, see SOD. Weather changes with CC and climate variability. CC may change soil quality and cultivation techniques

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
16919	2	7	7		19	Linked to the above: The key problem here is not so much the range of decisions, but the range of decisionmakers. My sense is that it may be important to separate out (1) private decisionmakers, (2) government decisionmakers on internal policy decisions, and (3) decisionmakers and influencers in international negotiations (which collectively one might hope tries to converge towards some kind of global strategy). The objectives, and processes, are quite different in each case.	The points regarding the range of decision makers has been addressed by Table 2.1 in the revised Introduction. This taxonomy is designed to link Chap. 2 with the other chapters in WGIII.
11486	2	7	7	19		This part repeats page 4 line 25 to line 36	The introduction has been rewritten.
13791	2	7	9			Change 'himself' to a gender neutral term.	Thank you. Correction has been made.
8232	2	7		7		Each item depicted in figure 2.1 has been described individually in section 2.1.1 but the links between each of them have not been described well enough in order for the reader to understand clearly what Figure 2.1 illustrates.	We have clarified Fig. 2.1 in the SOD so the links between the boxes are clarified
6303	2	7	7	7	8	In describing "the decision to be made," it is essential that the problem be properly scoped and justified, before a "set of alternatives" are identified. So many times, decision makers proceed to identifying alternatives to a problem that has been scoped in a particular way that already delimits alternatives, so scoping the problem properly is vital and should be noted here.	Figure 2.1 has been revised in the SOD so the first box is Problem Formulation
11150	2	76	11		15	States that no research has been undertaken to date that identifies the drivers of public concern or acceptance, as well as the anticipated risk levels associated with CO2 storage. It is a bit unclear to me if this statement refers to no research being done in Barendrecht or in general, but in both cases the statement is false. Barendrecht has been researched extensively and has been reported on in several publications. Generally, a plethora of research exists on the drivers of public concern or acceptance of CCS on national level as well as on the local level (case studies), using methods ranging from focus group discussions to information choice questionnaires which aim to measure public opinion development when people are adequately informed about CCS. Recently, a special issue of Energy&Environment was devoted entirely to this topic (volume 23, numbers 2 & 3, 2012: ISSN 0958-305X) including up-to-the-minute views on key issues facing CCS today. Stuart Haszeldine gives his take on what happened with the Longannet project; Vattenfall likewise gives its view on the cancellation of its proposed CCS project in Germany; other perspectives are provided by Greenpeace, the Green Alliance, the Global CCS Institute, the Indian government and leading consultants. Academic contributions from social scientists stress the importance of values, justice, communities and place. Other contributions include: site selection, water demand of CCS, CCS in the media, direct carbon dioxide capture from the air compared to CCS and using CCS to teach science in schools. Furthermore, research efforts have resulted in recommendations, toolkits and guidelines on communicating CCS. A list of references will be sent as ancillary material entitled IPCC AR5 WGIII refs CCS.docx.	Thank you. The text has been revised accordingly.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
11151	2	76	19		20	Here, concerns over local risks and impacts are labeled NIMBY concerns. The term 'not in my back yard' (NIMBY) is a well established policy belief. As a result of this belief, project proponents often call public protest 'emotional' or 'irrational' thereby implying that no valid arguments are used or that the opponents are acting selfishly. Policy makers do not always use these labels consciously to frame arguments as invalid. Rather, it appears that the NIMBYism belief is so widespread that it may implicitly influence the words chosen to describe public opposition. However many disagree with the idea that NIMBYism accounts entirely for the gap between positive public attitudes and negative behaviour towards specific projects, a.o. Devine-Wright, P. (2009). "Rethinking NIMBYism: The Role of Place Attachment and Place Identity in Explaining Place-protective Action." J. Community Appl. Soc. Psychol. 19(6): 426-441. Research on public protest against wind farms for example indicates that the visual impact of wind turbines is the dominant factor in explaining opposition against them, but also suggests that public animosity towards a wind farm is partly reinforced by the planning procedure itself: Breukers, S., & Wolsink, M. (2007). Wind power implementation in changing institutional landscapes: An international comparison. Energy Policy 35, 2737-2750. Top-down, hierarchical, and technocratic approaches to decision making may lead to feelings of injustice and inequity within local communities. These reasons should not be confused with the notion of NIMBYism.	Thanks for these references. We are removing the term NIMBY.
