WPS4941

POLICY RESEARCH WORKING PAPER 4941

BACKGROUND PAPER TO THE 2010 WORLD DEVELOPMENT REPORT

Climate Change Governance

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Abstract

Climate change governance poses difficult challenges for contemporary political/administrative systems. These systems evolved to handle other sorts of problems and must now be adapted to handle emerging issues of climate change mitigation and adaptation. This paper examines long-term climate governance, particularly in relation to overcoming "institutional inertia" that hampers the development of an effective and timely response. It argues that when the influence of groups that fear adverse consequences of mitigation policies is combined with scientific uncertainty, the complexity of reaching global agreements, and long time frames, the natural tendency is for governments to delay action, to seek to avoid antagonizing influential groups, and to adopt less ambitious climate programs. Conflicts of power and interest are inevitable in relation to climate change policy. To address climate change means altering the way things are being done today – especially in terms of production and consumption practices in key sectors such as energy, agriculture, and transportation. But some of the most powerful groups in society have done well from existing arrangements, and they are cautious about disturbing the status quo. Climate change governance requires governments to take an active role in bringing about shifts in interest perceptions so that stable societal majorities in favor of deploying an active mitigation and adaptation policy regime can be maintained. Measures to help effect such change include: building coalitions for change, buying off opponents, establishing new centers of economic power, creating new institutional actors, adjusting legal rights and responsibilities, and changing ideas and accepted norms and expectations.

Climate change governance

A paper contributing to the 2010 World Bank World Development Report

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This paper explores the challenge of climate change governance, examining in particular the role national governments can play in putting in place institutions, policies, plans and measures to promote mitigation of, and adaptation to, human induced climate change.

The discussion is organized into five parts. The first examines the general characteristics of the problem. The second explores preliminary considerations in developing governance responses to climate change. The third discusses key dimensions of climate change governance. The fourth considers some examples of recent innovations. And the final section draws some additional conclusions.

At the outset two points should be emphasized about the scope of the analysis presented here.

First, the focus is on national political units and domestic action, and not on international organizations and the architecture of the global climate regime. Of course, collective action at the global level is required to address climate change. But the discussion here deals with national rather than international governance. Despite changing patterns of societal interaction, increased international economic interdependence, and some surrender of sovereignty to supranational institutions, states remain the most important centers of political power in the modern world (Pierre and Peters, 2000). States make and enforce domestic law. They possess significant financial resources, based on their powers of compulsory taxation. They maintain systems to adjudicate disputes, redistribute resources, and compel obedience (Gill 2003). Mechanisms of representation and democracy allow states to claim to act legitimately for the common good of their citizens. And, of course, it is states that conclude agreements at the international level. Among the many lessons that are already becoming clear from the 2008 financial crisis is that states remain the most powerful agencies for mobilizing collective resources for dealing with acute societal problems.

Second, this paper deals primarily with process and institutional reforms to develop climate change governance rather than with the design of specific instruments (for example, carbon taxes or greenhouse gas cap and trade systems). It is concerned more with overall systems of governance for climate change than with the advantages and disadvantages of particular policy approaches. Of course, specific instruments and approaches impose particular demands on public bodies. Carbon taxes, for example, require an effective system of national taxation, while cap and trade systems require appropriate mechanisms of regulatory oversight.

1. Climate change as a governance challenge

There is now convincing scientific evidence that human activity is altering the global climate (IPCC 2007). Although uncertainty remains about the timing and impact of climate change, it is already clear that there are risks of significant adverse consequences (Schellnhuber *et al* 2006). Stabilizing greenhouse gas concentrations in the atmosphere will require a dramatic reduction of annual emissions, eventually to a small proportion of current levels. Governments in a

number of developed countries are already discussing reductions of 80% on 1990 levels by mid century. And greenhouse gas emissions from developing countries would also have to peak well before this time if some of the more significant climate risks identified by the Intergovernmental Panel on Climate Change (IPCC) are to be avoided (Höhne, Phylipsen and Moltmann 2007). Moreover, and notwithstanding future mitigation efforts, in coming decades societies will have to adapt to warming to which we are already committed.

International emissions reductions on the scale now being contemplated would require a dramatic change to existing patterns of production and consumption. The transition to a low carbon emission economy implies a transformation of key economic sectors including agriculture, transport, construction, forestry and energy. It requires the development and deployment of new technologies and the emergence of new ways of doing things. Governments have a critical role to play in orienting and accelerating the shift to a low carbon development trajectory.

To date individual countries have been largely free to determine the degree of their engagement with the climate issue. Some states have introduced significant measures, while others have virtually ignored the matter. In the next few decades this will change as the actual and anticipated impacts of climate change become clearer, and the international consensus favoring action (both mitigation and adaptation) continues to evolve. This does *not* mean that nations with different levels of wealth, and different actual and historic emissions, will be expected to contribute *equally* to mitigation efforts. But it does mean that *adopting an appropriate response to climate change will increasingly be considered as a normal component of what 'good governance' at the national level entails.* Governments that wish to be regarded as legitimate by their citizens, and by the international community, will have to display their credentials on this front. Moreover, states that are taking vigorous action will have less patience with those who are not seen to be bearing their share of the common burden.

In other words, governance for climate change is increasingly non optional. It will not just be left to enthusiastic countries, to rich industrialized countries, or to high per capita emitters.

Since climate change, and the responses to climate change, will have important economic consequences, *the issue will inevitably become entwined with other international economic issues including: a) international financial flows, b) trade policy and c) development assistance*. For example, there is already discussion in a number of countries (including the United States and European Union member states) concerning 'border tax adjustments' (tariffs) to penalize imports from jurisdictions deemed to be taking insufficient action on climate change. As mitigation costs rise in the developed states, and concern about the migration of carbon-emitting industries (and their associated jobs) to unregulated jurisdictions grows, this issue will inevitably attract more attention.

These realities create additional powerful incentives for developing countries to engage early with the climate change issue, minimizing potential economic and political fallout that could harm their development efforts. In such a context Mexico's recent adoption of an emissions

control target makes sound economic, as well as environmental, sense. So, too, does the interest of certain oil exporting states in the Gulf in carbon capture and storage (CCS) and renewable energy technologies.

There are a number of well known features of the climate change issue that present difficulties for existing governance mechanisms. These include:

- *societal reach*: greenhouse gasses are associated with industrial and agricultural activities which have sustained rising living standards over the past two centuries. Fossil fuels still provide 80% of global primary energy. The transformation of existing production and consumption patterns to reduce emissions dramatically, as well as the necessary adaptations to climate warming, will require change that reaches deep into current practices. Consciously steering societal adjustment on such a scale is in many ways unprecedented.
- *scientific uncertainty*: although much is now understood about the processes driving climate change and the implications for human societies, enormous uncertainties remain: particularly about the sensitivity of the climate system (how much warming will result from a given increase in atmospheric concentrations of greenhouse gasses); regional climate impacts; and the consequences for ecosystems. There is concern about 'tipping points' at which radical discontinuities in current climate patterns could occur (Lenton *et al* 2008). Although knowledge is steadily increasing, uncertainties will continue for the foreseeable future.
- *distributional and equity linkages*: climate change, and responses to climate change, will impact different groups in different ways. Some of these impacts can be anticipated, others remain uncertain. Climate change 'shuffles the deck' --changing the patterns of risk and opportunity to which countries, regions, industries, social strata, and individuals are exposed. Equity issues (domestic and international) have always been among the most difficult for governments to handle. And climate change layers new dimensions on top of established concerns (regional disparities, North/South tensions, fuel-poverty, and so on).
- *long time frames*: greenhouse gas emissions from fossil fuel combustion have been rising since the dawn of the Industrial Revolution; the climate system evolves over decades, centuries and millennia; and managing climate change is likely to be a governance challenge throughout this century. Such long term issues fit poorly with a four year electoral cycle, the two or three year tenure of ministers and senior officials, and the daily or weekly rhythms of everyday politics.
- *global implications*: the causes and impacts of climate change are international. And economic and other ties between nations make a collective response essential. Yet coordinating international efforts on such a scale is a major challenge

Each of these factors contributes to making climate change a tricky problem for governments to manage effectively (see table 1). Of course, none of these features is unique to climate change. Other problems and policy areas display similar characteristics, although rarely all together and to such a degree.

That existing governance structures and processes are not ideally suited to manage climate change is hardly surprising. Modern governance institutions with their well known

constitutional mechanisms, representative institutions, federal structures, functional differentiation of ministries, professional bureaucracies, policy frameworks, and so on, emerged through complex and long term processes of institutional evolution, cross national imitation and learning, and iterative lesson drawing and design. Over the course of the twentieth century, government activities in the OECD states focused largely on 'security' (the maintenance of order, the administration of justice), 'economy' (promoting economic growth, monetary stability, competition and consumer protection), and 'welfare' (welfare state, public provision, 'social safety net'). In less developed regions the focus of government attention over the past six decades has been accelerating 'development' – a multi dimensional process that involves economic, social and political advance. From the late 1960s modern institutions of environmental governance came into being across the developed world, spreading later to developing countries. But they remain weak compared to more established areas of government competence (Meadowcroft 2009). The emergence of climate change now requires a further phase of innovation and adjustment to governance practices.

There has been discussion in the literature about the difficulties democratic states encounter when dealing with climate change (and environmental problems more generally) (Lafferty and Meadowcroft 1996; Eckersley 2004). And some suggestion that democratic states do not perform better than non democratic states in reducing greenhouse gas emissions. Various factors that hinder decisive action in democratic states are cited, including: the tendency for politicians to hesitate to introduce reforms that may antagonize voters (imposing higher energy taxes for example); the incentives for political leaders to try to attract votes by opposing more vigorous measure that might be suggested by their opponents; the influence of powerful economic lobbies that can mobilize to protect their interests and resist change (as compared with the more diffuse concern for long term climate protection held by ordinary voters); the existence of multiple 'veto points' and 'checks and balances' that slow decision making; and the ambivalent role of the media in simplifying and polarizing debate.

