

Envisioning Futures for Climate Change Policy Development: Scenarios Use in European Environmental Policy Institutions

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ABSTRACT

Scenario-based exercises can contribute to policy debates on climate change responses, intended to help policy-makers visualize future worlds and help guide and develop adaptive strategies. This study explores the use of scenarios by policy-advisors within three institutions: the European Environment Agency, the European Commission and Scottish public bodies. Respondents pointed to different approaches to scenario identification and use as well as barriers to wider use of the method. A range of benefits of using scenarios was highlighted. Amongst the suggestions for better implementation offered by interviewees was the need for a scenario toolkit. An array of scenario systems (representing both climate change scenarios and socio-economic scenarios) are being used by policy-advisors and the paper concludes that the role for scenario exercises in planning and communications work derives from their capacity to develop imaginative thinking. Recommendations are proposed for improving practice. Copyright © 2010 John Wiley & Sons, Ltd and ERP Environment.

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Introduction

SCENARIO EXERCISES ARE A MEANS OR TECHNIQUE WHEREBY AN ORGANIZATION/INSTITUTION MAY BE SENSITIZED to a range or set of possible futures or ‘a plausible representation of the future’ (Hulme and Dessai, 2008, p. 3), or they may be a means of removing the mental filters we impose on our forward thinking to exclude possibilities outside current trends. Bradfield *et al.* (2005) have traced the roots of scenarios to treatises on utopias and dystopias and for strategic military planning (war games simulations), but the technique has also been used for topics including earthquakes and transport. Berkhout *et al.* (2002) refer to scenarios as a heuristic device or ‘learning machines’ to enable decision-makers and others to visualize imagined future worlds, where identified drivers give rise to new and distinctly changed conditions. The scenarios tool is intended to guide and

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develop adaptive strategies; scenarios are created and selected by a process including: description of the *decision challenge*, then identification of the most significant *driving forces* affecting future trends that will affect the decision in question, whilst bearing in mind levels of uncertainty and potential impact. Typically three to five scenarios are chosen, each of which explores a set of combinations of driving forces in order to provide greater detail, making each scenario 'a self-consistent and compelling story about the future' (Groves and Lempert, 2007, p. 73). A scenario showing the projected baseline or business as usual is usually included.

The present research was conducted as part of the MACIS (Minimisation of and Adaptation to Climate change Impacts on biodiverSity) project looking at the range of environmental change scenarios that have been developed within the European context to explore climate change impacts on biodiversity. MACIS is an EU-funded Sixth Framework Programme project: EC STREP 044399 (SSPI). Here we examine potential motives for the use of scenarios and other techniques used for addressing uncertainty, then report on a survey of three policy-making organisations where staff were interviewed to discover their views on the benefits and opportunities of using scenarios, as well as barriers and practical difficulties in implementation of the technique. We conclude with the key issues raised during the interview process and the insights gained about how scenarios may assist in European environmental decision-making.

Role of Scenarios in Climate Change Policy Studies and Alternative Techniques

Climate change adaptation is a complex and contested policy area where to assume that policy builds on neutral scientific facts is simplistic and naïve (Jørstad and Skogen, 2010) and that a better representation of the relationship is the interaction of science and policy rather than transmission of knowledge from one to the other. Issues related to the quality of evidence used in making policy decisions with respect to climate change adaptation have been studied by various authors, frequently highlighting uncertainty. For example, van der Sluijs *et al.* (2008) have explored methods to be used in assessing and communicating uncertainty. They discuss how it is not always possible to quantify and assess uncertainties in a formal way, and consider complementary, reflective approaches to exploring the quality of evidence. Processes which determine the acceptability of a scientific assessment as a shared basis for action between scientists and policy-makers include the framing of the problem, the choice of methods, data gathering strategy, review and interpretation of results, and the function of the results in the policy arena.

Scenarios have emerged as a tool for decision-making – and, in particular, decisions on adaptation to climate change – for reasons such as the complexity of the problems to be addressed and the long-term nature of the changes examined. The sources of complexity here include the diversity of baseline conditions across regions, uncertainties (of models, of levels of change, of severity and timing of impacts, etc.) and the existence of feedback loops throughout the systems: 'Socioeconomic changes are key drivers of projected changes in future emissions and climate, and are also key determinants of most climate change impacts, potential adaptations and vulnerabilities' (IPCC, 2007, p. 154).

