Chapter 9

Climate Research and Climate Politics in Germany:

Assets and Hazards of Consensus-Based Risk Management

Carsten Krück, Jutta Borchers, Peter Weingart

Department of Sociology, University of Bielefeld

I. Introduction

Germany's stance toward climate protection appears to be characterized by extremes. In the 1970s, and for much of the 1980s, Germany trailed developments in international politics and science, devoting little attention to the subject. Starting in late 1980s, however, climate swiftly developed into one of the main concerns of German environmental and research policy. Germany, it seemed, converted almost overnight "from laggard to leader" (Cavender Bares et al. 1995). By the 1990s, the German climate research system had become one of the best-equipped in the world, and the country had established a reputation as one of the political pacemakers in the international arena, particularly for its ambitious goals for the reduction of CO_2 emissions. On closer inspection, however, this drive towards climate protection has produced fewer results than expected. Experts expect that Germany will most likely *not* meet the goals for emissions reductions it has set for itself, and the measures it has adopted to reduce CO_2 emissions have been almost exclusively limited to "no-regret" measures, i.e., to reaping the benefits of technological change and energy-saving initiatives undertaken for reasons other than climate

change. Contrary to its reputation as a leader on the issue, Germany appears presently unable to take climate protection beyond these limited means.

The equally pronounced *expansion* and then *retardation* of the climate issue in Germany begs an explanation. In our view, both are due to the *same* structural factors. Some of these are 'typically German', e.g., Germany's strong, well-integrated science system and corporatist political system. Other structural factors are variations of a more general theme: the *institutional structures and dynamics of science and politics* in modern societies and the *interaction* of these dynamics when both are *coupled* in efforts to deal with issues like climate change that are characterized by *high scientific uncertainty* and *high stakes political decisions.* The following account will describe these peculiarly national as well as more general societal features. The account stresses the role of science in the framing, formation and management of the climate change issue and uses insights from policy analysis and from the sociology of science to assist in making these dynamics transparent.

The paper begins by delineating a theoretical framework in section 2. Section 3 portrays the development of the climate issue in Germany, focussing on phases in the mobilization of science and politics. Sections 4 and 5 describe the 'typically German' features of German science and politics which contribute to the adoption of a *consensus-oriented approach* to coupling science and politics. Section 6 examines how the interface between science and politics works in this approach. Finally, sections 7 and 8 offer some concluding remarks on the centrality of the science-policy interface in the future evolution of Germany's response to climate change.

II. The Interaction of Science and Policy in the Climate Issue

A. Risk Management and Interlocking Credibility Cycles

Scientific and political institutions can only function to address a problem such as climate change if several basic requirements are met. To understand the dynamics of social issues in which science has become involved, it is useful to look at the *institutional structure, the dynamics* and the *interaction* of both science and politics in modern societies.

Scientific actors, to begin with, need to convince political actors to provide the oft considerable *resources* required for much contemporary scientific research. In the modern research process, this does not simply mean money; it means a complex web of machinery and institutions. Second, scientific institutions must act to ensure the *legitimacy* of scientific research results. Legitimation is vital to sustaining the 'social contract' of science with society. Establishing legitimacy for scientific findings in modern societies has typically involved separating the production of scientific knowledge from both social influences which might influence it and its subsequent societal effects. Science, in other words, must be "seen" to be accountable to and for only itself (although in practice these conditions may only rarely be met). Third, science has to maintain *credibility*. Credibility means that people (a) believe that science will achieve *reliable* knowledge about nature and that (b) this knowledge is *useful* for society. If these requisite features are in danger, the functioning of science is in danger.

Political institutions are faced with a similar set of requirements including, principally, *legitimation*. They must convince society that a particular issue is a legitimate part of the political agenda, i.e., should not be left to societal self-regulation. Political actors frequently "scan" society

to be prepared for problems which may threaten their legitimacy and also actively explore new issues for what appear to be promising candidates for new areas of political activity. *This prospecting for and acquisition of new political agendas* is an important part of politics. Second, politics also has to guarantee *credibility,* i.e., the citizen's belief that politics presents an effective way to address social problems. Third, politics has to convince society to release *resources* to fulfill its service. The justification and expansion of budgets and tax burdens is an important motive in the shaping of political agendas.