Such mechanisms are real, and appreciating their operation is important in order to develop more effective governance around climate change. On the other hand, it is not clear that at this point comparisons between the climate performance of democratic and non democratic states are particularly meaningful or helpful. The sorts of mechanisms described above are always operative in democratic polities: perverse results often arise from the operation of political and administrative processes. But, of course, parallel processes are also at work in non-democratic states – it is just that they are hidden from view. Over the long term, governments in non democratic states also have to pay attention to the impacts of policy on their citizens; and while political and policy competition are organized differently, they still take place.

The results of large-n studies that compare climate policy performance between democratic and non democratic states must be treated with caution. A period of at least twenty years is generally regarded as the minimum over which meaningful studies of policy change should be conducted (Sabatier 1993), and in the case of major long term issues like climate change the period is probably longer. Moreover, the absence of non-democratic advanced industrialized

states subject to binding emission reduction commitments creates a gap in the cases on which generalizations are founded.

The argument for the superiority of democratic political systems does not turn on the claim that democracies always make wise decisions. Obviously, this is not the case. Nevertheless, the flexibility and adaptiveness of democratic systems, and the capacity of electorates and politicians to learn lessons from previous rounds of policy failure, should not be underestimated. Voters can come to support policies -- to promote longer term goods or collective values -- that contradict their immediate economic interests. For example, in the 1970s there was considerable discussion about 'the fiscal crisis of the state' (O'Connor 1971; Offe 1982), brought on by voter demands for expensive public services encouraged by the ever more extravagant promises of political parties. Yet this did not ultimately lead to political breakdown. Electorates gradually learned that government spending could not grow indefinitely and that long term deficits encourage stagflation, and then entrepreneurial politicians successfully sold public service cutbacks and public expenditure retrenchment as 'short term pain' required for 'long term gain'.

Different types of political systems are underpinned by complex political, economic and cultural factors, and it is unlikely that in the near future the relative performance on climate mitigation will motivate movements towards more or less democratic or authoritarian political forms. Nevertheless, it is true that in the longer terms major government failures in managing climate risks could contribute towards political instability and regime change.

Of far more interest than the contrast between democratic and non-democratic states is the variation in performance among states within each grouping. Thus, for example, certain developed states have witnessed policy-linked emissions reduction in recent years (Germany, the United Kingdom, Sweden) while others have failed to control emissions growth (Canada, the United States). Political system characteristics (electoral and party arrangements, presidential or parliamentary constitutional forms, federal or unitary structures, and so on), influence the articulation of interests, the conduct of political contests, and the development and implementation of policy. But how these play out – to support or weaken climate initiatives – depend on many particular circumstances. Structural economic factors, administrative and legal practices, and ideational dimensions (such as political culture and ideological fissures) also play an important role. For example, on the structural side, countries with major fossil fuel export industries have proven less enthusiastic about emissions reductions and more hesitant to embrace the shift to renewable energies. Sweden and Norway provide an illustration here. Despite similar political traditions, high levels of concern about climate change, and enthusiastic participation in international climate agreements, Sweden has made an explicit commitment to ending fossil fuel dependence that has not been matched by Norway. Moreover, there is evidence that countries with more consensual (as opposed to conflictual and litigatious) political cultures, and strong traditions of state intervention to promote collective projects (such a social democratic, and corporatist states) can more effectively address environmental problems (Lafferty and Meadowcroft 2000; Duit 2008).

Thus rather than framing the discussion in terms of the performance of democratic and non democratic states, it may be more productive to examine mechanisms that can favor sound climate policy more generally, while keeping in mind that these must be adapted differently depending on particular institutional configurations.

Climate change governance remains very new. A number of developed states have introduced systems of greenhouse gas emissions controls, but policy experience in this area is barely fifteen years old. Initiatives around adaptation are newer still. Thus societies are only beginning to learn what approaches are more or less promising. With respect to climate change, there is no rulebook or agreed 'best practice' manual on governance that can serve to transfer lessons from one country to another. For this reason, discussion in this paper is organized around some key themes and practical examples.

2. Initial considerations

Before examining governance implications of climate change in more detail it is necessary to discuss briefly three general issues: the linkage between adaptation and mitigation; the differentiation of climate change governance requirements according to the level of national development; and the particular significance of energy and deforestation.

1) <u>Adaptation and mitigation</u>

Climate change governance requires action on two fronts: adaptation and mitigation. Adaptation implies the adjustment of society to a changing climate. Mitigation requires shifts in current behavior to end practices driving further climate change. Neither can be avoided. Adaptation is required because climate change is already underway, and further warming from existing emissions is inevitable. *Mitigation is required because there is no way to adapt out of climate change*. As long as greenhouse gas emissions continue at substantial levels, their concentration in the atmosphere will rise, and so will average global temperatures.

Governance of adaptation requires knowledge of anticipated regional and local climate effects. And it requires planning to deal with expected impacts on human activity. As the climate continues to change, the scale of the necessary adaptation will also evolve. Important climate issues detailed in scientific reports relate to sea level rise, extreme weather events, and changing temperature and precipitation patterns. Ecosystem stresses and biodiversity loss will increase. This has the potential to disrupt human settlement patterns, infrastructure, and agriculture; to generate significant and growing economic costs; and to threaten directly livelihoods and wellbeing of human populations (Stern 2007). The poorest countries and groups are likely to be most vulnerable to these pressures as they are a) most directly dependent on natural resource systems (for example agriculture) for livelihoods and b) have least resources to adjust to change.

Critical elements required for successful adaptation include the following: enhancing scientific understanding of regional and local climate change, and ecosystem and societal impacts; the systematic monitoring of climate, ecosystem and societal impacts; accounting for climate issues in long term planning for infrastructure and for key socio-economic sectors; developing public education around anticipated climate impacts to encourage individual and collective adaptation (changes in farming practices, development of new crop varieties, etc); initiating societal debate about the impacts of climate change and appropriate societal adjustments.

Particular governance measures that can be taken include: a requirement for climate change impacts to be addressed in national, regional and local planning processes (for example land use planning); the preparation of periodic national and regional reports on adaptation and anticipated long range adaptation costs; the establishment of regional and sector based adaptation forums with key stakeholders to explore impacts and responses; collaboration with the insurance industry to identify vulnerabilities and take remedial action; the integration of climate adaptation into planning for protected areas and in agriculture and natural resource management plans; and the incorporation of adaptation issues into work of research funding councils.

Governance of mitigation requires an understanding of emissions sources, cost-effective abatement potentials, and policy approaches. An array of policy instruments is available to encourage mitigation. The difficulty lies less in the design of approaches than it does in the political will to implement them. For countries pursuing mandatory emissions abatement the introduction of a *cost for carbon dioxide emissions* provides an economy wide incentive to move toward less carbon intensive pathways. Even in situations where economic resources available for climate change mitigation are extremely limited it is generally possible to identify 'no regrets' policies which can encourage mitigation at little or negative economic cost. The abolition of subsidies for fossil fuel usage (although politically challenging) can bring substantial economic and environmental benefits. Energy efficiency is another promising area, where analysis suggests there are many potential gains. *Regulatory standards* to raise minimum efficiency requirements for industrial equipment, consumer products, and building standards have a role to play here. Provision of additional financial assistance to developing countries to encourage mitigation efforts, and enhanced mechanisms for mitigation technology transfer from developed to developing nations, are an important focus for ongoing international climate negotiations.

2) <u>Levels of socio-economic development</u>

The level of socio-economic development and the effectiveness of existing governance arrangements have direct relevance for climate change governance and for the priorities governments will adopt in relation to this area.

All states require institutions capable of undertaking climate change governance. But the particular institutional forms and capacities will vary according to national circumstance. In the most general sense it is true to say that:

1. countries with effective and resilient governance institutions will be able to build on that base to develop institutions more specifically adapted to manage climate change, while countries with less effective and more brittle general governance arrangements will have to establish more modest goals in the climate sector as they concentrate on more pressing governance issues; and

2. economically developed states will require more elaborate institutional mechanisms to ensure the control and reduction of absolute greenhouse gas emissions, while less developed countries will place more short term emphasis on governance for adaptation, and on sector specific or project-based mitigation activities.

A number of efforts have been made to assign countries to different groups for the purpose of determining international climate obligations (Baer and Athanasiou 2007; Höhne, Phylipsen and Moltmann 2007). Lists of countries ranked by per capita and absolute GNP, per capita and absolute greenhouse gas emissions, inclusion or not as Annex 1 parties under the Kyoto Protocol, the availability or not of low cost abatement options, and so on, do not correspond very directly with one another. The different levels of effort expected of each of country, as well as the scale of resources to be made available to the less developed countries by the most developed countries, is the subject of ongoing international negotiation.

Notwithstanding this, the following general observations can be made:

High income countries (whether or not they have binding emissions reduction targets under the Kyoto Protocol, but with due attention to their size, and to the scale of their greenhouse gas emissions) should aim to develop *a comprehensive system of climate governance institutions* with the capacity: 1) to contribute actively to international climate governance (at the political, administrative and scientific levels); 2) to monitor, control and reduce their greenhouse gas emissions; 3) to ensure appropriate adaptation policies and measures; and 4) to provide assistance to poorer developing countries;

Low income countries should aim to develop *a competent basic climate administration* with capacities: 1) to participate in international climate processes; 2) to complete basic scientific assessments of climate change vulnerabilities, current emissions and future scenarios; 3) to monitor local ecosystems and climate impacts; 4) to develop public education and stakeholder engagement around adaptation; and, 5) to solicit and fruitfully deploy international funds related to climate change.