Climate modelling currently shows incremental change over the next 80–100 years, with periodic extreme events. Adaptation strategies for climate change must respond to a range of future conditions over time, and measures and strategies for the 2020s may have become less useful by the 2080s – so flexible or *adaptive* strategies are needed. Past experience of planning (e.g. economic, spatial or health planning) has normally addressed relatively short time horizons, typically 5–10 years (Wilson and Piper, 2007); planning for major infrastructure (e.g. water supply, transport) may consider a more distant future.

The value of scenarios as an approach in climate change work thus lies in: the change in focus from trend analysis to include new types of change, the possibility of developing scenarios relevant to particular audiences, a means of opening minds to situations not currently expected and provoking new responses; in the words of Lempert *et al.* (2003, p. xii) they are 'a prosthesis for the imagination'. They are useful in that they can take planners away from both trend-based thinking and issues of complexity to show possible futures that are relevant to specific sectors and policies. A further value may be the relative accessibility of scenarios – presented as storylines that can be relatively easily formulated then understood by participants (the incorporated modelling and assumptions of climate change science do not need to be made explicit). Scenarios enable policy-makers to assess the

implications of situations on the basis of large amounts of information in a systematic way, and in so doing may also expose flaws in reasoning, or bias (Lempert *et al.*, 2003). Weaknesses in the use of a number of scenarios identified by Parson *et al.* (2007) include insufficient focus on the needs of a particular audience, inconsistent assumptions and exclusion of relevant information.

Methodology

This preliminary study explores the use and perceived value of scenarios in European environmental policy development and focuses on identifying where scenarios have been used, for what motives and what potential barriers exist to their use. Interviews were conducted to establish the on-the-ground experiences of policy-advisors with regard to using environmental change scenarios, thus capturing early experiences of use and indications of the lessons to be learned.

Three European policy institutions were identified which work in the field of climate change policy. These bodies were chosen as they represent both Europe-wide and (in Scotland) national and local levels of governance. The individuals who participated were contacted via contact networks, and were invited to take part because they each had a policy-advisory role and it was understood they had some experience of using scenarios (in some cases this proved to be minimal, although they were aware of scenarios work by colleagues). Although the sample is small and not comprehensive or fully representative of the institutions approached, it gives some indication of current use and understanding of the scenarios tool of the individuals using this tool, at these levels. The bodies and interviewees selected were:

European Commission – four staff from

- DG Environment and
- DG Research

European Environment Agency – three staff from

- Scenarios and Forward Studies Group

Scotland – public bodies – seven staff from:

- Climate Change Division,
- Scottish Parliament Information Centre (SPICe) and
- Sustainable Scotland Network (SSN).

Semi-structured interviews of approximately one hour each were conducted face-to-face with interviewees during October and November 2008. Semi-structured interviews were chosen as the method rather than questionnaires as they allow for greater exploration of each interviewee's perspective and more qualitative data to be collected. Although the sample size could have been increased by the use of questionnaires, they would not necessarily have provided the detail and insight into the individual's use of scenarios that was required for this study.

The interviews explored the use of uncertain data by policy-advisors, for which scenarios are a potential tool, and established the level of use of scenarios, and how they related to the individual's role, as well as investigating potential barriers and benefits of using both climate change and socio-economic scenarios to advise decision-making. The current study examined the use of long-term exploratory scenarios rather than short-term narrative policy targets.

Detailed notes were taken and transcribed. This approach permitted a free-flowing discussion in which interviewees were not restricted by verbatim recording. The interview protocol included questions regarding the interviewee's background and role, before establishing if they were using scenarios and, if so, how. Examples of specific scenarios being used or developed were sought. The interviewees were then asked their views on potential barriers to using scenarios as well as benefits and practical difficulties.

Given the small size of the sample (14 interviewees) and limited interview time, this study is essentially preliminary. It provides a snapshot to gain insight into current use of environmental change scenarios by policy-advisors and barriers to this use. Further studies will be needed, as the technique is more widely applied, to address issues

such as political and institutional aspects of decision-making, or whether scenario-based exercises have a role in testing the robustness of policy decisions.

Responses from Organisations

This section highlights the main issues raised by the interviewees in the organizations approached. It gives an overview of the main issues relevant to each of the organizations with regard to their use and views of scenarios.

