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OECD Workshop on the Benefits of Climate Policy:
Improving Information for Policy Makers

OECD Workshop held 12-13 December 2002

SUMMARY REPORT

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PREFACE

This report was prepared by Jan Corfee Morlot of the OECD Environment Directorate. It draws on inputs from authors of the papers commissioned by the OECD for a Workshop held in December 2002. The Workshop agenda, related working papers and presentations can be found on the OECD website: www.oecd.org/env/cc .

The Secretariat would like to thank Workshop participants for their contributions to a lively discussion and to the ideas outlined in this paper. In particular, thanks go to paper authors attending the meeting: John M. Callaway, Hadi Dowlatabadi, Michael Hanemann, Sam Hitz, Henry Jacoby, Eberhard Jochem**,** Roger Jones, Rik Leemans, Robert Nicholls, Dale Rothman, Jan Rotmans, John Shellnhuber, Stephen H. Schneider, Joel Smith, Richard J.S. Tol, Tom M.L. Wigley, Gary Yohe. Written and oral contributions from other participants at the Workshop are also gratefully acknowledged (Philippe Ambrosi, Sebastian Catovsky, Lynda Danquah, Geoff Jenkins, Reinhard Madlener, Petra Mahrenholz, Merylyn McKenzie Hedger, Andre van den Moor, Martin Parry, Anand Patwardhan, Michele Pittini, Ademar Ribeiro Romeiro, Rich Richels, Tana Stratton, Dennis Tirpak, Farhana Yamin) as well as inputs from other members of the OECD Secretariat, in particular, Tom Jones, Shardul Agrawala, Martin Berg and Pascale Scapecchi.

This report represents the views of the author alone and does not necessarily represent the views of the OECD nor of its Member countries.

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Introduction

This OECD Project aims to outline a conceptual framework to estimate the benefits of climate change policies and to help organise information on this topic for policy makers. The Project relates to both adaptation and mitigation policies, and thus to different spatial and temporal scales for decision making. Particular emphasis is on understanding how global benefits (avoided impacts) shift with different levels of mitigation, in other words, on the incremental benefit of going from one level of climate change to another. The Project also aims to identify gaps in existing information and recommend areas for improvement, including topics requiring further policy-related research and testing.

The OECD sponsored an Expert Workshop in December 2002 to to contribute ideas on what a conceptual framework for climate policy benefits might encompass.[1] The Workshop brought together experts from different disciplines with national policymakers from OECD Member countries to discuss the range of issues underlying the estimation of climate policy benefits.

This report highlights interim conclusions on a few themes: i) the IPCC and the UNFCCC context for work on the benefits of climate policies; ii) the state of our knowledge on global impacts of climate change; and iii) the conceptual framework. Further information from the Project, including the commissioned papers and related workshop documentation are available on the internet: www.oecd.org/env/cc (see Benefits of Climate Policies).

FCCC and IPCC context [2]

The current lull in the international climate negotiations, may provide an opportunity for the OECD project to contribute insights about the benefits of climate policies. Debate on potential impacts or damages associated with climate change has never occurred within the UNFCCC. Trade-offs and complementarities exist between adaptation and mitigation in connection with impacts and these need to be explored. Though there is a link between adaptation and the nature of impacts, clear connections also exist between levels of mitigation, adaptation and expected impacts. Few countries doubt the science and governments accept the conclusions of the IPCC on impacts. However the willingness to pay to mitigate those impacts varies widely by country.

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1 The issues addressed in these expert papers were identified in an earlier WP/GSP background paper, see "The Benefits of Climate Policy: An OECD Project", ENV/EPOC/GSP(2002)6Rev1. The OECD would like to thank the governments of Canada, Germany and the United States for providing extra-budgetary funding to support the Workshop and the expert papers.

2 Section based on workshop presentations by Dennis Tirpak, UNFCCC Secretariat, and Martin Parry, IPCC WGII Co-Chair.

Significant gaps in information and uncertainties about climate change impacts remain and these argue for establishing a policy-driven research agenda. In addition to feeding into IPCC assessments, results of new research on impacts and benefits might be relevant to negotiations on next steps under the UNFCCC. Thinking broadly about the type of agreement envisaged by the international community may help to orient such a research agenda. For example, a Kyoto-type agreement necessarily emphasises mitigation, with the pursuant emphasis on advancing technology transfer, financial assistance, capacity building and other mitigation policies. Of course other types of future agreements may be imagined, such as one that emphasises adaptation. In this case, the emphasis is necessarily shifted to support adaptation to anticipated impacts rather than mitigation of emissions. National policies in this context might provide tax incentives to reflect the higher risk of climate change in some areas compared to others, or to collaborate to develop and supply vaccines at low cost to limit the spread of vector-borne disease. A policy orientation could shift research to add precision to our understanding of nearer term, unavoidable impacts of climate change, perhaps at the regional rather than the global level. In practice, information on climate change impacts across different spatial and time scales will be needed to inform policy decisions.