Middle income countries present a more complex and varied picture, and the extent and focus of their climate change activities and governance mechanisms will vary with national circumstances. Issues such as per capita income, attainment on the human development index,

size, rate of economic growth, per capita emissions, and Annex 1 status will influence international expectations about mitigation efforts. Countries whose income levels are approaching 'high income status' should work to develop more elaborate climate governance structures. Large and rapidly growing states that aspire to an enhanced international role in coming decades will need sophisticated institutions for climate governance, as over time they will be expected to make a major contribution to mitigation efforts, and are likely to experience major adaptation challenges (Höhne *et al* 2008).

On a scale of several decades the difference in the climate change governance requirements between high and low income countries will remain quite stark, with the high income countries requiring elaborate policy frameworks to reduce emissions, while low income countries emphasize adaptation. Yet ultimately all countries will require systems to govern both mitigation and adaptation.

As time passes, and the pressures to drive down emissions further grows, more difficult issues will have to be brought into international climate change debates. Two elements which have been present from the outset, but which governments and international institutions have so far been unable to address adequately, are levels and rates of growth of consumption and of human populations. Over the long term, consumption growth and population growth cannot be treated as exogenous variables, and national authorities will have to take responsibility for the policy regimes put in place to orient their long term development.

3) <u>The energy and deforestation linkages</u>

Climate change is linked to *energy production and consumption*, because fossil fuel usage is the single largest contributor to greenhouse gas emissions. Indeed, the IEA has argued that 'what is needed is nothing short of an 'energy revolution' (IEA 2008).

Affluent countries generally have high energy use and high greenhouse gas emissions, although among these countries the level of emissions from the most carbon dioxide intensive economies (such as the United States, Australia and Canada) are about four time those of the least carbon dioxide intensive economies (such as Sweden). The deployment of low carbon emitting energy systems is therefore a critical response to climate change. Approaches to reduce emissions from the energy sector include energy efficiency gains (throughout the production/consumption cycle); expansion of established large-scale low carbon generation systems (hydro, nuclear); deployment of new renewables (such as solar, wind, wave, tidal, geothermal, biomass, small scale hydro, and so on); and carbon capture and storage on large fossil fuel generating facilities. Climate governance and energy governance need to be drawn together. Institutions and policies are required to accelerate the development and deployment of low carbon energy technologies. Since energy projects typically involve long lead times, large

capital investments, and long project lifetimes, *long term public sector planning is critical if energy and climate policy objectives are to be met successfully*.

Low income countries typically have low per capita energy consumption and low per capita carbon emissions. Meeting basic energy needs, for human and economic development goals, is the priority here. Nevertheless, energy policy decisions should be made in full awareness of climate implications. In particular, care should be made to avoid substantial financial commitments to technologies that are likely to be rapidly superseded as technological advances gather pace in the next decade. Funds will be available from international donors and international carbon markets to encourage a shift to low carbon emissions pathways.

Middle income countries find themselves between the situations described above. Although many may not immediately face the prospect of mandatory emissions caps, they may come to accept some form of internationally agreed mitigation obligation. Even if this is not the case, over time (with increased affluence and higher per capita emissions levels) such controls will come. It therefore makes sense to explore low emissions energy development trajectories in the present. This may avoid reinforcing path dependence with a high carbon emitting infrastructure, which will prove costly to replace in the future. This is all the more so considering the potential co-benefits of many low carbon options (financial saving from energy efficiency, environmental and human health benefits from reducing dependence on fossil fuels, energy security from reducing dependence on imported fuel, and so on). In some contexts, low carbon options can already compete on an even basis with carbon emitting fuels (IEA 2008).

Deforestation currently accounts for 25%-30% of human generated carbon dioxide emissions, with most occurring in tropical and temperate areas of Africa, Asia and Latin America. Reducing this rate, and developing ways to manage forests more sustainably is one way in which middle and low income countries can make a contribution to mitigation in the coming decade. There is substantial evidence that much of the deforestation generates little long term economic value or contribution to sustainable livelihoods. So improvement of governance in the forest sector, and the integration of climate concerns into this governance, can bring economic and social as well as climate benefits. Tackling this problem will require efforts of low and middle income supplier countries and large timber consumers, as well as funding from higher income states. Brazil provides an example of a country whose government has recently reaffirmed its commitment to strengthen action in this area.

3. Key dimensions of climate governance

We will now explore four dimensions of climate governance and some institutional innovations with which they are associated.

1) Building strategic capacity

Climate change governance requires strategic capacity. Strengthening capacities to address this problem can be considered under four headings:

a) *Leadership*

The most important factor influencing the success of climate change governance to date has been engagement (or not) by the top political leadership. In situations where political leaders have taken an active interest, matters have moved forward. There is nothing that focuses the minds of officials and external stakeholders more than the knowledge that the prime minister or president is actively interested in a file.

However, leadership is not just an individual question, but also an institutional one. Establishing leadership capacity in the climate change area can include:
- creation of a cabinet committee on climate change, or a cabinet committee which links climate change with a critical area such as 'energy and climate change';
- designation of a senior government minister to take particular responsibility for climate change policy;
- selection of an administrative lead agency on climate change;
- establishment of an intra-governmental coordinating committee (chaired by the lead agency) to bring together officials from across government working on climate change;
- introduction of regular reporting to parliament on climate change objectives, policy and performance.

In cases where initiatives around climate change are not developed, a first step can be the creation of a national task force or parliamentary commission with a mandate to conduct hearings, investigate the issue, educate the public, and report back to the government on priorities.

Internationally, there are three basic organizational models for developing administrative leadership capacity around climate change. First, placing responsibility for climate change policy within the environment ministry or agency; second, establishing an independent climate change authority (a secretariat or agency, perhaps linked to the Prime Minister's office); and third, linking climate change with another senior ministry (such as energy). Examples of these three approaches are provided by: Sweden (the Ministry of the Environment); Australia (The Australian Greenhouse Office (until 2008)); and the United Kingdom (the newly formed Department of Energy and Climate Change).

The option pursued by most states has been to lodge responsibility for climate change with the environmental department (with foreign affairs playing an important role in relation to international negotiations). After all, climate change is an environmental problem and the regulation of emissions is a core element of the policy response (as it is on more traditional pollution issues). And yet problems with this approach (related to the cross-cutting nature of climate policy, the significant economic implications, the challenges of adaptation and mitigation, and the general weakness of environmental ministries) have led some states to pursue alternatives.

Prima facie there is no reason to prefer one of these patterns over the other. True, climate change governance should not simply be considered as an 'environmental' issue: its implications extend across government, and managing climate change implies initiatives in many key areas -- energy, industry, spatial planning, urban affairs, transport, international relations, and so on (see section 2 below). On the other hand, depending on the concrete political and administrative context in the given country, and provided adequate weight is given to the enterprise and appropriate integrative measures are enacted, the lead climate agency can be structured in various ways. Each model has advantages and disadvantages. The stand-alone model can result in isolation from more established central and line departments, and Australia has now abandoned it. Yet in another context -- with strong executive support -- it may be practical. The environment ministry base provides core expertise and an established institutional home, but typically these are junior ministries. The linkage to the energy ministry engages a key sectoral connection (fossil fuel combustion lies at the root of climate change), but it also contains some risks: climate policy may be captured or overwhelmed by more established energy policy orientations and/or other sectoral connections may be neglected.

At present it is still too early to say whether any of these models has a decisive advantage over the others. The key is that, wherever it is located, the lead climate change agency must enjoy appropriate resources, political support from the top, and authority to engage with other groups working in climate change across the whole of government.

 b) *Knowledge and the provision of expert advice*

Increased understanding of climate change and the transmission of sound scientific advice are essential for good governance. Issues here include:
- establishing a system to provide authoritative advice to government. This can be organized in a variety of ways including appointment of a chief climate change advisor or establishment of a national advisory committee. A requirement that advice be published at regular intervals can increase the perceived public importance of the climate issue;
- supporting the continuing development of scientific knowledge about the climate system and the potential impacts of climate change, especially on the home jurisdiction;
- ensuring the monitoring of climate and ecosystems across the country;
- developing capacity in economic, policy and social sciences related to climate change, because such knowledge is a crucial support for policy.

The potential of each country to develop activities under these headings is linked to the maturity of the national scientific, academic, technical, and economic infrastructure. Nevertheless, even the poorest countries should be able to establish a national advisory capacity and domestic monitoring. A variety of capacity building opportunities related to climate change exist, and governments in developing countries should make a priority of accessing these funds.

c) *Defining the national interest and elaborating a strategic policy framework:*

National governments assume responsibility for representing the collective interests of their citizens, domestically and internationally. But understandings of what constitutes the national interest are contested and change over time.

It seems obvious that governments should approach climate change from the perspective of a rigorous assessment of their national interest – establishing their policy stance on the basis of an overall appreciation of the risks, and also the costs and benefits of potential mitigation and adaptation actions. Yet in many countries the policy stance has evolved in an ad hoc way, in response to contingent domestic political circumstances, and the need to present positions in international negotiations. In short, the vision is partial and fragmented. It has not been based on a detailed scientific, economic and political assessment. And it does not consider the 'national interest' in a multi-dimensional way that includes long term considerations, and the collective good of a prosperous and peaceful international system.

Good governance on climate change requires a redefinition of national interests in light of climate change risks. This necessarily entails an effort to understand the potential implications of climate change, and the costs and benefits of possible mitigation and adaptation responses. On the basis of such effort, all governments should be able to formulate an overall perspective on the significance of human induced climate change on long term national welfare.

Some governments have concretized such a perspective by adopting an indicative temperature target – stating that their policies are intended to restrain global average temperature increases to some specified value (for example, 2 degrees centigrade for the European Union). Others have focused on specific domestic emissions reduction targets (say by 2020 and 2050). Still others have focused domestic action on adaptation. At present there is no agreed international objective in terms of a temperature target, atmospheric concentration target, or global emissions level target.