European Environment Agency

The European Environment Agency (EEA) is an agency of the European Union. It is charged with providing sound, independent information on the environment for those involved in developing, adopting, implementing and evaluating environmental policy. It is also an important source for the general public. Currently (2009) the EEA has 32 member countries and six co-operating (West Balkan) countries.

The EEA is developing its own scenarios and also using scenarios developed elsewhere – these are generally socio-economic scenarios rather than climate change scenarios. The PRELUDE socio-economic scenarios (see Table 1) were developed by the EEA as a participatory scenario building exercise. Interviewees did not favour the probabilistic approach as they felt that it is not required and that probabilities are often arbitrary (although they had no hands-on experience of such an approach), and recommended using a maximum of five scenarios at any one time as sufficient detail could be provided without over-loading the participants. Reasons given for making five a maximum included giving sufficient detail but not providing too much to allow participants to capture the detail and compare and contrast scenarios. Another suggestion was that if more than five were used then the analysis would be too complicated and resulting messages would be unclear.

EEA interviewees see the purpose and process of scenarios as the key to ensuring the effectiveness of the scenario exercise. Consequently, the documentation of the scenario construction process is seen as very important; for example, it should detail the design and outreach aspects. Moreover, language and definitions used are very important; for example, clarity is needed about the difference between a scenario and a projection.

Interviewees identified a number of different cycles of change as being potential barriers to scenario use (these include the various policy cycles, financial cycles and even individual career cycles of policy-makers, which can be mismatched with the time horizons used in scenarios). Benefits of using scenarios were identified as: more robust decisions, a platform for dialogue, help with thinking about non-linear events and the handling of uncertainty.

European Commission (DG Research and DG Environment)

The mission of the Research Directorate General (DG Research) is to develop the EU's policy in the field of research and technological development and to coordinate European research activities with those carried out at the level of the member states. It also supports the EU's policies across environment, health, energy, regional development, etc., and aims to promote a better understanding of the role of science and to stimulate public debate. According to the EEA website, the main role of DG Environment is to 'initiate and define new environmental policy and legislation, to promote integration of environmental concerns into other policy areas, and to ensure that agreed policy measures are implemented effectively in the EU Member States'.

Three of the four EC staff interviewed were in DG Research and were not actively developing scenarios, but instead organizing research themes. Generally they made limited use of scenarios in their work, but often had a liaison role in coordinating the process of developing the scenarios. Where scenarios were used in exercises they were more frequently expert-led than stakeholder-led; explaining the purpose and process of producing scenarios was deemed very important, and interviewees suggested that three to five scenarios can be presented at any one time – although interviewees commented that this depends on the audience involved.

A European scale is most often used for European Commission scenarios work (in line with the Commission's role) and selecting the appropriate scale of decision-making is critical for use of scenarios. In common with EEA staff, European Commission staff also highlighted cycles of change as a key issue – policy and time frames need

Scenario	Description	Used by staff at:
PRELUDE socio-economic scenarios	Explores what European landscapes will look like 30 years from now and beyond. Five contrasting futures: Great Escape – Europe of Contrast; Evolved Society – Europe of Harmony; Clustered Networks – Europe of Structure; Lettuce Surprise U – Europe of Innovation; and Big Crisis – Europe of Cohesion. See EEA (2007) and: www.eea.europa.eu/multimedia/interactive/prelude-scenarios/prelude	EEA
GEO 4	Global Environment Outlook. Four scenarios to 2050 exploring different policy approaches and societal choices at both global and regional levels (Markets First, Policy First, Security First and Sustainability First). See www.unep.org/geo/geo4/media/	EEA
GECAFS	Global Environmental Change and Food Systems. See www.gecafs.org/	EEA
SCAR Foresight	Foresight process identifying scenarios for European agriculture in a 20-year perspective (Climate Shock, Energy Crisis, Food crisis, and Cooperation). See http://ec.europa.eu/research/agriculture/scar/index_en.cfm?p=3_foresight	EC
SCENAR 2020	Scenario study on agriculture and the rural world (Baseline, Regionalisation, and Liberalisation). See http://ec.europa.eu/agriculture/publi/reports/scenar2020/index_en.htm	EC
AG 2020	Foresight analysis for world agricultural markets (2020). See www.risoe.dk/Research/sustainable_energy/energy_systems/projects/AG2020.aspx?sc_lang=en	EC
FARO	Foresight Analysis of Rural Areas of Europe (Global competition, Cohesion, Security and Sustainability). See www.faro-eu.org/home/tabid/195/Default.aspx	EC
UKCIPo2 Climate Scenarios	The UKCIPo2 Climate Change scenarios provide four alternative descriptions of how the climate of the UK might evolve over the course of this century. See www.ukcip.org.uk/	SG CCD SPICe & SSN
Foresight Future Flooding	Scenario analysis to inform strategic choices to address future flood risk in the UK (30–100 years) (World Markets, National Enterprise, Local Stewardship and Global Sustainability). See www.foresight.gov.uk/OurWork/CompletedProjects/Flood/index.asp	SG CCD
REAP	Resources and Energy Analysis Programme (REAP) – tool to access data for a whole Local Authority or Region, to develop policy scenarios and model changes in the footprint of residents. See www.resource-accounting.org.uk/	SPICe & SSN
GRIP	Greenhouse Gas Regional Inventory Protocol (three scenarios formulated on the basis of economic growth/stability, population change and levels of governance). See www.grip.org.uk/htmlversion.htm	SPICe & SSN

