DECISION MAKING AND POLICY FRAMEWORKS FOR ADDRESSING CLIMATE CHANGE

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Contents

Summary

Climate change is a very long-term global stock pollution problem with pervasive uncertainty. Aspects significant for the decision-making process are vestigial uncertainty on the science; great uncertainty on impacts and substantial uncertainty on technological prospects; sharply different geographic and temporal distributions of responsibility and vulnerability; ignorance of the threshold for danger; and long timescale, with potential for sequential decision taking.

In a process driven by scientific information that requires wise interpretation, information available through the Intergovernmental Panel on Climate Change (IPCC) process is pruned of the policy insights of the scientific community that might help policy makers see the wood for the trees. The formation of an effective coalition has been delayed, and may be blocked, by pressure groups. Uncertainty on the science is of no importance when it is certain that serious risks arise from inaction. Scientists know this, but process obscures scientists' certainty of the need for action from decision takers.

Taking proper account of uncertainty and ignorance within a sequential decision process is a decision analysis problem. The approach to mitigation has often been faulty, disregarding the United Nations Framework Convention on Climate Change Article 3 requirement for precautionary measures, and focused on the statics of emissions limitation rather than the dynamics of technology change.

Prospects of progress hinge on recognizing past error. Economists now recognize that early predictions of a high cost of response were erroneous. Technological change is now being integrated as an endogenous factor in analysis *per contra* its previous treatment as an exogenous "autonomous energy efficiency improvement" parameter. Methodologies now exist for robust strategies that use sequential decision taking to cope sensibly with current ignorance.

Synergies from effective response are becoming recognized. Local benefits associated with effective response—clean air, improved public health, etc.—often outweigh the response cost. Non-Annex 1 parties can benefit from an effective response strategy through accelerated sustainable development. As an approach that eases the process of energy sector technological transition through augmenting supplies of biofuel, policy driven land-use change has great potential for land-rich but otherwise impoverished developing countries.

Whether these new perspectives will be perceived soon enough to erode entrenched attitudes and facilitate the formation of the large coalition represented by ratification of the Kyoto Protocol remains to be seen. Failure will mean further delay and increased risk that positive feedback mechanisms in the climate system will gather too much momentum to be controlled.

1. Introduction

To know one's ignorance is the best part of knowledge. (Laozi, *The Tao*, No. 71). The topic of decision making and policy frameworks encompasses both the decision-making process (how well are decisions reached?—Section 3) and the methodology of decision analysis (what is a good decision?—Section 4). Each of these is difficult because climate change has features that are sharply different from other environmental problems. These may be summarized by describing climate change as "a very long-term global stock pollution problem with pervasive uncertainty." The different components of this characterization are discussed in Section 2.

Decision-making frameworks for addressing climate change are reviewed at length (some 14 000 words) in *Climate Change 1995: Economic and Social Dimensions of Climate Change*. This is the contribution of Working Group III to the second assessment report (referred to hereafter as SAR) of the Intergovernmental Panel on Climate Change (IPCC). They are addressed at greater length (over 40 000 words) in the Working Group III contribution to the third assessment report of the IPCC (TAR). Here, the objective is to present the matter in a sufficiently compact form for the key issues to be seen in perspective and free of the political constraints on the IPCC.

2. The Dimensions of the Climate Change Issue

2.1. Pollution

The form of pollution is the level of greenhouse gases (GHGs—mainly carbon dioxide (CO_2)) in the atmosphere above the pre-industrial norm. This pollution is substantially due to cumulative industrialized use of fossil fuels, but with a significant impact from land-use change, including cumulative deforestation. It causes more of the sun's heat that reaches the earth's surface to be retained. These certain facts have in turn, almost certainly, caused the observed increase of the average surface temperature in the twentieth century (i.e. global warming). Since increased cloud cover may reflect more incoming heat, allowing less of it to reach the earth's surface, slight doubt exists that observed global warming may be due to other causes (see *History, Status, and Prediction of Global Climate Change*). This is significant in the decision-making process.