Some governments have commissioned major studies to assess climate change and evaluate appropriate responses. Prominent examples are the Stern Review (United Kingdom, 2007), the Garnaut Climate Change Review (Australia, 2008), and the earlier reports of German Parliamentary Enquete Commissions (starting in 1987).

Since climate change requires a response stretching over decades, governments need to establish a clear strategic policy framework. This can provide the stability required to encourage long term investments (in energy and infrastructure, for example) required to control emissions and to adapt to changing climates. It will also ground policy initiatives in distinctive national conditions, including important political and cultural values. Thus Australia's strategic approach has sought to emphasize stewardship of a unique island continent; while

Sweden has linked climate change policy to traditional values and building a 'green welfare state' (Papadakis 2000; Eckerberg 2000).

The parameters of this strategic policy framework will vary according to particular national circumstances. It should include specification of:
- the county's overall perspective on climate change;
- national objectives with respect to mitigation and adaptation;
- the bodies responsible for making and implementing climate change policy
- the main policy approaches, instruments, and funding mechanisms;
- what is expected from other societal actors (layers of government, business, civil society, individual citizens);
- the approach to international cooperation around climate change.

In historical terms, many countries have developed similar overarching and future-oriented strategic perspectives with respect to economic development objectives and/or strategic defense policy. It is not an issue of producing a single showpiece climate change document, but rather of ensuring that the core strategic orientation is clear to the government itself as well as to key external stakeholders. Over the past decade a number of European countries (such as Sweden, Norway and the Netherlands) have developed this sort of framework for climate policy. The Netherlands, for example, has linked climate policy to the country's unique vulnerability to sea level rise; to its tradition as an environmental policy innovator; and to its open trade-oriented economic structure.

d) *Building organizations focused on a low carbon emission economy*

Existing institutions and programs should be adapted to address climate change issues, but it is also necessary to establish bodies that are focused particularly on the development of a low carbon economy. Such specialized bodies can focus on this issue, build networks of innovation, develop expertise, and nurture emerging approaches to mitigation and adaptation. A web of such institutions can accelerate change.

Although many climate change programs will be run directly by key government departments (such as environment, industry, energy, health, and so on), it is advantageous to encourage the development of organizations outside direct ministerial control. These may take many forms including independent agencies, publicly funded trusts, joint public/private/not for profit partnerships, and so on. The advantages of such quasi-independent but publicly funded organizational forms are many: they are protected from everyday political interference by politicians; they are freed from cumbersome government rules over purchasing, hiring and operations; they can move more quickly to adapt to circumstances and exploit opportunities; their mandates and organizational forms can be structured specifically for certain tasks (education or research or supporting firms); they can build their own independent reputations for effectiveness and objective assessments; and they may have more credibility with the public and with stakeholders than politically-linked officials.

Areas for the attention of such bodies focused on the low carbon future include:
- research on the transition to a low carbon economy, including social and cultural dimensions as well as scientific and technological ones;
- education of the public on the science of climate change, anticipated impacts, and critical policy choices;
- stimulation of public debate and controversy around options for a low carbon future;
- critical assessment of national and international policy measures, and constructive criticism of the performance of government and other social actors;
- support for the development of low carbon technologies that are not yet ready for commercialization;
- encouragement for community engagement with climate change;
- training for professions (building trades, designers, and so on) in low carbon technologies and providing help to public and private bodies seeking to reduce their carbon footprint;
- assistance for those seeking to establish new businesses in the low carbon sector.

Of course, different types of organization would be suited to different tasks. Examples of such bodies established in the United Kingdom include the Carbon Trust and the Tyndall Centre for Climate Research (see section 4a below). In Germany research organizations such as the Wuppertal Institute for Climate, Environment and Energy play an important role. In Sweden The Mistra Foundation for Strategic Environmental Research (established with funding from the former wage earner funds) is supporting education and research around climate change. The International Institute for Sustainable Development in Canada provides another example.

Over time, the objective should be to create an array of organizations, more or less independent of government (funded to some extent, or at some point, through the public purse), but all aligned with the political goal of establishing a low carbon-emission economic system. By operating at multiple levels, in multiple forums, with different types of publics and stakeholders, these groups can accelerate change processes. Inevitably there will be some redundancy and overlaps among such bodies, and some competition and jostling over spheres of operation. Some groups may fail to achieve defined objectives, while others will expand more quickly than anticipated. But the goal is a system of organizations of different types, with different remits, which *taken all together* accelerate change towards a low carbon future.

In addition to the specific functions each of these groups performs, collectively they provide leadership for a complex and protracted transition towards the carbon emission free economy. *Combined with a) green business organizations and b) not-for-profit green organizations, they provide an organizational weight that can help overcome institutional inertia (within government and without) that is slowing down societal adjustment*. Thus building these semi-independent agencies (in addition to providing support for green business) is an important strategic measure governments can take to strengthen long term economic and political support for the low carbon emission economy.

2) <u>Integrating climate change into development decision making</u>

Central to the notion of sustainable development, first formulated by the Brundtland Commission more than twenty years ago, is the idea that environment and development decision making should be linked (WCED 1987). Climate change represents a perfect case in point. Climate change policies can only be successful if they are formulated in relation to economic and social realities and goals. In particular, climate change policies need to be integrated into the development trajectories of a) key socio-economic sectors (energy, industry, transport, and so on); and b) key regions (cities, provinces, and so on) (Lafferty 2004).

Integration implies an attempt to find synergies among different types of goals (Gibson *et al* 2005). For example, some mitigation approaches can provide positive economic benefits (removing subsidies that encourage energy use saves money as well as lowering emissions) and/or health benefits (fuel switching from coal to gas reduces urban air pollution and associated respiratory disease; improvements in rural cook stoves can improve indoor air quality). A shift away from deep tillage agriculture may provide diverse benefits including reduced soil erosion, higher carbon dioxide retention in the soil, reduced fertilizer inputs, and so on.

In terms of the organization of the work of government, approaches for integration include:
- establishing individuals and groups responsible for climate change in each ministry or agency
- requiring climate change mitigation and adaptation implications to be addressed in national, sector, and regional development plans
- establishing sector and regional climate change roundtables to bring together stakeholders to explore climate implications of current development paths
- integrating climate change into the mandates of all public bodies, especially those with an important role in energy governance, and forestry and land use planning.
- requiring climate change impact assessments for all major infrastructure projects (mitigation and adaptation implications)

More generally, 'integration' requires the consideration of climate change when developing sector policies (Lenschow 2002; Nilsson and Eckerberg 2007). Thus transport policy should be made with climate change mitigation in mind. The same goes for the construction industry, and so on. By integrating climate change considerations in at the start, abatement and adjustment costs can be kept down.

For example, over the past two decades the emphasis on energy policy in the many countries has been on market reform, with the introduction of competition into the energy sector, and development of regulatory institutions focused on delivering low prices and reliable supplies to consumers (Doern and Gattinger 2004). But in many case, climate change did not feature prominently in the new architecture of the electricity supply system. As climate change moves up the political agenda, adjustments must be made to the mandates of bodies in the electricity

supply sector so that the development of low carbon electricity supplies and energy efficiency becomes an explicit part of their responsibilities.

Equity considerations also form an important element of climate governance integration. Reference has already been made to the complex equity implications of climate change. A concern with fairness is a basic property of human social interactions. Equity is valued in its own right. And, from the perspective of governance, it also has important instrumental value. This is because perceptions of fairness make social actors more willing to accept sacrifices, and perceptions of inequity generate social resistance and make the effective implementation of policy more difficult. The distributional implications of adaptation and mitigation policies therefore need to be carefully assessed. For example, the removal of fossil fuel subsidies, or the imposition of a carbon tax, might adversely affect vulnerable groups, and redistributive measures may be required to protect the poor from such abatement strategies.

Research suggests that in times of crisis organizations in both the public and private sector are more open to alternatives to traditional ways of doing business. Stakeholders who are convinced that they must change in order to survive can (in appropriate conditions) come to share a vision for renewal that encompasses significant change. Thus *sector and regional redevelopment plans* provide a good context for integrating climate policy with economic and social initiatives.

In the context of the current economic downturn, for example, there is an opportunity for governments to link economic stimulus with climate policies. Infrastructure investment can be targeted at sectors and projects with an emissions reduction potential. And climate change adaptation criteria can be added to project goals – to make sure new infrastructure will be able to weather conditions that will emerge over coming decades. Sweden provides and example of a country which used a previous economic crisis to leverage environmental change. In the 1990s Sweden faced a serious economic downturn which threatened job losses and traditional welfare spending. Rather than abandoning environmental goals the government place sustainable development at the core of its economic stimulus package (Eckerberg 2000).

Climate change governance requires both the establishment of specific institutions, groups and policies *and* the integration of climate change into the normal practice of government. The balance of emphasis between these two imperatives will vary over time and from country to country.