Table 1. Scenario systems known and used by study interviewees

EEA, European Environment Agency; EC, European Commission; SG CCD, Scottish Government Climate Change Division; SPICe, Scottish Parliament Information Centre; SSN, Sustainable Scotland Network.

to be fully considered. The benefits of using scenarios were identified as: opening up discussion, focusing people on the problem, awareness-raising for policy-makers and the public, and confronting complexity.

Scottish public bodies: SG CCD, SPICe, SSN

The Scottish Climate Change Division (CCD) is responsible for government action on climate change and is located within the Department of Environment. It is working on Scotland's Climate Change Adaptation Framework, and is steering the Scottish Climate Change Bill, with ambitious emissions reduction targets (80% by 2050).

The Scottish Parliament Information Centre (SPICe), as well as acting as an information hub generally for the Parliament, provides research and information services, including tailored research briefings across many fields (agriculture, forestry, climate change, energy and emissions, etc.). The Sustainable Scotland Network (SSN) is a network of sustainable development officers and advocates from Scotland's 32 local authorities. The network aims

'to improve local government's contribution to achieving a sustainable Scotland; supporting local government's sustainable development obligations'. SSN receives core funding from the Scottish Government. (SSN website) <http://www.sustainable-scotland.net>

Generally these Scottish bodies are not developing their own scenarios, but are using scenarios developed elsewhere; they are generally using climate change scenarios such as those of the UK Climate Impacts Programme (UKCIP) (especially the Scottish Government CCD). Other systems used include the Scottish Energy Scenarios. This group of interviewees had a very positive attitude towards the future use of probabilistic scenarios.

The approach is generally used at a national level, for 'painting pictures' to communicate the potential impacts of climate change to organisations and individuals in Scotland. Nevertheless, SSN is also promoting ecological footprinting scenarios such as the Resources and Energy Analysis Programme (REAP), a carbon and ecological footprinting tool. Developed by the Stockholm Environment Institute and the Centre for Urban and Regional Ecology, REAP provides scenarios and modelling plus policy assessment with regards to sustainable consumption and production; it is used by local authorities in their sustainable development approaches (see www.resource-accounting.org.uk/).

Interviewees stated they believed the focus of the work should be on the evidence base for forward planning. They suggested that a maximum of three to five scenarios could be presented at any one time, depending on the audience. The benefits of using scenarios were identified as: consistency of the approach, promoting a common language and improving understanding, to give more informed discussions. By simplifying uncertain futures to two or three storylines, the scenarios provided a starting point for discussion and debate. In addition, scenarios were seen by this group as a way of building skills and capacity amongst stakeholders.

Analysis

In this section we introduce the scenario sets used, differences and similarities of use between organisations, the benefits and opportunities identified, and perceived barriers to use as well as some practical recommendations for implementation of the technique.

Range of Scenarios Discussed

The interviews revealed that the use or development of scenarios depends on the specific role of the organization conducting the work – for example, whether it is a research agency or has more of a policy development focus. Table 1 lists all the environmental scenario sets mentioned by the interviewees; there is little overlap between use of scenario sets by institutions, which is perhaps not surprising given their different roles and other (e.g. geographical) considerations. However, this diversity makes comparison of outcomes difficult and raises the question of whether a more widely useful set of scenarios could be developed.