8121	2	8	12	8	16	Please provide agreed evidence for these statements. Another perspective is that normative models of choice tend to be simplistic and not suitable to represent a real complex problem situation.	The evidence for these statements is provided in Section 2.2, as we say in line 27 on p. 5 in the FOD. We preview now more explicitly in the paragraph you refer to that heuristic and other non-normative approaches have a wisdom and function of their own.
11488	2	8	15	8	17	This argument demonstrates an overestimation of the knowledge of "experts" in so far as it fails to describe how those experts are identified. The broad claim that decision makers are myopic and use simple heuristics requires qualification.	We are simply describing observed regularities, but have tried harder to avoid unwanted connotations of terms like "myopic" throughout the chapter.
11489	2	8	16	8	17	The notion that farmers underestimate risk of drought is derived from priviliged societies in which crop insurance protects farmers from disaster. In most of the world, such insurance is not available, and farmers are unlikely to underestimate such risk. Their options for adaptation, however, are constrained, and they may not (from a behaviorist point of view) demonstrate their calculation of drought risk. This example seems unusual and misleading.	These are just possible examples, not general statements that apply to all contexts. We have tried harder, however, to add more examples relevant to non-western and developing country contexts throughout the chapter.
8119	2	8	17	8	18	As said above, for farmers the risk of drought on a yearly basis is almost independent from climate change.	Our chapter in general is pointing out that risks and uncertainties arise from many sources, not just the climate system.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
13794	2	8	17	8	18	This example mixes reference to 'risk' and to 'probabiliby.' This leaves out the 'consequence' part of risk without explanation.	thank you, we substituted "probability" for "risk" here. Chapter 2 in general makes the point that risk is being used in different ways by different groups, but that risk needs to incorporate both the probability and the outcome dimension, so we agree.
13795	2	8	18	8	22	A better example is short-term coastal investment that ignores long-term loss of that investment due to sea level rise	Yes, this is another good example, thank you.
4907	2	8	35			probabilities .. are uncertain. ??	Thank you, the sentence was reworded.
8120	2	8	38	8	40	Imprecise: models do not reduce costs directly. Model results can raise the quality of decisions and this may lead to increasing profits.	Agreed. We will implement the suggested changes.
6061	2	8	39	8	42	The difference between investing in irrigation system and merit of carbon tax is unclear. Namely, why cost effectiveness criterion applies to the former and cost benefit criterion applies for the latter. If it says "communities deciding on which irigation system they invesr", it is reasonable that cost effectiveness criterion applies as society has always decided to invest to irrigation system. Whereas, cost benefit criterion should be applied to decide whether to invest in irrigation system or not.	Text has been modified to reflect clearer examples
9790	2	8	45	9	2	Already here and later on in section 2.3 resilience management should be considered as a major methodology. The International Organization for Standardization is currently preparing a standard on this topic and thus companies will use this structure later on for establishing their own tools.	Intro is rewritten
8916	2	8	7	8	7	Section 2.1.1 is the current section; I assume this reference is wrong?	Noted
13792	2	8	7			change 'impacts' to 'affects'	Wording change made in the SOD
13796	2	9	16			change 'impact on' to 'affect'	Thank you. The correction has been made.
11491	2	9	17	9	17	Change 'Figure 1' to "Figure 2.1'	All tables and figures have been correctly labelled, and captioned.
6063	2	9	21	9	21	"Implementing carbon market" may be replaced with pricing the carbon.	I disagree with the reviewer here. The implementation of a carbon market is not only to put a price on carbon, but may also include other benefits such as redistributing the emissions threshold through bilateral trading of quotas. Meanwhile, the section has been edited and the point clarified.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
8481	2	9	24		26	Important to consider the spectrum and difference between policy (as strategy) and policy instruments (as implementable tools) May also be helpful to note the different types of policies and policy instruments via a basic typology (see for example the work of Ted Lowi, and Four Systems of Policy... in particular)	Thank you for this helpful comment. In the SOD we are trying hard to clarify this point. The core communication element that we are emplying is a matrix that maps the climate policy space according to different types of choices, and different sets of actors making choices. Among the choices to be made is the choice of policy instrument. An instrument, of course, is a tool, and a piece of furniture built with hand tools will look very different from one built with machine tools. As far as we are aware, the policy chapters (13, 14, and 15) are developing a typology of policy instruments.