3) Societal mobilization

Societal mobilization is critical to developing an effective response to climate change. After all, it is communities, business, families and individuals that will have to change their behaviors and to provide the social and technological innovations required to reduce greenhouse gas emissions and to adapt to a changing climate. A central dimension of climate change governance involves finding approaches to *activate dynamic forces in society* to engage with the climate challenge. Important approaches to this task include:

- *sending consistent economic signals* that encourage some behaviors and discourage others throughout society – for example, encouraging energy efficiency and discouraging the use of energy produced from high carbon emission sources;
- *developing public education* about climate change mitigation and adaptation. This includes changes to the curriculum of schools, colleges and universities. The media provide a critical link to the public, and activities can be organized to raise the awareness of journalists. Professional organizations (doctors, scientists, nurses, architects, engineers, public servants, teachers, farmers, and so on), business associations and trade unions also have an important educational potential. They can communicate with their members and bring them tailored messages that are more likely to be believed.
- *engaging cities and localities*. Climate change is always experienced locally; the vast majority of the world's population now lives in cities; and the local level of government is closest to the everyday life of citizens. If mitigation and adaptation activities are to become concrete for ordinary citizens, cities and local governments are key. The development of neighborhood based activities can activate a great dynamic potential for change.
- *encouraging participation of stakeholders in key socio-economic sectors*. Many of the concrete strategies for emissions reduction and adaptation must be developed and applied at the sector level, and the mobilization of key sector players (businesses, labor organizations, and environmental organizations) is essential for innovation (Glasbergen, Biermann, and Mol 2007).
- *encouraging informed public discussion*. Climate change governance involves complex and contested decisions and difficult policy choices. These decisions affect long term societal welfare and the distribution of costs and benefits. It is only right that citizens be involved in these decisions. By involving them in public debate and discussion they can come to appreciate more clearly the difficult trade offs policy makers confront, and they will be more willing to assume their part of the collective societal burden of adjusting to climate change.

Traditionally, governments are ambivalent about societal mobilization. One the one hand, it is nice to have citizens actively supporting government initiatives and applauding ministerial statements. On the other hand, active citizens and stakeholders tend to be demanding, and more open public debate can also bring more criticism of officials and resistance to proposed policy. Sometimes stakeholders and publics can mobilize to block needed reforms. In other cases they resist distributional consequences of government action. Moreover, in developed countries governments are sometimes wary of taking on an 'educational' role, arguing that at most they can provide 'information', and consumers must be left to make up their own minds. In any case, in many contexts consumers are distrustful of messages coming from government (for example, reassurances about food safety). Public skepticism is usually based on previous experiences where politically motivate messages turned out to be false or one-sided.

But the depth of societal change required by climate change adjustment and the long time frame over which the issue will play out (50-100 years and more) mean that successful policy

cannot be engineered by visionary politicians and efficient bureaucrats 'behind the backs' of the citizens. If the population is unhappy with the orientation of policy they will ultimately have many occasions to undermine implementation or ensure a change of orientation. Moreover, governments cannot know in advance the appropriate shape of low carbon economic institutions decades from now. Moreover, resistance will come anyway (as some actors try to avoid costs imposed by adaptation or mitigation). So it is preferable to involve key stakeholders in policy debates and design from the outset.

4) Learning how to do climate change governance

Human societies are at the beginning of a process of understanding the climate change issue, and of developing institutions and approaches suited to its management. Precisely because we have such limited experience it is important to adopt a 'learning' oriented approach to climate change governance.

Central to such an approach are:
- the effort to develop policy in an iterative manner, where objectives are carefully specified, policy tools are selected, policies are implemented, and then the results are critically assessed, before a new round of policy design and implementation is launched;
- the careful formulation of measurable goals, targets and indicators, because with clear objectives it is easier to determine the extent to which progress is being made to attain them;
- the establishment of monitoring programs to track climate related changes and the impacts of policy;
- the creation of an array of independent assessment organizations that can provide rigorous evaluation of the state of the environment, human pressures and the effectiveness of policy. Basing such organizations outside the purview of the executive branch of government ensures that they can offer independent advice, that can be trusted by the public, and will not be compromised by political interference (Meadowcroft 2007b);
- the adoption of an experimental approach – in the fields of policy design, social innovation and technological development. In many spheres of life humans develop experiments to trial new ideas, gain experience, and sort out more or less promising innovations. Governments also need to experiment with policy options, and to support promising new social practices, and alternative technological solutions (Kemp, Rotmans and Loorbach 2007). Experiments always involve risk: because one cannot know in advance which will succeed and which will fail. But by managing portfolios of experiments, one can moderate this risk and identify winners. And even unsuccessful ventures are often rich with lessons;
- the encouragement of transparency in climate change governance;
- the promotion of societal 'reflexivity' -- a continuing process of collective reflection about social goals and the means of attaining them, involving political forums, policy making institutions and the public sphere (Grin 2006; Voß and Kemp 2006).

Despite the obvious relevance of a 'learning-oriented' approach, governments are often reluctant to talk in these terms. Officials in many countries (including many developed democratic states) remain horrified at the thought of independent appraisals of the effectiveness of policy measures and government operations. Politicians worry that calling a policy approach 'experimental' may give the impression it has not been thought through. There is pressure to come up with firm 'answers' to policy problems. *But explaining why we can not have all the answers today, and why it is sometimes good to trial policy innovations, and then draw lessons from the experience, is part of the public education challenge confronting governments.* It is not just about the cause and potential impacts of climate change that citizens require education. They also need a better appreciation of the science/policy interface, of the need to adopt sound policy in a climate of pervasive uncertainty, and of the importance of a 'learning-oriented' public policy.

The Netherlands provides a number of examples of 'learning oriented' environmental policy. The National Environmental Policy Plans NEPP I-IV, from 1989 to 2002) established an iterative process that drew lessons from each round of policy making to develop a progressively more comprehensive and coherent approach to managing environmental burdens (NEPP4 2002). The Netherlands Environmental Assessment Agency (PBL 2008) provides independent assessment of social trends and policy impacts in the area of environment, climate change and sustainability. Such assessments are routinely used to adjust policy orientations, and have been sought out by government officials and politicians. Moreover, the 'transition management' approach (Rotmans, Kemp and M. van Asselt 2001) adopted since NEPP4 in 2002 is explicitly centered on the notion of transition experiments to accelerate movement towards sustainability (see Section 4c below).

With respect to 'reflexivity', this is best understood as a product of the interaction of diverse societal institutions and ongoing processes of debate and lesson drawing in the public sphere. Critical elements for its development are: a broad and vibrant civil society capable of independent evaluation of policy performance and substantial self organization; transparency of policy making, and of the climate performance of corporations and public bodies (for example through compulsory reporting requirements); and continuing openness to reconsider not just the *means* for policy attainment but also the *goals* of policy.

4. Some examples of recent governance innovations[2]

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[2] This section draws material directly from a scoping paper recently completed for the Policy Research Initiative in Canada: James Meadowcroft and Francois Bregha, 'Governance for sustainable development: meeting the challenge ahead, Ottawa, 2009).

Over the two decades governments (particularly in developed countries) have experimented with a variety of climate governance approaches. This section briefly presents three examples drawn from the United Kingdom, Sweden and the Netherlands.

a) The United Kingdom

Over the past decade the United Kingdom has developed a set of innovative approaches for climate change governance. This has included the creation of new organizations and detailed policy frameworks. The most recent additions to the system are included in the Climate Change Act 2008. Key provisions of this Act include the creation of periodic 'carbon budgets' and the establishment of a statutory Climate Change Committee to advise government on its emissions reduction strategies.

The United Kingdom engaged early with the climate change issue. Through a combination of factors -- including a firm commitment at the prime ministerial level, a strong and influential scientific input, and fortuitous circumstances that resulted in significant emissions reductions (the switch from coal to gas) – it has emerged as an international leader in this area. An important feature of the UK effort on climate change has been the emphasis on processes that establish government responsibility in this area, and institution building – the creation of publicly supported bodies with explicit remits linked to climate change.

Such institutions include:

- *The Carbon Trust,* set up in 2001 to encourage innovation for a low carbon economy. The Trust operates as an independent company, carrying out educational work and providing loans and grants. It operates a venture capital fund and technology incubator. It has also launched a Carbon Trust Standard and Carbon Label. A typical example of its work is the recent announcement of The Offshore Wind Accelerator: a five year 30 million pound research and demonstration project to reduce the cost of off shore wind in the near and mid term future. The project focuses on issues such as deep sea foundations, reduction of wake effects, and electrical control systems. Industrial partners include some of the largest players in wind and off shore development such as Scottish Power and Statoil-Hydro.
- *The Tyndall Centre for Climate Research*, has been set up to coordinate interdisciplinary research around climate change, mitigation and adaptation. A consortium established by six major research institutions and involving dozens of other partners, it has been financed by three UK Research Councils.
- *The Hadley Centre for Climate Prediction and Research*, is the official center for scientific research around climate in the UK. It is based in the UK Met office and partly funded by the Department for the Environment, Food and Rural Affairs. The Centre has been involved in the development of long term climate models, but also has programs for outreach and education around climate change.

Recent governmental reorganization in the UK includes the establishment of a new Department of Energy and Climate Change (October 2008). It merges the energy division from the Department of Business Enterprise and Regulatory reform (BERR) and the climate change section from the Department for the Environment and Rural Affairs (DEFRA). The new ministry is responsible for energy security and climate change. It is led by a Secretary of State and includes two Ministers of State and a Parliamentary Under Secretary of State. The purpose of the change is to more closely integrate energy and climate initiatives.

However, the most interesting recent innovations are in the Climate Bill 2008. Key provisions of this legislation include:
- Providing a statutory foundation for the official UK carbon dioxide emissions targets of at least a 26% reduction by 2020, and a 80% reduction by 2050, based on 1990 levels..
- Establishing a system of five year carbon budgets which set annual levels for permissible emissions. Three budgets spanning a fifteen year time horizon will be active at any given time, presenting a medium term perspective for the evolution of carbon emissions over the economy as a whole. The first budgets relate to the years 2008-2012, 2013-2017, and 2018-2022.
- Establishing a Committee on Climate Change, as an independent expert advisory body which can make recommendations to government concerning the 'pathway to the 2050 target and to advise specifically on: the level of carbon budgets, reduction effort needed by sectors of the economy covered by trading schemes, and other sectors, and on the optimum balance between domestic action and international trading in carbon allowances' (DEFRA 2008). The Committee will report annually to parliament, and government will be required to formally reply to its reports. Every five years the Committee will offer a more comprehensive assessment of the country's overall progress towards the long term targets.