Each of these elements can be portrayed as a mutually reinforcing segment in a *cycle of institutional prerequisites* which scientific and political actors have to maintain and possibly expand to fulfill their functions. In a very simplified way, one may speak of the *credibility cycles* of scientific and political institutions (extending a concept by Latour and Woolgar 1979). These credibility cycles have to be maintained, but they are also driven by the *self-interest* of social actors in expanding the realm of scientific analysis and political agency.

Resources, legitimacy, and credibility are scarce resources and are permanently at risk. Science and politics are *partly dependent* on each other to procure these resources, and they often *draw upon* each other to sustain and "keep spinning" their own credibility cycle (Elzinga 1993). For politics, scientific evidence has become a prime argument to justify that something is a political problem and that political action (or inaction!) is effective at solving the problem (Müller 1994). Science, in turn, has become skilled in addressing politics because research has become more expensive and the legitimacy and credibility of many fields of science have been cast into doubt. Processes such as these have been analyzed as *interfoliating credibility cycles of*

science and politics (Elzinga 1996).

In the field of climate change research, the credibility cycles of both science and politics are particularly at peril and in peculiar need of interlocking. Scientific institutions have sought to secure considerable resources because climate research is both expensive and (equally demanding) dependent on stable, long-term funding (Smagorinsky 1992). Scientists have also invested a great deal of work in sustaining the credibility of their efforts. Global warming is a *virtual problem* in the sense that neither experts nor policymakers nor citizens can perceive it directly but instead must rely on deductions from a variety of indirect clues which themselves are frequently open to interpretation. Moreover, the research effort requires contributions from many different scientific disciplines and research approaches all of which entertain rather different agendas and research styles. The necessary concatenation of these streams of expertise can be accompanied by distributional conflicts and cultural incompatibilities, e.g., when field sciences meet "synthetic" sciences such as computer modeling.

For politics, the problem is similarly risky. Legitimacy and credibility are in danger because the issue touches many sensitive political agendas like energy, transport, and agriculture as well as the everyday consumption patterns of most, if not all, citizens. Precautionary measures are bound to spark controversy and raise questions about the legitimacy and effectiveness of political intervention as an option. Moreover, climate change is defined as a global problem requiring international coordination. International coordination, however, may be perceived as weakening the decision-making power and authority of the national state, threatening the legitimacy of the national political system.

In this situation, in which there are substantial opportunities (agenda prospecting) and risks (erosion of credibility), it becomes an attractive option *to manage the interface between science and politics more strategically*, so as to reduce the friction and enhance the benefits of interfoliation for both sides. It is not surprising, therefore, that the climate issue has resulted in quite elaborated attempts at *coupling science and politics.*

B. Managing the Interface: Coupling Science and Politics Through Consensus

Science and politics can be coupled by myriad different means (through, e.g., symbols, procedures, institutions, rule systems), and it can be done unintentionally or consciously. Most important internationally, and in Germany, have been special *hybrid institutions* that combine scientists and political decisionmakers founded explicitly to achieve coupling. Many of these institutions (e.g., the Intergovernmental Panel on Climate Change or IPCC) operate with a rule system based on the principle of *consensus*. Political actors have stressed that they could only respond to evidence presented in the form of a position shared by all scientists, so that science would not present a target for political controversy. For science, consensus is usually a peripheral principle. Scientific progress is not usually a matter of ballots and is often driven by competing (instead of consenting) scientific opinions. However, scientific actors desires to appear credible and useful to society (perhaps simply to procure continued access to resources, perhaps out of moral conviction) have led scientific actors to adopt a public stance committing themselves to consensus procedures such as those encountered in the IPCC.