14528	2	9	24			I am not sure it’s helpful to define “policy” in terms of “strategy.”	The dictionary I looked at defined policy as a consistent approach to dealing with problems in order to achieve a particular outcome or set of outcomes. That made sense to me. I have a policy of getting up at 6:00, in order to make sure that my kids get to school by 8:00. "Strategy" is one way of describing this, and not a bad way. What it does do is allow the word "policy" to be construed expansively, and not limited to particular governmental policy instruments. Perhaps, strictly speaking, a policy is a manifestation of a strategy. But I don't think that really adds clarity.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
9112	2	9	27	9	29	Growing proportion is tied to complex international flows of goods. Schulz shows an extreme example from Singapore where almost everything is imported (Schulz, N. B. (2010): Delving into the carbon footprints of Singapore — comparing direct and indirect greenhouse gas emissions of a small and open economic system, Energy Policy, 38, 4848–4855.)	This is an interesting article, showing how in a place like Singapore the direct emissions generated locally account for less than half of the the total emissions generated by the people's consumption. But it is quite tangential to our chapter, and even to the point being made in this sentence, since the Schulz paper describes an accounting of emissions, not a particular national choice.
6368	2	9	35		37	Should say "even more difficult to predict than they had previously been thought to be." The point is that the uncertainty existed previously, but was unacknowledged. So prediction only appeared easier earlier.	Intro is rewritten
13797	2	9	36	9	37	The difficulty is inherent. The perceived uncertainty may change with this new information.	Intro is rewritten
8122	2	9	38	9	38	These general statements should be avoided. Handling uncertainty is quite normal and not unique for handling climate change risks. Besides rational reasoning, other factors like culture, history and so on are relevant for sound decision making. The chapter should focus only on situations sensitive and relevant for climate change!	We agree that all of these factors play a role, but the chapter's role as a framing chapter is also to make the general point that uncertainty and risk DO influence the processes by which people make decisions, both in general, and in the climate response context.
13798	2	9	38			Change 'presence' to 'perception'	Thank you. The change has been made.
13800	2	9	38	9	45	One's access to and understanding of decision-making tools also affects the process.	Thank you. We have incorporated this note into the narrative.
7224	2	9	39		41	the sentence does not parse.	The section has been edited.
13799	2	9	40			Remove first 'that'	Thank you. Correction has been made.
11492	2	9	40	9	41	Missing word: "outcomes that … from their choices"; and missing "?" question mark.	Thank you. Correction has been made.
11493	2	9	43	9	45	Grammar: "intent of possibly change their decisions' - needs correction. Missing "?" mark	Thank you. Correction has been made.
7225	2	9	43			change -> changing	Thank you. Correction has been made.
7226	2	9	43			whey -> when	Thank you. Correction has been made.
9113	2	9	47	9	49	Construction related (embodied included) emissions have been shown to cause a large share of the emissions when a region goes through a rapid growth phase, e.g. Minx, J.C.; Baiocchi, G.; Peters, G.P.; Weber, C.L.; Guan, D.; Hubacek, K. A “carbonizing dragon”: China’s fast growing CO2 emissions revisited. Environ. Sci. Technol. 2011, 45, 9144–9153.	This reviewer recommends the inclusion of this sentence with its reference. I believe the contribution is relevant, but I am not sure of how to address its inclusion. Nonetheless, the section has been edited and re-written.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6062	2	9	9	9	10	It is unclear why the chapter considers from the "social planner's perspective". If this means policy makers perspective, the subject to be taken up in dealing with concentration tagget should definitely be catastrophic loss and its fat tail issue on probability density function of climate sensitibity.	We will be clearer in the SOD why we ventilate the social planner's perspective. The idea is, indeed, that it gives at least one version of a plausible choice for policy maker that observes the known system dynamics most important for the decision problem at stake. Targets have the very goal to avoid catastrophic losses. We will link the tools' discussion and its application with IAMs clearer in the SOD.