While it is far too early to tell how this system will work out in practice, it contains a number of promising features. First, the notion of carbon budgets emphasizes to all societal actors the idea of a carbon constrained world: that the economy must function within limits defined by ecosystem functions. Just as a family must live within its financial budget, so must the nation live within its carbon budget. Second, it places the emissions reduction efforts within a long term perspective, but also links the short term, medium terms and long term. The annual accounting, five year budget, fifteen year budgeted period, and forty year goals are connected so that the link between current behavior and long term objectives remains present. Third, the establishment of an independent expert group at arms length from government emphasizes that scientific knowledge must orient action and decisions must not be driven by everyday political concerns. Fourth, the regular reporting mechanisms, and the direct involvement of Parliament emphasize the significance of the issue and open possibilities for continuous policy adjustment and lesson drawing.

b) Sweden

Sweden has been a frontrunner in climate policy since the issue emerged on the international agenda in the late 1980s. This represents a continuation of the country's leadership in environmental matters from the late 1960s, signaled by its hosting of the 1972 United Nations Conference on the Human Environment. While many nations later abandoned energy efficiency measures adopted in the wake of the oil price rises of the 1970s, Sweden continued to promote energy efficiency and non-fossil based energy resources. In 1991 Sweden became only the second country in the world (after Finland) to introduce carbon taxes. A wide portfolio of policy initiatives over the past twenty years has included particular emphasis on district heating, biomass, and improved energy efficiency. District heating now accounts for about 40% of the heating market in Sweden with more than 60% of the fuel for such systems coming from biomass. Biomass is also increasingly important in the forestry sector. Since 2003 Sweden has operated a green certificate system to promote renewable energy. By 2008 oil use had fallen to 30% of the total energy supply, from 70% in 1970. Greenhouse gas emissions had also fallen by more than 40% since the mid-1970s.

Leadership on climate change issues rests with the Ministry of the Environment which on energy-related climate issues now works closely with the Ministry of Enterprise, Energy and Communications. Examples of recent policy initiatives include the creation of 'a national network for wind power' (SME 2008) to expand the relatively underdeveloped wind sector, measures to improve further the energy efficiency of the housing stock, industrial plants, and the transport sector.

Overall, the Swedish approach has relied heavily on government intervention and planning. It has also emphasized consultation with key stakeholders and municipalities. A 'Local Agenda 21' movement played an important part in mobilizing the public and local communities in the 1990s (Eckerberg and Forsberg 1998).

One of the most innovative features of the Swedish approach has been the development of integrated system of environmental objectives. This has sent climate policy within a broader set of goals related to ending the intergenerational transfer of environmental burdens.

Adopted by the Swedish Parliament after extensive consultation with stakeholders, the environmental objectives include all major environmental issues and have been operationalized through quantitative targets and indicators. The initiative is overseen by an 'Environmental Objectives Council' (composed of key government agencies and important societal stakeholders) which is supported by a secretariat based in the Swedish Environmental Protection Agency.

In 1999 Parliament adopted 15 broad environmental objectives which were seen as integral to the ambitious goal of resolving all major existing environmental problems within one generation (2020 for all objectives except climate change, which was 2050). The first of the sixteen objectives is a 'Reduced climate impact'. Others relate to clean air, the ozone layer, eutrification, and so on. In 2005 a sixteenth objective was added related to biodiversity.

Several years were taken to elaborate the detailed content of the goals, to develop feasible time lines for their attainment, to fix interim targets, select appropriate indicators, and devise implementation approaches. All relevant stakeholders including central ministries and agencies, other layers of governments, business, and civil society actors were consulted and actively involved in developing the objectives and the plans for their attainment. In 2002 a national Environmental Objectives Council was created to monitor the effort. It is composed of representatives from central government agencies, county administrative boards, local authorities, non-governmental organizations and business. Its principal responsibilities are to monitor and assess performance, coordinate implementation efforts and advice the government on additional measures that may be required (EOC 2008). The Environmental Objectives Council publishes annual reports tracking progress towards the attainment of the objectives. Every four years it publishes more detailed studies that assess the overall status of the initiative and make recommendations to the government.

The most important instrument for realizing the environmental objectives is the national Environmental Code (adopted in 1998) which harmonizes environmental law in Sweden. The county administrative boards and the municipalities are responsible for regional goals. At the national level, responsibility for each objective has been assigned to a lead agency.

In terms of climate change governance the Swedish system of environmental objectives has a number of interesting features. First, it sets climate mitigation within the framework of a broader effort on the environmental front. Although the original goal of resolving all (domestic) environmental problems within twenty years now appears hopelessly optimistic, it reflected a strong political commitment to leave a better world to the next generation by cleaning up environmental pollution and moving towards sustainable use of the biosphere. This normative frame has been broadly accepted in Sweden and constitutes a significant ideational underpinning for a vigorous climate policy.

Second, although this approach employs widespread collaboration and consultation, and a variety of policy instruments (including economic instruments), it rests on a strong regulatory role for central government. It relies on the strengths of the Swedish planning approach and the administrative competence of the bureaucracy. Lundqvist has described this as sustainability through 'management by objectives' (2004). Thus government and public service have not hesitated to take an active leadership role in helping to articulate clear long term societal goals.

Third, while this system was developed in a relatively centralized and homogeneous state with a strong tradition of governmental steering, there are elements that could be adapted to other circumstances. Of particular interest are: the establishment of an independent multi-stakeholder body to conduct assessments and provide advice; the setting of general goals with quantifiable targets, indicators and interim objectives; the assignment of clear responsibility within government for the attainment of each objective; the publication of regular assessments; and the active role of parliament in setting the parameters of the initiative.

c) The Netherlands

The Netherlands has also been a pioneer in environmental and climate policy (Anderson and Liefferink 1997). Its National Environmental Policy Plans achieved early prominence for taking a comprehensive and long term view of managing national environmental burdens. Over the past decade a great deal of emphasis has been placed on new policy instruments, including negotiated agreements between government and industry, including in the energy efficiency and climate change areas (Driessen and Glasbergen 2002). The Netherlands was an early adopter of a carbon tax, has extremely active research networks around climate change (including economic and social as well as natural scientific fields), and has been a vigorous proponent of EU climate policy.

'Transition management' is one of the most distinctive governance perspectives with direct relevance to climate change to be developed in the Netherlands. This approach focuses on identifying promising pathways for the evolution of key societal sectors (the energy system, agriculture, health care, and so on), and developing a portfolio of 'transition experiments' to accelerate innovation and explore potential avenues for change. These activities are supported by government and carried out in collaboration with key societal stakeholders.

'Transition management' was first adopted by the government in the Fourth National Environmental Policy Plan (NEPP) in 2002. The Plan pointed to the need for large-scale 'transitions' in key societal sectors in order to address persistent environmental problems. For example, the 'mobility system' requires a fundamental transformation (because of its current dependence on oil) if society is to avoid the dangerous climate change caused by greenhouse gas emissions. Similar changes were required in other areas. But such deep change might take one or more generations to achieve. And the idea of 'transition management' was introduced as a technique for consciously orienting and managing such long term change.

The theoretical underpinnings of transition management were developed by a number of prominent Dutch researchers concerned with innovation policy and sustainability development (Kemp and Rotmans 2005; Geels 2005). They examined historical cases of earlier socio-technological transition and drew lessons about the character of change processes. Key insights revolved around the importance of protected niches where emerging technologies mature, the value of experiments to try out alternatives, the importance of networking among innovators, and the tendency for dominant socio-technological regimes to resist system change and favor incremental adjustments to established designs.

In the Netherlands the approach was taken up with particular enthusiasm by the Ministry for Economic affairs which has responsibility for energy policy. Initial steps involved consultation with stakeholders, the development of long range energy scenarios, and the selection of key themes to ensure a 'clean, affordable, and secure' energy supply. Transition platforms were established to elaborate more detailed visions around six themes ('chain efficiency', 'green resources', 'new gas', 'sustainable mobility', 'sustainable electricity', and the 'built environment') and to identify 'transition pathways' to realize these visions. Funding has been

provided for dozens of 'transition experiments', proposed by different combinations of stakeholders, to try out novel practices in the energy field. Other developments have included the establishment of a 'Trendsetters' Desk' to assist innovative firms. In 2005 governance of the whole process was formalized through a steering committee ('Taskforce on the Energy Transition', led by the Chairman of Shell), and an interdepartmental coordinating committee that included representatives from six implicated ministries.

Across the Netherlands transition experiments now number in the hundreds. For example, in the health care sector a steering committee judges proposals submitted by stakeholders, and support is provided for the most promising approaches to improving patient care. At the core of transition management is the idea of encouraging innovators, developing collaborative visioning exercises of the future, and supporting practical experiments – which push beyond established practices and define alternative technological and social pathways.

With respect to climate change governance transition management has a number of interesting features. First, it is deliberately focused on the problems of 'path dependence', 'institutional inertia', and 'system lock in'. It seeks to probe the limits of existing approaches and develop more fundamental alternatives. It attempts to chart a role for government in seeking to accelerate and orient change in the desired -- low carbon emissions -- directions. Second, it emphasizes networks and the mobilization of innovators. While many government regulation and subsidy programs engage with the mainstream, or even lagging enterprises, this approach is targeted at the most innovative firms and technologies. Third, it tries to avoid 'picking winners' in the short term, instead encouraging competition among technological and social options, and leaving open for the future (and 'selective processes') the determination of which alternatives best satisfy evolving social needs.