In Germany, coupling was achieved through a variety of measures. Notable is the role *climate models* played in integrating the national research effort and in procuring credibility for

science and politics (see section 4.2). However, the most effective and far-reaching way coupling was again achieved through hybrid institutions, two *Enquête Commissions* (EK) on the "Protection of the Earth's Atmosphere". Enquête commissions are elements peculiar to the German political system. They are initiated by the German parliament, the *Bundestag*, to supply scientific evidence and advice on problems seen as urgent and complex. ("Enquête" is a French term for enquiry or investigation.) One half of their members are parliamentarians, the other half scientific experts chosen by the political parties. The commissions prepare reports which again require consensus support from all members. Enquête Commissions forge a rare direct link between political and scientific actors in Germany and initiate a process of information exchange and negotiation. On occasion, commission activities lead to a substantial convergence of views that, in turn, often establishes an at least temporarily stable foundation for political action.

The two commissions on climate change were unusually successful in achieving this goal and marked the apex of German efforts to couple scientific fact-finding to political decision-making. (We discuss the two commissions in greater detail in section 6.) They promoted the creation of new scientific research programs that have grown into the foundation of a strong climate research system as well as remarkable political agreement on new policy obligations (including Germany's basic commitment to dramatic reductions in carbon dioxide emissions). However, as an effect of the consensus-oriented negotiations, they also had the effect of *narrowing the social and moral discourse informing political and scientific measures.* With this impulse, the study commissions reinforced and shaped a distinct *problem definition* in both climate science and climate protection policy which remains dominant in Germany to date.

With these characteristics (the coupling of scientific analysis and political action through consensus-oriented hybrid institutions), the German response to climate change appears as a culturally-specific variation of the more general theme we discussed above, the interfoliation of credibility cycles necessary to legitimate public action on a science-related social issue. The following chapters will analyze the intricacies of this "typically German" path.

III. The Development of the Climate Issue in Germany

One can discern five phases in the development of the climate issue in Germany. Phase 4 can be called the breakthrough phase because scientific and political actors, for a limited time of intense coupling, combined their efforts.

A. Phase 1 (1941 - 1969): Scattered Activities in Science

The possibility of anthropogenic climate change was first suggested in Germany by the meteorologist Hermann Flohn in 1941. After World War II, Flohn, together with Fritz Möller, became one of the leading figures of German meteorology and tried repeatedly to arouse interest for the subject in the 1950s and 1960s. Yet, by and large, climate remained unnoticed outside meteorological circles (Graßl 1992).

B. Phase 2 (1970 - 1978): Catch-Up and Competence-Building in Science

In the early 1970s, initiatives by international scientific organizations alerted the German scientific community to the possibility of anthropogenic alterations of the atmosphere. Research associations, especially the German Research Foundation (DFG), reacted by creating two "Priority Programs" to spur research and development in atmospheric science and to bring

German science up to date. A further milestone was the foundation of the Max Planck Institute for Meteorology (MPI) in Hamburg in 1975, headed by Klaus Hasselmann. Despite these activities, however, climate research remained a minor part of the Germany's overall scientific research system.

C. Phase 3 (1978 - 1984): Monitoring and Preparation

In the late 1970s, political and scientific interest in climate change began to intensify and, slowly but surely, to march in step. German political institutions became active for the first time in 1978 when government agencies sponsored international conferences on energy and climate. From 1979 on, these activities intensified and resulted in increased funding for climate research and in a request for the creation of a Federal Climate Research Program which, with some delay, was finally established in 1984. This phase might be called one of active monitoring. The Federal government scanned science and the administration for existing expertise and initiated support for the creation of a scientific knowledge base. With these instruments in place, however, it waited.

The shift from political indifference to monitoring was mainly motivated by science, first and foremost by mounting research in the United States and in the international arena. In particular, the First World Climate Conference of 1979 signaled to German leaders that the issue would sooner or later appear on the international policy agenda and require a political response. This impetus was taken up by prominent scientists, most notably by Hermann Flohn, Wilfried Bach, and Hartmut Graßl. These three began to popularize and politicize the issue by campaigning for it in the media and in political circles.