4628	2	9				As a general comment I would say that too little is made of the problem of making forecasts. Estimating the technical nature of risk in climate forecasts is an immense challenge. The word “forecast” occurs about six or seven times, and three of these are references to seasonal forecasting or weather forecasting which have no relevance in making climate forecasts. Given the long time horizon for most climate forecasts, we cannot take the step usually taken by forecasters of comparing forecast and actual outcomes. The various computer models of climate, which like all quantitative models contain a high degree of subjectivity, can collectively give an impression of the forecast distribution. But these models are generally not stochastic in the way most econometric models are. And even econometric models tend to underestimate the forecast error. In short, forecast error in climate models is of unknown magnitude and not likely to be better estimated in the near future. We have just started to apply standard forecasting techniques to decadal forecasts (of global temperature). This section is where some of these problems could more forcefully be pointed out.	Correct. There are two approaches in the chapter, the independent U&R perspective and the climate perspective. Although forecast is not related to climate research it may be used within the chapter as part of U&R assessment.
14823	2	9				This section must not only enumerate different types of uncertainty, but distinguish between then and explain their characteristics: profound and unquantifiable and entangled with values, or straightforward and quantifiable? It should also say something helpful about which are most important for climate policy. Arguably, one would be the profound uncertainty associated with the unknown magnitude of the downside risk of unmitigated CC. This completely defines the climate problem and structures the nature of the response.	The distinction made between different types of risk and uncertainty in this section is by no means the only one, and other distinctions including the ones you point to are clearly important, and are being made in Section 2.3 on tools.
4700	2	9	23			Perhaps distinguish between reducing risk as reducing the probability of the bad outcome occurring vs. reducing risk as reducing the impacts of the bad outcome. That is, planting drought-tolerant plants differs from insuring yourself against a drought while planting NON-drought-tolerant plants.	In this section we are focused on the broad range of sources of uncertainty and risk that impact climate policy. The distinction on the goals of uncertainty or risk reduction is probably better made later in the chapter, i.e., in Section 2.4.

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
6064	2	9	23			When dealing with uncertainties and risks, ordinary ones and others that include uncertainties that may lead to catastrophic damages (shown here as fat tails or tippint points) should be discussed separately as these are really serious issue of risk management under uncertainty. Also inevitable global warming and the necessity of adaptation, R&D or geoengineering should be explained, if briefly. Also another uncertainty with respect to immediate participation to global framework of all the countries as well as uncertainty of global economic situation that is an important driver should explicitly be included here.	In this section we are focused on the broad range of sources of uncertainty and risk that impact climate policy. Fat tails are mentioned in the climate impacts and damage costs paragraph, and then also in Section 2.3 on tools to deal with uncertainties and risks. One of the additional uncertainties you describe would be included in the Future Development Pathways category, but we added a category on International Relations and Negotiations.
11524	2	Overall				All of the examples in this chapter are based on the knowledge and knowledge-systems of Europe, North America, and Australia. This chapter lacks any examples from other areas of the world where the on-the-ground realities of climate change, perceptions of climatic risk, decision-making processes, and epistemological conventions are different. This chapter lacks applicability for most of the Earth's population, particularly those who are most vulnerable to climate change impacts. At the very least, the authors need to acknowledge that diverse knowledge systems exist, and that these will serve decision-making processes in the parts of the world that they have not investigated.	Accepted. The text will be modified to acknowledge that diverse knowledge systems exist and CAs will provide additional material in this regard that will be incorporated in the text.
11525	2	Overall				The implications of the term "policy" needs to be elaborated, because it seems to exclude decisions made by individuals. The difference between policy makers and social planners is not clear. The inconsistent use of these terms often reveals an emphasis on top-down approaches to climate change mitigation and adaptation yet ultimately climate change response will be undertaken by individauls and their communites.	Than you very much -- this is a crucial point. Moving into the second roder draft we are now clearly considering the actions of individuals, and drawing a clearer distinction between prescriptive literature (based on a set of priorities assumed to lie with a social planner) and a descriptive literature. At the same time, we have also been quite clear to use a definition of the word policy that includes private actors: "Policies are strategies for satisfying a set of specific objectives or criteria." FOD page 10, line 24