5. Further discussion

Climate change governance poses difficult challenges for contemporary politico/administrative systems. In the first section of this paper reference was made to five key features: societal reach, scientific uncertainty, distributional and equity linkages, long time frames, and global implications. Above all, it is the interactions among these elements that matter. Thus the deep societal reach, and the distributional and equity linkages, mean that established interests can feel threatened by the implementation of mitigation initiatives. And *when the influence of groups who fear adverse consequences of mitigation policies is combined with scientific uncertainty, the complexity of reaching global agreements, and long time frames, the natural tendency is for governments to delay action, to seek to avoid antagonizing influential groups, and to adopt less ambitious climate programs.* This is all the more true when there are other pressing problems (including economic dislocation, reform of health and pension systems, and development imperatives) that require attention.

Conflicts of power and interest are therefore an important explanatory factor for the slowness governments have evidenced in establishing adequate climate governance regimes. This reality

should not be papered over, but should be addressed directly. A vigorous approach to climate change governance (especially on the mitigation side) cannot avoid disturbing powerful economic and political interests. To address climate change means changing the way things are being done today – especially in terms of production and consumption practices in key sectors such as energy, agriculture, construction, and so on. But some of the most powerful groups in society have done well from existing arrangements, and they are cautious about disturbing the status quo.

This is not to suggest that interests are fixed. In fact they are highly mutable. And they can be redefined by changed understandings, conscious agreements, new incentive structures, or otherwise altered circumstances. *Climate change governance requires governments to take an active role in bringing about such shifts in interest perceptions so that stable societal majorities in favor of deploying an active mitigation and adaptation policy regime can be maintained*.

A variety of approaches may be of use here, including:

Building coalitions for change. Societal change is a difficult process that imposes costs on social actors. Governments can use a variety of tools to build change coalitions including moral injunctions, public information and education, and material incentives. Coalition building is a basic feature of political action, and most successful politicians have an instinctive grasp of the need to build alliances and recruit allies in order to secure support. What may not immediately be clear, however, is how alliances are to be built to support major disturbances to established ways of doing business, such as those implied by managing climate change. One approach is to emphasize co-benefits. Thus mitigation policy can be linked to industrial policy and innovation policy. So money invested in emissions reduction is not seen as 'wasted', but as deployed to develop new technologies, establish new firms and product lines, create `green' jobs, export markets, and so on. Mitigation policy can also be linked to heath policy. For example, reducing coal use (by increasing efficiency, fuel switching to oil or gas, or developing non carbon electricity supply) also reduces air pollution. And so on. Thus climate change appears not just as a cost, but also as an *'opportunity agenda'*. Another possibility is to link adaptation and mitigation policy. A vigorous adaptation policy can actually strengthen public support for mitigation investments, as it brings forward to the present the costs of adaptation (on infrastructure projects, for instance), making it more clear why immediate mitigation action is needed to prevent additional change that will force further (expensive) long term adaptations.

Coalition building is to some extent about 'reframing' issues so that a wider range of actors can see benefits in a given course of action. Thus, for example, including carbon capture and storage as a technological alternative within a portfolio of abatement approaches can be seen as a political move to broaden the coalition in favor of an active climate policy (to include the fossil fuel industries), as well as a prudent policy choice to keep open a wide range of possible energy sources and emission reductions options.

Buying off opponents: States command considerable financial resources and sometimes it is necessary to deploy these to compensate those who will be disadvantaged by enhanced

climate mitigation activities. Such intervention can take many forms, including: retraining workers from industries that will shed labor, assisting companies with R&D budgets to accelerate the development of alternative products (hybrid cars from automakers), and contributing to the costs of new abatement infrastructure (pipelines and demonstration plants for CCS). Money may also be spent to encourage the retirement of polluting assets. Although such payments can be justified in various ways, in political terms they are a means of diffusing opposition. An example of such an approach in the energy sector (though not related directly to climate change) was the German government program to phase out nuclear power, which offered generous incentives to nuclear operators to bring forward the closing of plants.

Establishing new centers of economic power. Government intervenes to strengthen economic actors whose activities point in the direction of desired social ends. The best example here is encouragement of the green business sector (renewable energy, organic farming, climate change consultancies, and so on). *Not only do such interventions secure direct environmental and economic gains (more green energy, growing export markets), they also have the indirect effect of bolstering constituencies advocating further change -- for example, the removal of subsidies to fossil fuels.* Current economic interests (with established facilities, technical know-how, jobs, export earnings, and so on) are like large masses in a gravitational system – they exert political 'pull' in proportion to their size. To counter-balance their influence it is necessary to build rival enterprises that can offer jobs, tax revenues, exports, along a line of advance congruent with a low carbon economy.

Creating new institutional actors. Governments lend support (financial, organizational, moral) to encourage the creation of autonomous actors who can promote change. This can include transferring functions from the core of government to bodies that work at arms length. This can provide many advantages including reducing day to day political interference, freeing the bodies from bureaucratic routines and mind-set, increasing public confidence, and serving as a hedge against changed political priorities. New actors can be created by hiving-off existing structures, fusing discrete units, or starting from scratch. And the resultant bodies can be granted different degrees of autonomy. Alternatively, governments can assist other parties to organize themselves – to promote particular causes or regulate their own affairs. The encouragement of sector self-organization to engage with climate change is a case in point. The creation of semi-independent bodies such as the Carbon Trust in the UK illustrate this approach.

Adjusting legal rights and responsibilities[3]. Government intervenes to adjust the legal obligations of established actors, making some avenues of development easier and others more difficult (costly, contentious, and risky) to pursue. An example is provided by disclosure

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[3] The following four paragraphs draw directly from Meadowcroft 2007a.

requirements that oblige industry to identify hazardous substances used at local facilities. By requiring companies to make such information public, the balance is tipped slightly towards groups campaigning against toxic releases. Changes to liability regimes for environmental damage can work in a similar way. Requirements for carbon labeling (or energy efficiency labeling) of goods and services work in a similar way. Alternatively one could consider re-defining the responsibilities of regulatory agencies. For example, utility regulators can be given specific responsibilities for ensuring the development of renewable energy; consumer regulators may be required to assess carbon abatement claims made by retailers (for instance, carbon offsets); development authorities may be required to consider the cumulative climate impacts (rather than just the marginal impacts) of projects.

Encouraging inter-organizational collaboration. Government encourages new patterns of interaction among existing organizations to favor innovation for climate change. By bringing groups together to address particular problems, power relations can be subtlety adjusted. These may be groups already enmeshed in an established problem matrix; but by encouraging interaction in a collaborative, solution-oriented, framework, it may be possible to redefine issues and interests. Or groups previously unaware of each other's existence may be brought together in 'innovation networks' that link some combination of consumers, producers, administrators, entrepreneurs, and researchers to accelerate technological and social innovation. Such organizational alliances can encourage the development of new products and markets, new ideas and cultural values – and strengthen the resources available to those championing climate change initiatives. For example, in the Netherlands the government encouraged contacts between renewable energy suppliers (ground source heat pump and solar energy specialists) and horticultural producers to spark innovation in the energy performance of the glasshouse sector.

Changing ideas, and accepted norms and expectations. Government encourages the emergence of new social norms and expectations, so that actors self-orient their activities in desired directions. The power of ideas, and the possibility of redefining what is considered 'normal', 'possible', and 'acceptable' is often neglected in policy discussion. In the short term these boundaries appear quite fixed, and the tendency is to imagine that because some policy alternatives appear 'unthinkable' today, they will always remain so. An example of the power of ideas to shift policy frames is provided by the turn towards free markets and away from state provision that occurred in the 1980s. Over the course of two decades reforms aimed a reining back government and encouraging market growth dramatically altered expectations about the boundaries of public and private economic activity. Public intellectuals, political parties and ultimately governments deliberately altered the ideational tenor of political life and changed the parameters within which normal policy debate occurred. To some extent similar processes are already beginning to occur in relation to climate change. In Europe businesses are becoming accustomed to considering the cost of carbon emissions in investment decisions. Consumers are beginning to think about carbon implications when making purchasing choices. Consider the rapid growth of the offsets market in air travel. Note also the UK effort involving major retailers to develop a common methodology for lifecycle greenhouse gas accounting for all goods and

services. But governments could be more active in developing educational campaigns, and funding third parties, to promote such ideational change.

Although the emphasis in climate policy will be on building consensual policy, it is inevitable that there will be differences in perspective and some groups will mobilize to resist climate policy. Every social reform sparks resistance. In particular*, predictions of economic doom and gloom have preceded every major political innovation in developed states including introduction of the 8 hour day, minimum wage rates, universal suffrage, and clear air legislation.* In the environmental sector research commissioned by the European Union suggests the costs of environmental compliance of impending measures are regularly overestimated by industry, often by several times. This is because of a systematic neglect of scale and learning effects. Clearly climate governance will sometimes imply government moving forward with regulation, pricing mechanisms, and other initiatives even in the face of vocal opposition from some concerned interests.

Another way of appreciating the difficulty of climate change governance is to introduce the concepts of path dependence and of dominant socio-technical regimes. Previous rounds of development decision making have bequeathed to us a specific industrial structure; and each major sphere of socio-technical activity (for example, the energy system) is dominated by established socio-technical regimes. These regimes are composed of a complex set of technologies and practices, actors (primarily firms but also scientific and educational bodies), and institutions (capital markets, regulatory bodies). *The interdependence and co-evolution of these elements encourages continuous incremental change within the regime, but makes more radical innovation difficult*. Thus institutional barriers to the development and deployment of alternative technologies are substantial. For example in the renewable power sector they may involve issues related to: securing insurance and finance, customer expectations, training and maintenance, grid architectures and protocols, regulatory standards, and so on.

To illustrate the deep embededness of current patterns of energy use consider the fact that the higher energy intensity of the economies of countries such as Canada, the United States and Australia (as compared, for example, to that of some European countries and Japan) is rooted in long term economic trends. From the middle of the nineteenth century cheap and abundant resources constituted a comparative advantage for these large industrializing territories which they exploited consistently in competition with the other powers. But today their energy-intensive infrastructure is turning to a comparative disadvantage as the climate change externalities generated by fossil fuel usage have become clear. Moreover, when we consider the advance of energy efficiency and renewable energy options in countries such as Sweden and Denmark we should remember that the trajectory that generated present successes dates back not just forty years (to the oil shocks of the 1970s), but has roots in even earlier industrial development (for example, early experiments with district heating systems in Sweden and Denmark go back a century).