The EEA was the only organization contacted which is developing its own scenarios independently, while the Scottish public bodies are only utilizing scenarios developed by others – most notably the UKCIP climate change scenarios. The situation was less clear cut with the European Commission: staff in DG Environment appear to be more likely to have had experience of developing their own scenarios, whereas those in DG Research were not involved in scenario development and either did not use scenarios at all, were using scenarios developed elsewhere or were involved only in the commissioning or coordination of scenarios work.

Differences and Similarities between Organisations

None of the systems referred to by the interviewees makes use of probabilistic scenarios but nevertheless there was a clear split in the views regarding this approach. The issue is: how to effectively communicate probabilities (e.g. regarding risk) and whether this information can provide a framework for decision-making. The EEA interviewees questioned the usefulness of the probabilistic approach, while the Scottish public body interviewees felt that it was a valid way forward. The views of European Commission staff were less clear-cut, but veered more towards being in favour of using a probabilistic approach. It was recognized that in general policy-makers want to be given specific prediction figures (growth rates, frequencies) and that there is a need to explain very clearly the limitations to how much detail and certainty can be given. (This viewpoint reflects the *credibility criterion* suggested by Cash *et al.* (2003)).

In terms of the similarities in approach, all three organizations generally believe that the use of scenarios in environmental decision-making enriches policy discussions. It was clear that all believed that it was critically important that the purpose of the scenarios needs to be made clear from the outset of the process and that there was a need to define why scenarios were being used as a tool and who the key audience would be (whether for being involved in the scenario exercise process or for the output of the scenario exercise).

Interviewees at all institutions agreed that the maximum number of scenarios to be presented at any one time should be five as a workable basis for discussions, in order for them to be absorbed by and differentiated by participants. However, it was felt the actual number depends on the participants/stakeholders to be involved and their experience of using scenarios (thus, academics and experts were felt to be able to deal with more, while policy-makers might prefer to look at only two or three scenarios at any one time).

Benefits and Opportunities of using Scenarios

In their responses interviewees suggested the following benefits and opportunities.

Visualization

Scenarios can indicate a set of possible futures for organizations and individuals showing what the future might look like. They can raise awareness (amongst both policy-makers and the public) and also provide for consistency of approach: by providing a common language and understanding, scenarios can focus people on the problem being addressed. The Scottish Government Climate Change Division, in particular, discussed the ability of scenarios being used to paint meaningful pictures for organizations and individuals and how climate change scenarios could be used to inform behavioural change.

Debate

Furthermore, scenarios provide a starting point and a platform for dialogue between different groups of people from diverse backgrounds to assist them in finding common ground and language. They can ease communication as they can be readily simplified to two or three storylines. (This is the 'beauty of scenarios' according to one interviewee.) Another interviewee commented that scenarios could be useful in facilitating sensible discussions about policy interventions and budget issues and could assist in a practical way by de-sensitizing uncomfortable discussions by looking at different options.

Technical issues

Interviewees claimed that scenarios can assist with thinking about non-linear events and cause-and-effect when often there are no other structural tools to do this. Scenarios can allow uncertainty and complexity to be handled in a fresh and structured way and also allow new approaches. They can help with the consolidation of information and provide support for more informed discussions.

Decision-making

Interviewees suggested that scenarios can support more robust decisions (but only if they are used properly). One way scenarios might achieve this would be by visualizing futures where specific uncertainties have been resolved, so providing an opportunity to test a decision in that environment. Moreover, they can increase policy-makers' awareness of the future and the possibility that policy can be adapted for new developments. At various levels (institution, individual), it was stated, scenarios can be used to inform behavioural change.

Barriers to using Scenarios

This section focuses on the barriers identified by interviewees as affecting the use of scenarios and some of the practical difficulties faced when using scenarios in environmental decision-making and advising on policy.

Policy cycles

The short-term nature of various cycles that affect the work of institutions and individuals (e.g. legislative, research, policy, financial and even career cycles) and the associated windows of opportunity for scenarios to influence policy were all described by various interviewees. They believe that these cycles and the time horizons contained within them are a potential barrier to using scenarios to influence decision-making. Moreover, as the policy agenda changes, so does the relevance of a particular scenario set.