2.2. Global

This pollution is likely to affect the climate pattern worldwide, but in ways that are uncertain, different in different places, and—due to inertia effects in the climate system—on a timescale of several centuries. Mixing in the atmosphere is sufficiently rapid for the GHG level to be broadly uniform globally, with net emissions (i.e. emissions due to human action minus absorption due to human action) equally important wherever they occur. Thus the spatial and temporal distribution of impacts is different from the spatial and temporal pattern of responsibility for the current raised level, so far due mainly to the industrialization of the rich and powerful countries listed in Annex 1 of the United Nations Framework Convention on Climate Change (FCCC). This in turn is different from the "business as usual" (BAU) pattern of net emissions predicted from the continued growth of rich countries and from rapidly advancing developing countries.

These temporal and spatial variations of both responsibility for and vulnerability to climate change are also important for the decision-making process. This is because responding to a global pollution problem involves concerted action by an effective grouping of sovereign states. Such action by the parties to the FCCC should, under its Article 3 be based on "equity, in accordance with their common but differentiated responsibilities and capabilities" with Annex 1 parties (the industrialized countries responsible for the bulk of historic emissions) "taking the lead." But, because of economic progress anticipated in developing countries, it is not possible for the rich countries to control climate change through the twenty-first century by their own actions alone, however drastic.

Achieving an effective and stable grouping of sovereign states requires each member of the group to find its ongoing interests served by aligning its policies with the agreed direction for action. Annex 1 parties would not have signed the FCCC without an Article 3 provision that measures taken should be "least cost." And developing country parties would not have signed it without another Article 3 provision, that their needs "should be given full consideration," particularly those of them that are most vulnerable to likely climate change impacts or to the likely impact of action in the agreed direction. Scenario studies show that the BAU growth of developing countries will involve using fossil fuels. In this they would be following the path of industrialized countries in the past and, prospectively under BAU, in the future. Doing otherwise is perceived to make their development process more costly, as well as bearing adversely on fossil fuel exporting countries (mainly oil exporters).

The most vulnerable countries are vulnerable because of low income that prevents them taking effective adaptation action on their own account (ultimately by liquidating assets and migrating, if defenses against rising sea levels are infeasible). Their best response, in the absence of compensation for doing otherwise, is to develop and enrich themselves as quickly as possible, rather than hamper their progress by diverting resources to costly mitigation measures.

Thus, in deciding on a direction for action towards the common good of controlling the level of GHG, there are conflicts of interest between developing and industrialized countries in general, between fossil-fuel-rich countries in each group and the rest, and between the most vulnerable countries (all of them developing countries) and the rest.

2.3. Stock

Like all pollution problems, a public good (global climate stability) is under threat from an externality of market transactions. (An externality in economic theory is a good or bad side effect (or spillover) of a market transaction experienced by people who are not involved in the transaction and whose interests are not taken into account by the buyers or sellers. Climate change due to cumulative net emissions resulting from transactions in the energy and land-using sectors in, say, New Zealand in the 1950s, will affect holiday makers in, say, Blackpool, England, in 2050.) But unlike the flow pollution problems that provide the bulk of experience with environmental policy, where an acceptable level is known and the problem is to prevent the flow of pollution entering an environment from exceeding the capacity of the environment to dispose of it, the acceptable level is unknown. Also it is reached over time, as the cumulation of net emissions minus enhanced natural absorption adds to the stock (i.e. measured level) already in the atmosphere, so that climate change is a dynamic problem. When the acceptable level is known and reached, climate change will become a flow pollution problem. Essentially the stock pollution problem is a very long drawn-out transient phase pending stabilization at the acceptable level, defined by FCCC Article 2 as one "that would prevent dangerous anthropogenic interference with the climate system."

Two consequences arise from the dynamic nature of the problem. Firstly, with decision analysis, the conventional "comparative static" apparatus of economic theorizing on externality problems is significantly misleading. Secondly, with the decision-making process, the problem is open to sequential decisions taken as uncertainties are resolved.

2.4. Pervasive Uncertainty

Pervasive uncertainty includes uncertainty as to the probable change in climate that is predicted to result from a given increase in GHG levels. It also includes uncertainty as to the damage (in terms of both losses in marketed goods and services, and extra-market damage to ecosystems and other non-market values) that will result. And it includes uncertainty regarding technological progress that will determine the cost of both mitigation and adaptation measures.