The deep institutional embededness of the carbon emitting industrial structure is one reason why carbon taxes and cap and trade systems (which seek to internalize externalities associated

with greenhouse gas emissions) are unlikely *on their own* to provide an adequate policy response. Because all sorts of political mechanism (including political action by aggrieved industrial interests and complaints from households facing higher energy bills) operate to keep down the (politically set) tax rate (or the cap level in a cap and trade system). Thus a whole basket of complementary policies – especially those aimed at encouraging rapid technological development and overcoming institutional barriers to innovation – are required in tandem with price based policy instruments.

The development and deployment of innovative technologies is therefore crucial for climate mitigation, especially in the energy sector. Over the past decade governments in a number of developed countries have introduced policies to develop low carbon electricity supply. For example, portfolio standards and feed-in tariffs have provided subsidies for renewables production. Valuable lessons can be learned by studying experiences with these instruments. But more comprehensive programs to encourage innovation will be required in most countries.

Precisely because path dependence is real, government should consider how a low carbon energy system can most easily develop from the configuration of technologies, actors, and institutions already in place. For instance, this suggests that a technology such as CCS might play a particularly important role in a country with important fossil fuel reserves and fossil energy export industry (and enthusiasm for CCS in Australia, Canada, the United States and China can be seen in this light). And continuation and/or expansion of nuclear power may be appealing to countries with a substantial installed nuclear capacity. But the substantial uncertainties relating to technological futures mean that climate change governance is necessarily also about maintaining multiple options and developing a flexible response.

The term 'institutional inertia' can be used to capture this resistance to change, and the tendency to remain on the same development pathway despite convincing evidence that better alternative are available. Yet the term misleads if it suggests that this inertia is simply a passive characteristic of social systems. In fact, much of the resistance comes from specific groups and individuals who actively organize to resist change. Resistance to transforming existing socio technical regimes is not just economic, but also political. Established players who do not want to loose their position of ascendance (based on particular infrastructure investment, organizational links, technical processes, patents and intellectual capital), exploit their political connections to block policy change. The politics of reform is to a large extent concerned with minimizing and neutralizing opposition. Some approaches to carrying this out have been mentioned above.

When considering ways of overcoming this institutional inertia particular importance should be placed on 'turn-key' reforms – measures that open up the way to further reforms, ideally by generating momentum that encourages additional positive changes. Encouraging low carbon emission business interests and agencies (as discussed above) can be understood in these terms. So too can the re-organization of administrative responsibilities to build 'countervailing powers' that can bleed inertia away from established trajectories and re-orient societal energies along more desired pathways. For example, in Germany responsibility for the

development of renewable energy was assigned to the environment ministry rather than to the sections of the government concerned with energy or industry. The thinking behind this was that while the fledgling renewable industries would be of only marginal concern to departments with longstanding links to major industrial players, they would be taken seriously by the environment ministry which lacked an industrial constituency. This decision played some role in the subsequent rapid growth of renewables in Germany. A similar logic motivated the German government to be a strong sponsor of the newly established International Renewable Energy Agency that is unhampered by the close institutional linkages the International Energy Agency has to the fossil fuel industries.

Societal-scale institutional inertia can be shattered by powerful external shocks. Historically such shocks have sometimes been administered by war, revolution, epidemics, and environmental collapse. Smaller scale shocks can also be administered to more specific subsystems and organizations deliberately by political authorities. This can be done by re-organizing institutions in the state sector, transforming property rights, dramatically altering policy, and so on. Opportunistic exploitation of crises effecting dysfunctional organizations (brought on by scandal, economic collapse, policy disasters and so on) can be important, because these shocks provide a window to reconfigure development patterns.

Less dramatically, path dependence can be overcome by incrementally shifting the development pathway – systematically weakening the established orientation over time and strengthening alternative pathways. But of course actors associated with the dominant trajectory, remain continuously active, constantly trying to reassert the established pathway.

Conclusion

This paper has focused on climate change governance at the national level. It certainly agrees with the motto 'climate-smart development starts at home.' Although international agreements facilitate cooperation – potentially lowering costs, addressing inequities, and managing collective action problems – national perceptions, initiatives and measures will underpin any advance at the global level. Moreover, excessive preoccupation with the international scene – where it is extremely difficult to reach agreement and develop workable and enforceable accords – can actually encourage passivity and disillusionment on the national and local levels, as everyone puts off action waiting for the global deal.

Starting action at home means beginning to learn about how to succeed at climate policy; it means getting a head start on what will have in any case to be done one day; and it provides a basis for more meaningful and influential international exchanges.

Table 1: Climate change poses challenges to traditional political institutions

Structural characteristic	Underlying issues	Political challenges	Potential political responses
Long time frames	- 200 year international development path based on fossil fuels - Incremental (but accelerating) changes to the composition of the atmosphere and Increased evidence of human induced climate change - further climate change already 'wired in' because of historic emissions - effects of current emissions reductions will take decades to work through climate system - warming will continue for more than a century after atmospheric concentrations are stabilized	- economic costs of emissions reduction must be born today, but benefits accrue decades in the future - existing political institutions scaled to human activities and life-spans, with 4-5 year electoral cycles and development plans, and annual budgets - incentives for politicians to defer mitigation because material benefits of action come in the distant future - tendency to address more immediate issues - lack of 'representation' of future people and non-human natural world in current political decision making	- linking of short term, medium term, and long term policy targets to ensure incremental progress towards substantial emissions reduction in the future (for example, through national and international carbon budgets). - development of public ethos of care for the future: for nature and future generations. - establish institutions with a mandate to 'think long' and promote the low carbon emissions economy - align short term incentives with long term policy goals. For example: placing a price on carbon emissions (through a carbon tax and/or; cap and trade system); establishing rewards for immediate movement towards low carbon solutions (renewable feed-in tariffs and portfolio standards); and desirable R&D
Global implications	- atmosphere is a single sink, so emissions anywhere effect the global climate - emissions are generated by all countries, but at vastly different absolute and per capita levels, varying over time - effects of climate change expected to vary considerably from region to region	- tendency to wait for others, as national and local actions appear futile and impose immediate costs - tendency to depress efforts to that of the least enthusiastic participant - need to coordinate action by political authorities at all different scales (local, provincial, national, regional, international, global) - disjunction between internationalized production chains and primarily national regulatory systems	- negotiate international agreements - do not wait for international agreements to initiate national and local action - explore sectoral initiatives - consider national responsibility for embedded emissions (total emissions generated by national consumption) rather than just territorial releases

Societal reach	- fundamental change required to many consumption and production activities - need for a 'revolution' in energy production and consumption, and dramatic changes in transportation, manufacturing, construction, agriculture, forestry management, land use and urban form - Implications for population levels and population growth rates	- how to guide a deliberate transformation of production/consumption patterns - 'lock-in' to existing technological trajectories (though sunk investments, industrial structure, business models, regulatory structures, and so on) - strength of vested interests that resist change - clash of climate policy needs with withdrawal of state from large scale economic intervention - established administrative structures that fragment policy into discrete sectors (that are cross-cut by climate change)	- government leadership role in driving societal change - mobilization of societal actors - stimulation of technological innovation - techniques to break institutional inertia - build change oriented coalitions - exploit conjunctural circumstances - encourage policy integration
Scientific uncertainty	-Future emissions trajectory uncertain - affect of given emissions on global temperature uncertain - temperature Impacts on regional weather uncertain - potential for radical discontinuities - uncertain ecosystem impacts	- uncertainty can be used as an excuse to defer action by those who fear their material interests will be impacted by mitigation - scale of uncertainty and unknowns make deterministic calculus of cost/benefit ratios impossible -scale of uncertainty and unknowns make traditional risk assessment impossible - uncertainty and unknowns will persist into indefinite future as we conduct a one-off experiment with the world climate system	-educate decision makers and publics about the nature of scientific knowledge, research, and uncertainties -educate decision makers and public about risks, complexity and uncertainty of climate change issues - apply hedging strategies (precautionary principle) and avoiding high impact events rather than optimizing - expand knowledge base
Distributional and equity linkages	- different countries and regions will be impacted in different ways, but how remains uncertain - different countries and regions have different historical and current patterns of emissions - the international system and national polities are characterised by deep social and economic inequalities	- disagreement about responsibilities for problems, and how costs of adjustment and costs of mitigation should be divided - disagreement over relevant criteria in determining burden sharing - difficulty determining costs this generation should carry to reduce risks for future generations - uneven regional distribution of fossil fuel dependence and fossil fuel reserves	- take socio economic inequalities seriously in climate policy design - allow localities and regions flexibility in policy design and implementation - develop representative forums for feedback on policy orientations

Table 2: Techniques for overcoming institutional inertia related to climate change

Institutionally link short term, medium term and long term targets	(for example, through a system of carbon budgets and periodic reviews)
Initiate alternative trajectories and create alternative centres of power	(for example, through creating new institutions, funding green business enterprises)
Neutralize opponents	(for example, by buying off opposition; or discrediting undesired technological pathways)
Exploit crises and weaknesses of high carbon emission alternatives	(for example, use pollution crises (oil spills, air quality issues, ash contamination) to leverage change, or use financial crises to impose climate conditions on state aid)
Develop a climate friendly public ethos	(for example, by using the educational system, and 'opinion makers' in the media, cultural industries, ethical and religious circles)
Favour innovators	(for example, protect green technological niches, reward green firms)
Use state apparatus to pioneer reforms	(for example, procurement policy, obligations on all public bodies)

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