Regardless of the policy orientation of future climate agreements, some common research issues exist. Given that some climate change is already inevitable, future policy will need to better incorporate adaptation into the public and private sector responses to climate change. In this light, the IPCC's Fourth Assessment Report (AR4),[3] will focus more on interactions between mitigation and adaptation policies than it has in previous reports. While the IPCC Third Assessment Report shed light on the cost of mitigation required to stabilise atmospheric concentrations of GHG (Hourcade et al. 2001), few studies examine the *incremental benefits* of achieving one concentration level over another.

The issue is what is gained in going from one level of action to another. Assessing the costs of various levels of mitigation is relatively straightforward. Though there are uncertainties associated with assessment of both mitigation costs and avoided impacts, the impacts issue is even more complex given the cause-effect chain from emissions to concentrations. Some new work on avoided impacts in different sectors and at different levels of mitigation has emerged in recent years (e.g. UK DEFRA 'fast track' project Parry et al. 2001). However, it is still partial at best and still provides only coarse indications of the trade-offs at stake.

The IPCC's Fourth Assessment Report might usefully include an assessment of the following "benefits-related" issues:

- damages avoided under varying emission mitigation strategies (benefits – monetised and non-monetised; market and non-market)

- adaptation opportunities and costs, including assessment of the barriers to and limits of adaptability

- residual impacts that are not addressed by either adaptation or mitigation policies but which nevertheless affect the net benefits to be obtained from climate policies

- different socio-economic futures (and baselines) and various climate response strategies, comparing results across these different dimensions.

Any conceptual framework to account for benefits will need to go beyond issues of avoided global damage costs alone. A number of central questions are already apparent: How can we identify key vulnerabilities in different national and regional contexts? What are the important non-linearities, critical

[3] Scheduled for release in 2007, it will drawing on results available by early 2005.

levels or thresholds for irreversible change that need to be taken into account, and under what conditions do they occur? What are the implications of such non-linearities and thresholds on natural systems and on socio-economic systems? What are the barriers and opportunities for cost-effective climate policies at different spatial and temporal scales? How might adaptation and mitigation interact over time to comprehensively address the most significant risks of climate change? Scientists and economists will need to work together to answer these types of questions in AR4 and this should lead to new insights on the benefits of climate policies (Parry 2003, personal communication).

Dealing with diverse types of impacts from climate change also implies working with both monetised (e.g. GDP, losses of capital) and non-monetised numeraires (e.g. millions of people at risk) as well as difficult to quantify elements, such as species loss (Jacoby 2003). Marginal benefits of one set of policies over another, will of course be a function of the scope of policy options across different actors and types of impacts, their costs and their effectiveness in avoiding damage costs (Hanemann 2003).

Current state of the global impacts literature

In the IPCC Third Assessment Report, Smith et al. (2001) outlined five "reasons for concern" about the impacts of climate change. In a main background paper for this Project, Smith and Hitz (2003) provide additional insight into one of these areas – the aggregate risks of climate change. That paper considers the question of benefits from different greenhouse gas emissions policies, with the key issue being: what is the magnitude of marginal benefits (avoided damages) in going from one level of global warming to another? Are changes in impacts constant, decreasing, increasing, or do they change in sign (from negative to positive) at some point?

Using global mean temperature (GMT) as a "proxy" indicator of climate change, the Smith and Hitz paper (2003) characterises the relationships between levels of climate change and impacts, based on the results of available global impacts literature.[4] Impacts in each sector are characterised as increasing with climate change, "parabolic" in shape (decreasing initially, shifting to increase with more significant climate change), or indeterminate. No sectors suggested positive impacts from climate change as temperatures increased beyond certain levels. In terms of assessing levels of impacts or damages, the study uses the metrics employed by authors of individual studies, with no attempt to aggregate across the sectors covered.