Difficulty in envisioning different futures

There was a view that some individuals find it difficult to engage in the process of scenario development and its limitations, and that the 'soft' knowledge contained within scenarios is often intangible. Some participating individuals may have a 'so what' attitude regarding the usefulness of scenarios. Similarly, bringing together people with different viewpoints can create tensions. The ability of individuals to buy into the scenario process is related to the relevance they see in the actual process and their priorities (for example, do they believe that climate change is directly affecting them?). Some people, it was suggested, cannot buy into the scenario process and the alternative ways of thinking that are required. This may be because participants think scenarios are too abstract or represent blue-sky thinking and they are concerned about the important issue of the evidence base.

Documentation of scenarios

There was a feeling across the interviewees generally that the documentation of scenarios, and particularly the scenario development process, was not sufficient at present. It was suggested that better documentation would improve the use, impact and effectiveness of scenarios, particularly with regard to the process (i.e. how scenarios are developed, who is involved, time frame, stages, etc.). The problem exists that research is often conducted and then pushed into a drawer and forgotten, and the lessons learned are not shared. There is a need to explain the evidence base of the scenarios.

Relevance to policy

There is an issue of relevance to policy and effective communication of research being conducted (This viewpoint reflects the *saliency criterion* suggested by Cash *et al.* (2003)). Some interviewees felt that often scenario research was asking the wrong question and was not correctly framed in a way that was interesting and relevant to policy-makers (particularly within specific time frames). The scenarios must also be focused at the appropriate scale of governance and to respond to the policy cycle, it was suggested.

Inherent uncertainty

Several interviewees discussed the unpredictability of the future and how there will always be surprises in the future that we cannot possibly predict. Many interviewees mentioned the current (late 2008) financial situation and its associated implications. One interviewee suggested that it would be useful to illustrate to the participants that they deal with uncertainty every day in their own decision-making processes and that uncertainty need not be a barrier to making a decision.

Practicalities of implementation

Participants and audience

Interviewees stressed that the process can be time-intensive – those involved in scenario exercises could be expected to have other priorities. It was noted that strong political backing is needed for the process to be successful.

The nature and identification of the key audience is seen as important. Depending on the purpose of the scenario, this may be either the people involved in the process of developing the scenario or those receiving the outputs of the scenario.

Clarity of purpose and communication of scenarios

A large number of the interviewees highlighted that the purpose of scenarios must be made clear from the outset with the focus and limitations being expressed clearly (who is the audience and what is the aim?). Scenarios must be fit for purpose and the use of scenarios as a tool should be identified as the correct way forward (or another tool should be used to achieve the goal instead).

Interviewees identified as crucial the presentation of scenarios in a way that shows possible pathways and choices and is clear about any assumptions being made. Scenarios cannot be a 'black box' approach – there needs to be an understanding of how the scenarios were constructed (including whether it is a stakeholder-led or an expert-led process), what the focus is and who they are relevant to. (This viewpoint reflects the *legitimacy criterion* suggested by Cash *et al.* (2003)). Similarly, those developing and then disseminating scenario work need to be clear at the outset what it is they want to communicate and to whom. This coincides with work by Parson *et al.* (2007), who identified particular weaknesses of a number of scenarios to be insufficient focus on the needs of a particular audience, inconsistent assumptions and the exclusion of relevant information.

Need for a 'toolkit'

The role of capacity building with regard to the use of scenarios as a tool for planning for the future was highlighted by a number of interviewees. There is a challenge (particularly at a more local level) of inadequate staff skills and a need for training in the use of scenarios. Suggestions were made regarding the role of government in advising and supporting tools such as scenarios and that 'hand-holding' and an 'apprenticeship' approach would be helpful in promoting and educating people about the mechanisms of scenarios, particularly with regard to adapting to climate change. The example of the UKCIP scenarios gateway website and its associated toolkit was highlighted – this includes a 'weather generator' package for use in buildings performance simulation programmes, as well as maps and guidance (see www.ukcip.org.uk).

van der Sluis *et al.* (2008) suggest a method for assisting in addressing deep uncertainties in problem framing, expert judgement, assumed model structure, etc., and propose an uncertainty matrix for use as a scanning tool to identify where the most important (policy-relevant) uncertainties are located, and how they may then be characterized with respect to other policy dimensions. Such methods, and the assessment tools they incorporate, may have value in improving the process and outcomes of scenario exercises. Guidance on a range of instruments for this process is provided in van der Sluijs *et al.* (2004).

Views on Usefulness of Scenarios; other Techniques used

At the end of each interview the respondents were asked if they had any final comments or a 'take home message' regarding their thoughts about scenarios. Box 1 below gives some examples of the types of responses and views of the participants.