D. Phase 4 (1985 - 1990): Interlocking and Consensus-Formation Between Science and Politics

Starting in 1985, a new phase of climate science and policy began, culminating in four decisive institutional innovations.

- Beginning in November 1987, Germany established first one and then a second Enquête Commissions (hereafter abbreviated as "EK I" and "EK II"). The EKs were charged with working out a consensus position on the state of scientific knowledge and recommendations for political action. EK I, in particular, was very efficient in reviewing and synthesizing the scientific literature and in establishing a basic consensus on the necessity of reducing GHGs, mainly CO_2. (See specifically chapter 6.)
- In July 1988, the German government established the Scientific Advisory Council on Climate of the Federal Government (abbr., Climate Advisory Council), containing eminent natural scientists, to work out recommendations for research programs and funding.
- Following recommendations by the Climate Advisory Council and EK I, a comprehensive program on "Environmental Research and Technology" went into effect in which federal funding for climate research was increased more than threefold from 1989 to 1994. Climate research, before perceived as a marginal field of science, expanded dramatically and unfolded into a new, independent and relatively strong research field in the German research system (see section 4).
- Finally, in June 1990, the German government formed an Inter-ministerial Working Group on CO_2 Reduction (IMA), consisting of representatives from nine federal ministries plus

the Chancellory and the Foreign Office. This permanent working group is the epicenter of political decision-making on climate, "developing, implementing and monitoring national climate precaution policy (Bundesregierung 1996)." At first, its creation marked a success for the Federal Ministry for the Environment (BMU) for two reasons: first, very few issues become promoted to this formal administrative level; second, the BMU managed to claim the presidency of the board. Today, however, some observers have also come to regard the IMA as a mixed blessing because it enables the other ministries to keep tabs on climate protection and to veto measures (Loske 1996, 286-288). The Environment Ministry holds the initiative in climate policy, but other government institutions also have strong voices (Müller 1997).

Following the recommendations made by EK I, at least in part, the Federal Cabinet decided in June 1990 that Germany would reduce its national CO_2 emissions by 25% by the year 2005 (compared to 1987). The IMA was established to specify and implement this decision. In the course of 1990 and 1991, it worked out guidelines and measures for achieving the reduction (Reichert et al. 1993). With these decisions, climate had become firmly established on the political agenda.

Various factors combined to catapult climate change to the inner circles of scientific interest and environmental decision-making. First, international activities, starting with the Villach conference in 1985, signaled to German political leaders that international initiatives were in the offing. The Federal government reacted to these prospects with the explicit aim of being prepared and becoming one of the pacemakers of this development.

Second, since the late 1970s, the environment has become one of the most important concerns of the German *public*, sometimes superseding even economic worries. This general undercurrent combined the influence among several issues, all of which hit Germany at about the same time: (a) In the mid-80s, acid rain, *Waldsterben* and the ozone hole were widely discussed in the media. (The latter was often mixed up with climate change and combined with it into a powerful twin issue.) (b) In spring 1986, the Chernobyl disaster led to the foundation of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) (before, environmental affairs had been located in the Ministry of the Interior). (c) In 1986, the German media "discovered" climate change and published several widely read reports, framing the issue in terms of panic and catastrophe and suggesting that global warming was already knocking on the door.

Both scientific and political actors practiced what we have termed *agenda prospecting*; i.e., they *actively sought to expand the subject* and strengthen their own legitimacy through these efforts. The sensationalist media coverage was fuelled not only by single scientists like Bach and Graßl but also by the interests of scientific institutions. In November 1986, the German Physical Society (DPG) published a report entitled Warning of an Impending Climate Catastrophe. This was the first time that the issue was emphatically endorsed by an influential scientific society, the report was also released as a widely quoted pre-print in a newspaper, and the report introduced the phrase "climate catastrophe". The war-cry "catastrophe" was used first not by the media but by *renowned scientists*. Only then was it taken over by the media and by parliamentarians (Engels et al. 1997).