Smith and Hitz (2003) concluded from their review of the literature that in all sectors, the results point to increasing damages beyond a temperature range of 3-4°C. Although it is clear that marginal benefits would accrue by moving to temperature levels lower than this, below this critical temperature range, the aggregate picture is much less clear, especially in the key sector of agriculture. In some sectors (e.g. ecosystems), adverse impacts may accrue immediately and continue to grow with temperature change. In others (e.g. agriculture and possibly forestry), initial positive impacts eventually give way to negative impacts or damages; alternatively initial damages may decrease first before steadily increasing again at higher levels of climate change (U-shaped curve). Changes in the key assumptions and simplifications upon which each of the studies depend could either lower or raise the temperature range beyond which all sectors show increasingly adverse impacts. Also significant variation will exist among regional results, which suggests that any such "critical" temperature range could be quite different depending on the particular combination of region(s), sector(s) and impacts considered. For example, aggregation of results at a global level can mask key outcomes, such as the potential for millions to be at risk from failed crops in

[4] Joel Smith and Sam Hitz (2003) surveyed published sectoral studies that quantify the global impacts of climate change. The study's main scope is global studies; it did not examine regional impacts literature, except to provide examples of how results might vary if a regional perspective is taken. The review draws on equilibrium climate scenario (generally older studies) and transient climate scenario (generally newer studies) results.

some regions. Thus, while the conclusions from the Smith and Hitz survey hold across the global studies reviewed, further consistent research is needed to test them, especially in the light of a number of the shortcomings identified in the source studies.

Of course Smith and Hitz's conclusions are significantly limited by the small number of studies available, especially in areas such as terrestrial ecosystems or biodiversity.[5] Even where there may be relatively more studies in some sectors, key factors may not be handled in a consistent manner or in a comprehensive way (see below). Importantly, Smith and Hitz identify key factors and assumptions underlying the global impacts literature that could substantially affect results. In particular, the surveyed studies generally:

- do not consider change in climate variability or extreme events; the impacts of temperature changes in excess of 1.4 to 5.8° C range considered likely by Houghton et al. 2001 or impacts due to long term (i.e. post 2100) climate change;
- do not consider the potential large scale singular events (e.g. collapse of THC or WAIS); and
- do not consider the interaction among impacts in different sectors (e.g. water and agriculture).
- handle adaptation with simplistic assumptions, which can over- or under-estimate impacts;
- do not standardise assumptions about population and development – or socio-economic baselines - making it difficult to compare their results with confidence. (Yet development can make a substantial difference in terms of the vulnerability of society sectors to external forces such as climate change.)
- do not consider "the ancillary benefits" that might also accrue from limiting climate change.

Many of these shortcomings in the existing global impacts literature were discussed in the Workshop and in papers by other authors (Table 1). Beyond providing a large caveat on the understanding of global impacts by sector emerging from the survey, these shortcomings also point to an important agenda for future research to provide more consistent and comprehensive information on impacts.

Discussion on the Smith and Hitz paper also highlighted a number of other shortfalls in the current global impacts literature. Beyond the difficulty to link impacts to changes in global mean temperature, or to any common indicator of climate change, the literature is also not providing sufficient information on some key impact categories, especially for sensitive sectors. For example, on biodiversity and other ecosystem effects, global impact studies are particularly weak, yet Leemans and Eickhout (2003) indicate results from the IMAGE model that confirm recent meta-analyses (Root et al. 2003; Parmesan and Yohe 2003) showing significant negative changes in ecosystems even at low levels of climate change. A range of work is needed to provide a comprehensive understanding of impacts in this area, including assessing non-linear change in eco-systems and path dependency of such change (see also Schneider 2003 and Leemans and Eickhout 2003) as well as the economic implications of these changes.

Global impact studies may also be misleading in part because of what they leave out and especially when they aggregate across regions and sectors. For example, in the agriculture sector, there appear to be

[5] It should be noted that there are relatively larger numbers of regional and local studies on ecosystems and biodiversity, which provide a clearer picture how these systems respond to climate change at this level. See also Leemans and Eickout (2003) cited below, who find clear shifts in ecosystems resulting from even low levels of global warming.

positive aggregate impacts (or benefits) at low levels of climate change due in part to the CO_2 fertilisation effect, which outweighs the effects of a rise in temperature. As temperature rises, this combined effect will reverse direction and shift to a globally negative impact on the agricultural sector. However, the distribution of agriculture impacts varies significantly among regions – even when the aggregate impact is positive, there are still negative changes at the margin in some regions and localities. These distributional effects are often hidden when there is aggregation across regions. Further, differences in method may also account for some of the significant differences observed in the studies reviewed, such as in the water sector.