Finally, interviewees were asked if they were using any other techniques to address uncertainty. The majority of interviewees responded that they were not. However, a small number (five of the 14) mentioned using other techniques: maximum abatement cost curves (in relation to climate change); horizon scanning; the Delphi

'Scenarios exercise must fit the purpose' (EEA)
 'Focus on use, impacts and effectiveness (of scenarios)' (EEA)
 '[Use] scenarios as a compass rather than a GPS coordinate' (EEA)
 'A good tool but needs to be created to suit policy debate' (EC)
 'Useful instruments to raise awareness and to discuss policy measures but at the same time must always realise that real development is different' (EC)
 'Scenarios help build the case for policy action – provide a good story to tell people. Can paint pictures with scenarios' (SG CCD)
 'Scenarios represent what the future can hold and what policy work needed to be done' (SG CCD)
 'Scenarios can be hugely empowering to those in the public sector, and current policy environment (in Scotland) supports this way of working, but they can often be complex and complicated' (SSN)

Box 1. 'Take home messages' about usefulness of scenarios in European environmental policy-making

method; impact assessment, and the precautionary principle. Experiences with these alternative techniques were not explored further.

Discussion

Groves and Lempert (2007), amongst others, have identified that scenarios can play an important role in contributing to policy debates regarding climate change. The use of scenarios has been evaluated by various researchers, including: Cash *et al.* (2003), who examined the credibility of technical aspects, relevance to needs of decision-makers and legitimacy; Hulme and Dessai (2008), who proposed evaluation based on predictive success, the resulting decisions, and the facilitation of participation and learning; and Lempert and others who, for the EEA, analysed scenario types and their influence upon decision-making processes and organisational strategies (EEA, 2009).

Whereas these three studies have addressed the design and evaluation of scenarios for institutions involved in developing such a system, in this study we investigated how the technique is viewed by policy-advisors who have used scenarios in the policy formulation process. Our paper is concerned principally with the current experiences of policy-advisors in using scenarios: motives for use and opinions of the tool in terms of benefits and drawbacks, as a guide to future use. As scenarios are used typically for discussions about long-term futures (i.e. 20 years and more into the future) it is too soon to assess their effectiveness in delivering wise policy directions. Thus, we have asked whether users find scenarios engaging, and whether they contribute to shared enquiry and learning. Has it been found, for example, that scenarios fulfil the claim made by Pulver and VanDeever (2007, p. 4) that '[Scenarios] can serve to build networks of individuals linked by common concerns, generate shared understanding or stabilize interaction between different social worlds'? The sample size and aims of the study were restricted by available resources, and further study would be required to investigate, for example, the political dimensions or institutional context of decision-making.

Other techniques for addressing uncertainty or the long term in policy analysis have included narratives and extension from the past, the Delphi method (producing a consensus-based response) and participatory foresight exercises. With the availability of many models and multiple simulations, ensemble-based probabilistic predictions based on concepts used in Bayesian decision analysis are now being attempted (Lempert *et al.*, 2003, Goodess *et al.*, 2007). Whereas all the scenario systems referred to by those we interviewed for this paper are deterministic, with each storyline considered equally plausible, probabilistic scenarios provide a distribution range for future events or parameters. The UKCIP climate projections (UKCIP09) are an example of the probabilistic approach (see <http://ukcip09.defra.gov.uk>), developed in line with the growing emphasis on risk and uncertainty in decision-making in the built environment and other sectors (Goodess *et al.*, 2007). Hall *et al.* (2007, p. 265) propose fuzzy scenarios within a flexible framework for aggregation of scenarios as a means to 'represent some of the semantics of socio-economic scenarios that defy conventional probabilistic representation.'