Haunting the problem is the unknown potential for catastrophic climate change. Many kinds of climate catastrophe are imaginable given the variety of potential instabilities driven by positive feedback in the climate system. For instance, a reduction in the size of the polar icecaps reduces the amount of incoming heat that is reflected back into space, increasing average surface temperature and causing further melting of polar ice. In 1987, Broecker wrote: "Earth's climate does not respond to forcing in a smooth and gradual way. Rather it responds in sharp jumps which involve large-scale reorganization of the Earth's system . . . whose timing and magnitude are unpredictable. Coping with this kind of change is clearly far more serious than coping with a gradual warming." This unknown potential is reflected in other FCCC Article 3 wording calling for "precautionary measures . . . where there are threats of serious or irreversible damage [with] lack of full scientific certainty . . . not . . . a reason for postponing such measures." It is this factor that drives policy urgency. Indeed, apart from the risk of currently unpredictable climate catastrophe, the best defense (from an anthropocentric perspective) against predicted probable climate change is perceived to be economic growth. This would tend to insulate the economy from early climate change impacts by being sufficiently wealthy to adapt effectively until the problem is better understood and until mitigation technologies are better developed.

Nevertheless, uncertainty regarding the most probable pattern of climate change sharply limits the range of decision analysis methodologies that are applicable, and sheer ignorance regarding the lowest threshold for climate catastrophe is highly relevant to the decision-making process.

2.5. Very Long Term

Some components of the climate system have great inertia that, in the absence of sudden catastrophic jumps, results in a very long time interval between a perturbation of the climate system and the full working out of its effects. Given a step up in net emissions, it takes a century or more for the CO_2 level to stabilize even if the average surface temperature were to step up at the same time and then remain constant. But if the average surface temperature of the atmosphere changes, so must that of the material at the surface with which it is in contact. In the case of land masses, the equilibrium is approached quickly (i.e. the effect of the perturbation is quickly swamped by diurnal and seasonal variation). But in the case of the oceans, wave motion and surface currents cause mixing to a substantial depth (with each 3 m taking as much heat to raise it by 1°C as the entire atmospheric system). And the "heat conveyor belt" provided by deep ocean currents takes upwards of 300 years to complete its cycle. Similarly, the polar ice caps take a very long time to melt. Apart from slowness in temperature change, there is a linked slowness in changes in the (temperature-dependent) absorption of CO_2 by the ocean.

This inertia is both a boon and a potential trap in relation to the policy process and to policy analysis. It is a boon because, if no climate catastrophe threshold is crossed, there is time enough to do the research needed to become confident what the "best" course of action is, and then to take it, possibly in a sequence of well-planned policy measures. It is a potential trap because the lowest threshold is unknown and may be unwittingly crossed before uncertainty is resolved (if it has not yet been crossed—if it is temperature that triggers Broecker's jumps (see Section 2.4. Pervasive Uncertainty), then Earth may already be headed to that trigger, but not necessarily irreversibly if remedial action taken is so effective that GHG levels fall and the current commitment is reduced). For, given inertia, it is obviously possible to have crossed a threshold and only discover later the consequences of having done so: "Climate models . . . provide only a dirty crystal ball in which a range of plausible fortunes may be glimpsed . . . At present we are altering our environment faster than we can understand the resulting climate changes. If the trend does not stop we shall eventually verify or disprove the models—by a real global experiment whose consequences we shall not escape."

The very long term raises issues of intergenerational equity—failure to take action now could place future generations in misery subsequent to climate catastrophe. But, under probable climate change, expected economic growth will place future generations materially better off than this generation. In that case, equity would indicate that this generation should make no greater sacrifice to mitigate climate change than they do in relation to normal inter-temporal decisions. The question is then whether the policy decisions result in actions that show a return on investment sufficient to meet the relevant criterion (i.e. does it show a positive present value when costs and benefits are discounted at the appropriate rate of interest?).

However, any conventional discount rate reduces costs and benefits at the several-century time horizon to zero, implying no concern for future generations. This problem has been met by proposing discounting at a very low rate. But any non-zero rate implies partiality for nearer generations over more distant ones, which has been argued to be unreasonable. We may be concerned for our children and grandchildren, and maybe great-grandchildren if we are fortunate enough to meet them. But our concern for more distant generations, while not zero, is undifferentiated. This leads to an approach that involves discounting up to a time horizon and taking account of only a finite set of worst-off generations from then on.