Table 1. Overview of key factors in global studies

Key Factors or Assumptions	Plausible Change in Impacts for a Given GMT Change	Cross reference to this collection of papers
Climate variability, extreme events	Increase	Schneider; Nicholls
LT impacts beyond 2100 or higher than 5.8 C	Increase	Nicholls
Ecosystem impacts (e.g. at low levels of climate change; or with differing valuation approaches)	Increase	Rothman; Leemans and Eickhout
Potential large scale, singular events	Increase	Schneider
Interaction among sector impacts	Decrease or increase	Hanemann (on water and agriculture)
Adaptation, including perception, anticipation and response and how this interacts with damage functions	Decrease or increase	Callaway; Yohe
Population and development -baselines and influence on vulnerability	Decrease or increase	Tol et al.; Nicholls
Ancillary impacts (other non-climate mitigation policy benefits); adaptive management strategies	Likely to increase but will vary by sector	Jochem; Dowlatabadi

Notes: List of key factors and assumptions as identified by Smith and Hitz

As noted above, extreme events are also not considered in the studies, which would change the variance around the mean outcomes being reported (Schellnhuber et al. 2003; Milly et al. 2002; Schneider 2003; IPCC 2001). While this may not shift the shape of the damage functions for any particular type of impact it would shift the nature of the risk and the probability density functions for each set of impacts. Looking carefully at the timing of impacts is also important. As the timing of impacts is collapsed through discounting when aggregating into monetary metrics, the need to look at the ability of society to respond to various impacts over time is another argument for providing different types of metrics to measure impacts and climate policy benefits.

Towards a conceptual framework

A number of the papers under the Project suggest new directions for the framing of benefit assessment associated with climate change policies. Jacoby (2003) provided a suggestion for what such a framework might include and why, focusing on global mitigation policy assessment (see Box 1 for main elements).

A limited portfolio of indicators of benefits

The framework proposed by Jacoby (2003) aims to have broad appeal to different types of countries, rather than simply amongst OECD Member states. It also aims to be widely understood and accepted by diverse actors in domestic decisions and international negotiations, as well as to be robust over the long-term. While it might be able to guide adaptation at a regional level, the main goal of the framework is to facilitate goal setting for international policies, focusing on where to go next from current policies.

The framework explicitly attempts to address three problems in the assessment of benefits. First is the difficulty of dealing with wide uncertainty and risk. Stabilisation or other long term mitigation policies will change the risk profile of climate change by shifting the probability distribution function of global mean temperature change towards lower levels of change (Jacoby 2003; see also Wigley 2003; Jenkins 2003; Schneider 2003; Jones 2003). Second is the problem of valuation of non-market impacts, where there are various advantages and limitations to doing valuation (Jacoby 2003; Rothman 2003). A wide range of approaches exist to value non-market impacts, however the application of these methods remains controversial and methods/values derived are necessarily specific to the particular region or location in which it is derived. Jacoby concludes that it is questionable that such methods can produce commensurable estimates of climate change impacts across regions. Third is the problem of aggregation more generally across widely different types of market sector, ecosystem and health impacts and across different regions (Jacoby 2003; see also Tol et al.2003; Rothman et al. 2003; and Hanemann 2003). This issue arises at all levels and types of economic analysis but it is particularly troubling for climate policy assessment because willingness to pay estimates are a function of income levels, and because not all of the decision makers are at the table where decisions affecting them may be reached (e.g. future generations, or regional or local stakeholders).

Box 1. Avoided climate impacts: A three-tiered framework to structure future work

Jacoby (2003) proposes **a three-tiered framework** to provide a structure for current (incommensurable) information and future research. It starts with a first tier of information on **global physical variables** which are characterised with quantified uncertainty ranges so as to cast the issue in risk reduction terms. A selection of global variables (e.g. mean temperature, perhaps by latitude or sea level) should be expressed in natural or physical units. This level of assessment would be free of valuation or aggregation controversies as the information is reported separately by variable and in different physical units. A priority for research at this level would be on how to characterise and communicate with stakeholders on how to deal with different types of risk associated with different levels of climate change. At least qualitative characterisation of abrupt, non-linear change should be included.