Political actors profited from the new issue in several respects. On the international level, climate change was a welcome opportunity for the Federal Government to become an opinion leader on an issue which could be expected to dominate future international agendas (Héritier et al. 1996). Stressing environmental aspirations also helped to alter Germany's prevailing image in international circles as an economic power solely interested in export expansion. On the national level, Chancellor Kohl endorsed the issue because it gave the government a stronger profile in environmental policy, one of the weak spots of his strategy for the 1990 general election. The newly founded Environment Ministry appreciated the issue because it helped to strengthen its weak position as a newcomer in the Federal Cabinet. And, for the Research Ministry, climate research was one of the few expanding budget categories which could partly offset the loss of resources suffered when the funding of nuclear energy research was sharply curtailed in the mid-1980s.

In sum, it can be said that the climate issue:

- *culminated* in 1990
- in a phase of *consensus-formation* which was
- *sparked* by international activities,
- *driven by science* (Engels and Weingart 1997),
- helped to a breakthrough by coincidental issue linkages and by the media
- and finalized through the agenda-prospecting of political actors.

E. Phase 5 (1991 to the Present): Move to the Administrative Arena and to Incrementalist Stabilization

After 1991, the issue reached a phase of *institutionalization and incremental stabilization.* On the one hand, it was well established on national policy agendas and had become an accepted and independent domain, with a strong institutional basis in science and politics alike. On the other hand, the issue also had to fully *compete* with other policy issues like economics, energy, transportation, taxation and broader issues of economic competitiveness. In this competition, climate change and other environmental issues had become a strong voice in a choir - no less, no more.

The present ambivalent state of the climate issue is a result of the mobilization and stabilization achieved in Phase 4 (which is further analyzed in the following sections). On the one hand, Germany has invested considerable resources and political capital in climate protection, and the issue has reached high levels of political and public acceptance. On the other hand, the political response has been limited largely to no-regret measures. The government's strategy for climate protection is mainly based on technological fixes that do little to alter underlying patterns of consumption (e.g., insulation in housing) and geared towards reaping the benefits of on-going measures created to deal with policy issues other than climate change as such. The government has not initiated new legislation specifically for climate protection, nor has it added any additional burden to taxpayers and industry. Instead, it has based its initiatives on moral persuasion. It issued an appeal to industry which the Federation of German Industries (BDI) answered with an announcement of "voluntary self-obligation" to reduce CO_2 emissions (BDI

1996). As such, this self-obligation is a worthy cause, but it is not legally binding. As a result, the Federal government's *Second Climate Protection Report* reveals that, unless additional legislation is introduced (which is unlikely), a CO_2 reduction of 15% by 2005 (instead of 25%) is the most that can be hoped for (BMU 1997). Until 1996, CO_2 emissions had only been reduced by 10.5%, so in the remaining seven years (to 2005) there is still a long way to go. Executives in the Environment Ministry regard this as "the maximum possible at the present moment (Schafhausen 1997, 292)." Most of our interviewees in federal ministries admitted (once the tape recorder was switched off) that they did not believe 25% a politically realistic goal.

To date, the reductions actually achieved have largely resulted from economic collapse in the former East Germany, which led to the dismantling of many industries based on outdated and highly polluting technologies. Emissions in the West German federal states (the so-called *Länder)* have barely stabilized and with reductions offset by economic growth (e.g., in the transport sector). Germany's reduction achievements are the result of a "reunification dividend" (Beuermann and Jäger 1996).

In sum, it can be said that the government has utilized and reinforced existing regulation and encouraged and sped up "the private initiative of German industry (Federal Government 1996, 3)." It has, however, issued few new measures, and certainly no radical ones for (as environmental organizations insist) grabbing the problem by its roots. At the moment, the political system appears unable to go beyond no-regrets and moral persuasion.

We will now explore the reasons for this, and stress, among other factors, the role of science in shaping this political arrangement and the problem definitions which inform it.