Several interviewees raised the issue of the fit between scenarios used and the policy issue at hand. A route to ensuring appropriate fit is that of the participatory development of a system specifically to meet a policy question. This is a topic that has been discussed, for example, by Wilkinson and Eidinow (2008, p. 2) and by Volkery *et al.* (2008). Wilkinson and Eidinow outline existing 'schools' or typologies of scenarios – indicating that these are determined by the aims of the approach used and may be, for example, explorative, predictive or concerned with decision support. They suggest that there is anecdotal evidence that environmental scenarios have been 'produced with enthusiasm but deployed with limited effect' and that relatively little attention is paid to 'wider philosophical assumptions, e.g. ontological, epistemological, etc.' They distinguish two main types of scenarios, the problem-focused and the actor-centric types, and then propose the need for a third type: reflexive, interventionist or multi-agent based (RIMA). This would be a formalized and methodical approach to collaboration, creating shared views of the future in a way that is sustained over time, iterative and addresses multiple time-horizons (other characteristics are also described). Volkery *et al.* (2008) describe the process of developing the EEA's PRELUDE scenarios (known and used by the EEA interviewees of the present study – see Table 1). The participatory process used there is described as cumbersome but leading to a set of detailed storylines which cover 'a wide array of important driving forces'. Volkery *et al.* (2008, p. 475) see the participatory process as increasingly valuable as the timeframe of the problem increases, along with its complexity and uncertainty. The balance of investment of time

required to build appropriate scenarios and then to use them in policy development is an issue that needs to be addressed for there to be wider use of this approach.

Pullin *et al.* (2009, p. 970) suggest that 'there often appears to be a mismatch between specific questions addressed by science (in peer-reviewed literature) and broad issues addressed by policy (in strategies and implementation plans'. This was a recurring theme emerging from interviews and relates to the issue of scenarios needing to be fit for purpose with regard to the policy process.

Conclusions

Whilst recognising the limitations of the current study, particularly the small number of institutions and individuals contacted, we believe that the interviews conducted with policy-advisors in European institutions have revealed a number of interesting findings regarding the uptake and use of scenarios within European environmental policy-making institutions. These were that:

- (1) An array of scenario systems is being used by policy-advisors. There is a role for scenarios in communications work and 'out of the box' thinking, to take participants into futures which are beyond trend or business as usual.
- (2) There is a conflict between recognition that scenarios are most useful if they are designed for a specific purpose, and the possible risk of developing too many scenario systems. While on the one hand they are sometimes tailored to the needs of users, if the system is not widely used (i.e. by more than one or two organizations) this may reduce its potential to promote social learning – that is, learning from others collaboratively, in a variety of contexts.
- (3) There were differing opinions about the usefulness of this type of work between interviewees, and recommendations were made by them to increase the value of the output (for example, giving appropriate background, how many scenarios to use, suiting scenarios to users).

A variety of benefits of using scenarios were identified by the interviewees. These included: providing a platform for dialogue between different groups of people from diverse backgrounds; assisting with thinking about non-linear events in the future; providing more robust decisions, and allowing uncertainty and complexity to be handled in a structured way; focusing people's attention on the problem being addressed, and raising awareness of issues both in policy arenas and for the public; being used to inform behavioural change; and allowing a starting point for discussion, debate and communication. In short, this is a capacity-building technique as well as a way of seeing possible futures. Volkery *et al.* (2008, p. 475) suggest that the participatory development of scenarios in particular can be useful in 'creating a language and a common platform for different policy communities to discuss complex and highly uncertain problems and related response strategies'.

Similarly, a range of possible barriers to using scenarios were highlighted by interviewees, including: the short-term nature of policy cycles and time scales; the difficulty in envisioning different futures; limited communication and documentation of scenarios; lack of clarity of purpose; debate over the usefulness of probabilistic scenarios; lack of relevance to policy; inherent uncertainty; and the need for a toolkit.

Interviewees emphasized the importance of being very clear about the purpose and relevance of scenarios being developed or used. As Hulme and Dessai (2008) suggested, scenarios can be seen either as products which may be the basis of decision-making or as learning processes. Many of the interviewees highlighted that often the process itself of structured thinking on possible futures may be seen as more valuable than the outcomes it produces. Individuals from all three institutions suggested that scenarios can be a means to open up different discussions and assist in envisioning alternative futures rather than focusing on business as usual, which is the usual default.

As scenario-based exercises are shown to have merit for supporting consideration of futures in which conditions are altered in more than one dimension beyond business as usual or continuation of trend, this technique's usefulness in raising awareness and promoting creative and imaginative thinking about more distant futures may help with planning and policy in ways that result in more robust and flexible measures to deal with change. An EEA study published since the interviews were carried out (EEA, 2009, p. 13) states that 'there is little work determining the extent to which long-term policy analysis brings about political decisions that effectively address

long-term goals'. Although it was not the goal of the present study to investigate this (given the short experience of the scenarios work in the three institutions), it is recognized that this will be a central topic for future research on scenario-based planning.

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