A second-tier of information is the **characterisation of effects at regional scale.** This might be mainly natural/physical units for non-market impacts and natural/physical units plus monetary estimates for market impacts where possible. A first step is to rethink the regional groupings to be used to structure the information. Ideally the structure would include only a few indices which would have high information content to a wide body of stakeholders. These should be clearly defined and allow for in independent assessment with global applicability (across regions), ultimately allowing for comparison across regions.

A third-tier is bottom-up, regional scale **non-market impact valuation and global aggregation** would allow valuation to proceed as methods and data allow. This leaves aggregation in the hands of the individual players, and provides clarity about different approaches to valuation, weighting and aggregation.

Source: Jacoby 2003

Explicit recognition of a framework of this sort would provide a more formal structuring of climate impact work according to the levels of detail, method, data and region (Jacoby 2003). While most of this framework is not new, people in the policy process should note that simple physical representations of benefits can be identified as well as more sophisticated economic estimates which have added layers of uncertainty. Jacoby concludes that given the incommensurable nature of climate benefits, it is necessary to organise impact estimates carefully so that decision makers can understand what they are working with. Development and use of such a basic framework to estimate climate policy benefits requires a high level of commitment and interest from the policy audience to reorient and focus much of the on-going research on impacts from climate change to fit with this structure and set of priorities.

Other dimensions of a possible framework

Taking the framework proposed by Jacoby (2003) as a starting point, how can this framework be extended to make the best use of limited resources to capture the majority of benefits associated with mitigation and adaptation? A comprehensive framework would need to cover several different dimensions:

- Interactions between adaptation and mitigation policies and avoided impacts due to different levels and types of policy interventions (i.e. both mitigation and planned adaptation)

- Direct climate benefits and ancillary benefits (non-climate) – in practice these may be difficult to separate but they are both important to include for comprehensiveness purposes

Direct climate benefits occur in terms of avoided (or reduced) adverse impacts of climate change, including the risk of irreversible damages and surprises. They occur over the medium to long term, rather than in the short term, and may be difficult to characterise at a regional, national or local level given the coarse regional level detail available from state-of-the-art atmospheric-oceanic general circulation (climate) models (AOGCM) (Wigley 2003). In contrast, ancillary benefits stem from policies that simultaneously contribute to GHG mitigation and to other social, economic and environmental objectives. They tend to be nearer term and require a high level of geographic detail for their estimation, so they are also difficult to characterise at a global level (Davis et al. 2001; Krupnick et al. 2000; and Jochem 2003).

Both adaptation and mitigation policies will be important in the short and long term to respond to climate change. In the short run, adaptation to climate change does not necessarily require that human-induced climate change be detected and in many situations firms and individuals will react to climate change as if it were a part of the existing climate variability. However, these kinds of adjustments will always be partial and limited by an economy's existing capacity to cope with climate variability. This "coping capacity" is partially dependant on the flexibility of existing management practices in natural resource sectors and partially on the capital stock that has been created to deal with climate variability (e.g. dams and dykes, grain storage facilities, harbour improvements, etc.). More complete adjustment, through long run investment, can only occur when climate change is detected or climate forecasts are deemed reliable enough to undertake risky investments to avoid climate change damages (Callaway 2003).

Understanding the interactions between mitigation and adaptation is also important. From the global perspective, adaptation may be the only policy available to handle unavoidable, near to medium term-impacts of climate change, whereas mitigation has the potential to prevent or delay longer-term impacts. Indeed, mitigation can deliver benefits in terms of limiting the risk of experiencing low probability, high risk events from climate change (Schneider 2003; Schellnhuber et al. 2003). Adaptation can also produce these kinds of benefits, for example, by building water supply reservoirs, additional grain storage facilities and flood control dykes (Callaway 2003).

Issues in valuation – market and non-market impacts

Valuation of benefits information is an essential step in benefits assessment and will be needed as input to modelling efforts (Jacoby 2003). Monetisation of benefits information also provides a common unit for measurement and comparison of change across sectors. However, the aggregation of monetised impacts information across world regions (as opposed to across sectors within a single region) is more controversial as it involves value-judgements about whether and how to weight monetised impacts in poorer versus wealthier regions (Fankhauser et al. 1996; Tol et al.2003; see also discussion in Jacoby 2003). Nevertheless, a key use of aggregated monetised benefits information is for comparison with costs of different levels or types of action (Wigley 2003; Nordhaus and Boyer 2000).