IV. Climate Change Research in Germany

A. Careful Accommodation: The Integration of German Climate Research

Climate research in Germany involves a wide variety of scientificinstitutions, disciplines, methodological approaches and institutional interests (Mormont/ Dasnoy 1993) which cannot be described here in detail. It should suffice to point to a few nodes in the research web to illustrate that the German science system is very well *integrated*, a major factor contributing to its credibility. Among the *scientific disciplines* involved, meteorology is the lead discipline, but research institutions dedicated to climatology, geology, geography, chemistry, atmospheric chemistry, atmospheric physics and various other subfields of physics, marine research, polar research, agricultural, forest and alpine research are also important.

The *research approaches* endorsed by state funding include climate modeling and prediction; climate observation and measurement (using ground-based methods, aircraft, and satellites); climate process studies (including the examination of trace-substance cycles and palaeoclimatology); and (since 1994) climate impact assessment (Klimabeirat 1996). Climate models, mainly developed at the Max Planck Institute for Meteorology (MPI) in association with the German Climate Computing Centre (DKRZ), have become the hub of climate research, with approximately 30% of the funding dedicated to model development (estimate based on BMFT 1992, 62).

As to the *institutions*, a bibliometric analysis carried out in our project (Schwechheimer 1997) revealed that more than sixty natural science research institutions are active in climate research in Germany. An inner circle of about twenty institutions are regularly quoted by the

international scientific community. These institutions come in various forms that have all had to be accommodated in the process of building a research field.

- Probably the most important class of scientific actors are the *research associations representing basic research*. Institutes run by the German Research Foundation (DFG), the Max Planck Society (MPG) and the Fraunhofer Society (FhG) are among the leaders in the field of climate research since they can provide the necessary long-term working conditions and steady resource flows.
- *Universities* and *academic research* are the backbone of the German research system, and universities are comparatively strong in climate research. Our bibliometric analysis revealed that institutes at the universities of Bonn, Berlin, Frankfurt, Hamburg, Kiel and Munich have a considerable impact on the direction and progress of climate science.
- National Research Centres (*Großforschungseinrichtungen* or GFE) are state-sponsored "big science" institutions which, in recent years, have used environmental R&D to gradually substitute for their traditional missions (nuclear, defence and aerospace research). GFEs operate much of the large-scale equipment used in climate research (aircraft, satellites, research vessels and computing facilities).
- The German *Länder* are integrated into climate research by way of three so-called *Blue List Institutes* funded jointly by the Federal government and the individual *Land* in which the institute is located.
- Notably *absent* from the German research scene is in-house government research, i.e. institutions financed directly by and performing first-hand research for government

agencies. Consequently there are no institutions which might serve as a direct, constant interface between research and politics.

- Climate research is well funded by any measure, although the exact funding levels are uncertain. Federal ministries funded climate research with 244 million Marks in 1996 (an amount which, as said, tripled from earlier periods). To arrive at a complete picture, however, one would also have to include:
- funding by the *Länder* governments,
- permanent support of the federal state and the *Länder* for large-scale research and Blue List institutions;
- project funding by the research associations DFG, MPG and FhG and;
- resources from the European Union's program on "Environment and Climate".

None of these numbers are presently available to the public. As a rough estimate of the complete research funding one may cite a British source (UK National Strategy for Global Environmental Research, personal communication) which estimates that funding for research on global environmental change as a whole (in 1995) amounted to $271 million in Britain, $260 million in France and $420 million in Germany. Climate research is far and away the largest sub-category in this figure.

In synopsis, one is struck by the fact that climate research in Germany seems to be a rather *well-established, independent, coherent and well-endowed field of research* even though as late as the mid-1980s the field was still regarded as an "orchid discipline" (Schönwiese 1991), i.e., as somewhat peripheral. The credibility cycle of German climate research has not only been

sustained but expanded remarkably. How was this achieved? Three general aspects address this matter.