But these prescriptive approaches are a reflection of the analysts' imputed social value system (or of the decision-takers' if they are well enough briefed on the implications of their decisions). Such prescription overlooks the reality that withdrawal of investment funds for GHG mitigation deprives future generations of the benefits of the observed market return on alternative investment. The SAR was unable to draw an objective conclusion as to whether a market-descriptive rate of discount or a prescriptive rate should be used. It may be concluded that decision analysis methodologies that lean heavily on the correct choice of discount rate are of limited value.

2.6. Summary

Two decision analysis problems have emerged from consideration of the dimensions of the climate change issue described in this section. First, and prior, is how much precautionary mitigation is needed to avoid potential climate catastrophe? Second is how best to adapt to the global warming that, subject to such precautionary mitigation, is predicted? The decision process question is how to form a grouping of sovereign states that will be effective in delivering such mitigation and adaptation, most likely through a sequence of decisions taken in the light of improving information?

3. The Climate Change Decision Process

The decision process involves the assembly of the information upon which decisions are reached and the negotiation of an outcome through the processes of the FCCC and its subsidiary bodies for scientific and technological advice and for implementation. Here, these processes are described before a review of the literature relating to the decision process question.

3.1. Filtered Information

Improving information is thus the basis for sequential decision taking. However, information needs to be synthesized into knowledge, and knowledge used wisely to yield better decisions and effective policy. The primary source of information to the FCCC process is the IPCC, which was "established jointly by the World Meteorological Organization and the United Nations Environment Programme to periodically assess the science, impacts, and socio-economics of climate change and of adaptation and mitigation options."

The IPCC procedure is that first drafts prepared by expert writing teams (principal or convening lead authors, lead authors, and contributing authors) are reviewed by other experts; second drafts are reviewed by governments (and experts); and final drafts are accepted in IPCC plenary. What is "adopted" from this process is a summary for policy makers (SPM), which is considered line by line in plenary (a process that can take one day per page). This slowness is because IPCC plenary is not, primarily, a meeting of experts (though many of these are present on government teams) but of government representatives whose main concern is that the version of policy-relevant science that they agree to is acceptable to their own government. Given the conflicts of interest outlined in Section 2.2, a blinkered vision necessarily emerges, formulated in the tortured language of compromise.

This is unfortunate, given that the FCCC process is essentially science driven. More interesting, as distillations of the state of scientific knowledge, are the executive summaries to individual chapters (the basic output of the writing teams) and the technical summary (about the length of a single chapter and, like the SPM, prepared by a team of principal lead authors drawn from the chapter teams). However, they provide little policy guidance since the basic material itself lacks the prioritization needed to synthesize knowledge for guiding decision analysis. This is because writing teams work to a rubric that they should be "policy-relevant but not policy-prescriptive." To say that one fact (that we don't know the threshold GHG level for climate catastrophe) is more important than another (that cloud in the daytime cools the earth's surface but cloud at night keeps it warm) is not done. For this verges on telling readers what to do (i.e. "put a lot of effort into researching thresholds") and may thus be construed as policy prescription.

Thus policy makers are faced with either a distillation of what information is not objected to by any of the FCCC parties, or a by mountain of un-prioritized information. That it is a mountain is ensured by the huge and expanding volume of scientific writing on climate-change-related topics and by the unwillingness of members of writing teams to call in question what other members regard as noteworthy. Add to this that very little is published about inconclusive research, whereas scientific publication of research conclusions expands exponentially. It is apparent that knowledge—the subjective organization of information for future use (e.g. problem solving)—especially knowledge of what information is missing and wisdom—the ability to make right use of knowledge—can find small place. For the "right" use of knowledge, and "right" regard for ignorance, certainly implies policy prescription.

Essentially, the process is such that many insights that the scientific community may have for providing clear guidance to decision takers towards a program of action for dealing effectively with climate change are obscured or filtered out by the IPCC rubric.

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Biographical Sketch

Peter Read is senior research officer in the Department of Applied and International Economics, Massey University, New Zealand, having recently completed his teaching career. Trained as engineer and economist, and having served in Whitehall in the development of energy policy some three decades back, Peter has focused on climate mitigation policy since 1990. His 1994 book advanced a strategy to link South (the developing world) and North (the industrialized world), and energy technology transformation with land-use change, in a win-win-win outcome yielding enhanced energy security, sustainable rural development, and low cost stabilization of CO_2 levels. His current focus is on linking this strategy to carbon capture and storage underground to yield a negative-emissions energy system as a precautionary response to the threat of abrupt climate change.