Hanemann suggests two major directions for future work to evaluate the market effects of climate change (2003). Firstly, more attention has to be paid to the specific economic aspects of climate change, such as its effects on consumer's preferences through adaptation behaviour change or its effects on the replacement of "lumpy" capital stock e.g. existing water supply infrastructure. Secondly, conventional analysis needs to be extended to look at interactions among individual commodities on the consumer side

or with impacts on the producer side. In other words, the current practice in economic assessments to conduct separate and independent studies of individual consumer sectors is unwise, as these sectors interact in a combined way to climate changes and ultimately act together to affect economic well-being. Looking forward, Hanemann (2003) also highlights the need to assess the impact of extreme events on markets, which would require going beyond comparative statics. Extreme events introduce a temporary disruption of production and a destruction of physical and natural capital. There is a need to estimate damage functions that show the extent of disruption as a function of the characteristics of extreme events. An important issue is whether there are non-linearities in these damage functions. Once estimated, these damage functions can be used to help predict damages from climate change.

In going from non-market physical impacts to values, it is important to make full use of a variety of different approaches to valuation. Different approaches to valuation will lead to significantly different outcomes (Rothman 2003). At a minimum, it is important to clearly identify which approaches are used to generate values. For example, both Rothman and Schneider (2003) note that most existing analyses of the damage costs of climate change do not clarify what is counted and what is not, nor do they explain how valuation was approached for non-market impacts. For these reasons, they suggest that such estimates are often misleading and therefore are unreliable as the basis for understanding the benefits of climate change policies. Significant progress in enhancing the transparency of non-market impact assessment could be made by clarifying the notions of valuation that are applied, documenting their construction and highlighting their limitations – in other words in establishing a traceable account of how they were derived from physical damage estimates (Moss and Schneider 2000). The use of multiple (non-monetary and monetary) metrics will also assist in providing transparency about the trade-offs among policy options with respect to non-market impacts.

Use of risk management in climate policy assessment

Risk management, based on probability assessment or quantification of uncertainty, may provide helpful insights to complement economic policy assessment and help to guide policy decisions (Patwardhan 2003; Jones 2003).

A risk management approach builds on quantification of uncertainty inherent in emission projections and climate predictions on key climate outcomes (Webster et al. 2002). It goes a step further to survey expert opinions to conduct a probability assessment of the risk of a particular climate event or impact. This information can provide insights to the policy maker on how to manage those climate change risks (Jones 2003). Different categories of risks or impacts might be examined individually, either in different regions or globally, for example, drawing on the literature review conducted by Smith and Hitz (2003). Such a framework can also be used to consider global mean temperature increase and the risk of exceeding a given level in a given time frame under different policy or no-policy scenarios (Jacoby 2003; Webster et al. 2002), or, more broadly, to consider the risk of exceeding systemic or normative thresholds for change (Schellnhuber et al. 2003; Jones 2003). Climate change impact and risk assessment can provide tools for better understanding and managing climate risks at various levels (global, national and sub-national). A risk management framework also provides a tool for communication about the trade-offs involved in different policy strategies.

Despite all the uncertainties and gaps in information, policymakers still need to proceed with incremental decisions to address the risks of climate change. In the immediate future, Schneider (2003) and Jones (2003) argue that climate policy should be seen as an insurance policy to protect against the risk of potentially dangerous, irreversible change and abrupt, non-linear events. They suggest that key questions are: *How to manage the risks of climate change, taking into account different types of risk and coping ranges in different national and regional contexts? Also on the global scale, what are the risks of*

surpassing a particular level of global mean temperature, or other proxies for global-scale climate change in any one time frame?

Concluding thoughts and next steps

A number of the papers suggested that we need to learn by doing and to start the learning process today before the risks of serious climate change are much higher (Yohe 2003, Dowlatabadi 2003). In thinking about choices to respond to climate change and priorities for research, a key question is where we will be ten year from now – will we have made progress by then? As neither science nor economics will be able to deliver beyond all reasonable doubt in the timeframes needed to leave open the full range of stabilisation options, there is a need to be pragmatic about how decision-making can be improved and not aim for an ideal methodology. This may be particularly important to adaptation policy because, unlike policy on mitigation, adaptation policy is not about a distinct body of international policy (McKenzie Hedger 2003). Rather it is about adjustments within the fine grain of an enormous range of organisations in the public and private sectors, who work to their own separate strategic processes. Thus it will take time, and multiple iterations to learn from experience, to be successful. However mitigation will also take time and requires learning about the costs and benefits of actions (Dowlatabadi 2003). An iterative "experimental" approach, tailored to motivations and interests of different groups of actors, may be just as relevant to mitigation as to adaptation.

Since we are many years away from sectorally and regionally detailed impacts integrated assessment (Schellnhuber et al. 2003), one cannot presume that there will be significantly better information from these sources available in the near-term to inform policy decisions. This suggests a need for decision-making that is driven by experience, learning and perceptions of risk and opportunities to manage it (Jones 2003; Schellnhuber et al. 2003; Schneider 2003; Yohe 2003).

Box 2. Suggested priorities for future work

Workshop discussion identified a number of other policy-relevant research priorities for the broader research community:

- a concise review of which impacts have been quantified/modelled in which regions and over which timescales;
- selected impacts numeraires for physical impacts, organised by type of impact, level of detail and region
- probabilistic characterisation of uncertainty and further work on how risk-based approaches can be used in climate policy analysis and research
- better characterization of eco-system and other natural system impacts, in non-monetary and non-monetary terms
- assessment of "hot spots" with top-down tools
- the characterisation of extreme events as drivers for impacts
- identification of socio-economic constraints and evaluation of eco-system thresholds that might correspond to long term climate predictions, including better characterisation of abrupt, non-linear change
- improved damage cost functions for use in integrated assessment and other modelling exercises, based on improved physical impact estimates
- new work to address "science of integration" questions and science-policy networks to improve integrated assessment modelling
- integrated approaches to mitigation and adaptation

A main recommendation emerging from the Workshop was the need to further our understanding of benefits of climate policies with emphasis not only on scientific and impact assessment, but also on how to use benefit information to assess the trade-offs implicit in any climate policy choices. A rich research agenda is associated with exploration of direct climate benefits of different levels of global mitigation over the long term (see Box 2). Increasingly, risk analysis is playing a key role to inform climate policy analysis and research; further work is required to explore the use of such techniques. Adaptation is also part and parcel of the challenge associated with the estimation of mitigation benefits, as (avoided and delayed) impacts through mitigation will depend to a large extent on the extent and effectiveness of autonomous and planned adaptation. Though ancillary benefits are also an essential part of the picture of the "benefits" of mitigation policy, this issue has received significant attention in recent years compared to direct climate change benefits (IPCC TAR 2001; OECD et al. 2000). By comparison to analysis of mitigation costs or of ancillary benefits, the direct climate benefits from mitigation have received far less attention from the policy and analytical communities in recent years. Policy makers will need to work closely with the climate impacts research community to ensure that research and resulting information on impacts is structured in such a way that the direct climate benefits from mitigation can be properly assessed and taken into account in policy decisions. While the workshop has begun to set out an agenda for future analysis and research in this area, such work will only proceed if funding and support follows from OECD governments.

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ANNEX 1: WORKSHOP AGENDA

OECD Workshop on the Benefits of Climate Policy: Improving Information for Policy Makers

Workshop Chair:
Ken Ruffing, Acting Head, OECD Environment Directorate

Day 1: 12 December 2002

8:30 - 9:00 Registration

9:00 – 10:00 WELCOME AND INTRODUCTION

- **Welcome, meeting objectives and background**

  by ***Tom Jones***, Head of Division, Global and Structural Policies, OECD Environment Directorate

- **A UNFCCC perspective on benefits issues**

  by ***Dennis Tirpak***, UNFCCC Secretariat

- **Dealing with benefits in the IPCC Fourth Assessment Report**

  by ***Martin Parry***, IPCC Co-Chair of Working Group II

10:00 – 10:50 UNDERSTANDING IMPACTS, DAMAGE COSTS AND BENEFITS OF MITIGATION POLICY

- **Background paper: Estimating Global Impacts from Climate Change**

  by ***Joel Smith*** and ***Sam Hitz***, Stratus Consulting Inc., Colorado, United States

Discussants: Petra Mahrenholz, Federal Environmental Agency (UBA), Germany; and Ademar Ribeiro Romeiro, State University of Campinas/SP, Brazil

10:50 – 11:10 Coffee Break

11:10-13:00 UNDERSTANDING IMPACTS, DAMAGE COSTS AND BENEFITS OF MITIGATION POLICY [continued]

- **Uncertainty in climate change predictions**

  by ***Geoff Jenkins***, Hadley Centre for Climate Prediction and Research, United Kingdom

- **Regional and global climate modelling and emission pathways**

  by ***Tom Wigley***, National Center for Atmospheric Research (NCAR), Colorado, United States

- **Handling uncertainty over long timeframes**

  by ***Jan Rotmans***, International Centre for Integrative Studies (ICIS), Maastricht, Netherlands

  Discussants: Roger Jones, CSIRO Atmospheric Research, Aspendale, Australia; Stephen Schneider

13:00 – 14:30 Lunch Break

14:30- 16:00 ESTIMATING BENEFITS: NON-MARKET IMPACTS

- **Non-market benefits/impacts**

  by ***Dale Rothman***, International Centre for Integrative Studies (ICIS), Maastricht, Netherlands

- **Other issues**

  by ***Rik Leemans***, National Institute of Public Health and the Environment (RIVM), Netherlands

  Discussants: Michele Pittini, Department for Environment, Food and Rural Affairs (Defra), United Kingdom; Michael Hanemann

16:00 – 16:30 Coffee Break

16:30 – 18:00 ESTIMATING BENEFITS: CROSS-CUTTING ISSUES

- **Case study on sea-level rise impacts**

  by ***Robert Nicholls***, Middlesex University, United Kingdom

- **Assessing non-linear, abrupt change and extreme events**

  by ***Stephen Schneider***, Stanford University, California

  Discussants: Government representative from Canada ; and Jan Rotmans

18:00 Cocktail for workshop participants

AGENDA [continued]

Day 2: 13 December 2002

8:30 – 10:30 ESTIMATING BENEFITS: CROSS-CUTTING ISSUES [continued]

8:30 – 9:10
- **Ancillary benefits issues of mitigation**

  by ***Eberhard Jochem***, Fraunhofer-Institut für Systemtechnik und Innovations-forschung (ISI), Karlsruhe, Germany

  Discussant: David O'Connor, OECD Development Centre

9:10 – 9:50
- **Adaptation benefits and costs – measurement and policy issues**

  by ***Mac Callaway***, UNEP Collaborating Centre on Energy and Environment, Denmark

  Discussants: Merylyn McKenzie Hedger, Environment Agency, United Kingdom

9:50 – 10:30
- **Distributional Aspects of Climate Change Impacts**

  by ***Richard Tol***, Hamburg University, Germany

  Discussants: Farhana Yamin, FIELD, United Kingdom

10:30 - 11:00 Coffee Break

11:00 – 12:30 ESTIMATING BENEFITS: MARKET IMPACTS

- **Market benefits/impacts**

  by ***Michael Hanemann***, University of California at Berkeley, United States

- **Other issues**

  by ***Gary Yohe***, Wesleyan University, Connecticut, United States

  Discussants: Philippe Ambrosi, CIRED, France; Mac Callaway

12:30 – 13:30 Lunch Break

13:30 – 14:50 USING INFORMATION ON BENEFITS AND COSTS FOR POLICY ASSESSMENT

- **How much do we know about costs and how can we learn more?**

  by ***Hadi Dowlatabadi***, University of British Columbia, Canada[6]

- **Trade-offs among greenhouse gases**

  by ***Richard G. Richels***, Electrical Power Research Institute (EPRI), California, United States

  Discussant: Andre van Moor, RIVM, Netherlands

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[6] Hadi Dowlatabadi's paper was presented by Gary Yohe

14:50 – 16:10 USING INFORMATION ON BENEFITS AND COSTS FOR POLICY ASSESSMENT [continued]

- **Developments in integrated assessment modelling**

  by ***John Schellnhuber***, Potsdam Institute for Climate Impact Research (PIK), Germany and Tyndall Centre for Climate Change Research, United Kingdom

- **Informing climate policy given incommensurable benefit estimates**

  by ***Henry Jacoby***, Massachusetts Institute of Technology, United States

  Discussant: Anand Patwardhan, Indian Institute of Technology, Bombay, India; Rich Richels

16:50 – 15:10 Coffee Break

16:30-17:30 WRAP-UP SESSION - DISCUSSION

- **Assessing benefits: towards a conceptual framework and priorities for policy-related research**

  by ***Jan Corfee-Morlot***, Global and Structural Policies Division, OECD Environment Directorate

- **Concluding remarks**

  by ***Ken Ruffing,*** Workshop Chair

17:30 Workshop close