First, it is important to realize that German science has traditionally been a very revered and autonomous endeavor. Research programs are coordinated and integrated mainly through *scientific self-organization* and *bottom-up decision-making* (for a general overview see Krull and Meyer-Krahmer 1996). Government agencies do not usually try to set specific priorities for science, but instead rely on what is called overall guidance (*Globalsteuerung*). They lay down some overall objectives for research but the specific directions and contents of research programs are then decided upon by scientific experts, usually by relying on commissions set up by the research associations. The administration does of course have the last say and intervenes when it finds propositions unbalanced, but usually it follows expert recommendations.

Second, research in Germany is very much characterized by *academic standards and orientations* as well as by *disciplinary divisions of labor and career paths.* The leaders of the research system are university professors, and eminent scientists derive their status from their academic standing (even if they work in applied research outside academe). The boundaries among disciplines are still quite strong; interdisciplinary cooperation or integration of disciplines is the exception to the rule in Germany and rarely practiced in environmental research (Fränzle and Daschkeit 1997). Both tendencies - scientific self-organization and academic and disciplinary orientation - contributed to the skill and authority with which German scientists and institutions could raise and establish the issue of anthropogenic climate change in the political realm.

Third, given the constant wealth of post-war Germany and the autonomy of the science

system, resources have always been relatively freely available for German science. However, the relative ease with which research funding could be multiplied was also partly attributable to a coincidental factor, the decline of nuclear energy, formerly the biggest category in the federal R&D budget. The displaced resources were partly reinvested in climate research.

Under these circumstances of authority, autonomy, prerogative and relatively freely available resources, science had the chance to achieve what could be called *horizontal, additive integration*, i.e., different disciplines and research approaches could be accommodated and reconciled in an *intricate balance.* A wide alliance of scientific interests found a place in the funding schemes, and there was little conflict over resource distribution. Integration was further strengthened through the prominence of the MPI and its climate models which provided a hub for the manifold national research activities without dominating the scientific agenda. This rather unified stance has contributed to the absence of scientific controversy or any *dissenters' movement* in German science. Scientists criticizing the hypothesis of global warming in the media usually have to be imported from the U.S. (usually, Richard Lindzen or Fred Singer are invited).

The pros and cons of this arrangement are equally outstanding. On the one hand, German climate research has been remarkably effective at preparing a sound scientific knowledge base about the climate and at designing a mix of natural-science disciplines attacking the problem from many different angles. This has translated into *high credibility* in the political sphere. Unlike in the U.S., anthropogenic climate change in Germany has been relatively unencumbered by political attacks. Industry lobbies in Germany have also kept a relatively low profile on the subject. They have, of course, tried to slow down and influence the government's response, but have not tried

to deny the existence of the problem as such (van der Wurff 1997, 180-182).

On the other hand, the system displays serious drawbacks. First and foremost, there is a major exception to the rule of horizontal integration. By and large, the *social sciences* were *not* included in this set-up. Social science studies have not been funded by the federal research programs (Fränzle/ Daschkeit 1993, 73). The social science do play a limited role in the federal subprogram for climate impact assessment. This project emerged much later than many of other climate research programs, in 1994, and remains dominated by natural science and modeling activities. The first funding schemes for the social sciences were not initiated by state agencies but by research councils. The German Research Foundation and the Volkswagen Foundation started programs on the social dimensions of global change in 1995 (Spada/ Scheuermann 1998).

The reasons for this neglect are too manifold to name here in detail (and also have to do with the complacency of social scientists themselves). Two systematic reasons are important to note, however: (a) The Enquête Commissions were (as we will see in chapter 6) decisive in forging public understandings of climate science. Guided by their consensus-based operational rules, they displayed a tendency to put last, or even disregard completely, aspects which threatened to be too controversial or too complex to be dealt with in unison. Social aspects touching upon controversial political matters therefore fell by the wayside. (b) Because of the mentioned disciplinary orientation of the science system, there are few interdisciplinary studies in Germany which could have served as meeting grounds for the "two cultures".

Apart from these, there are various minor problems which may ultimately become bottlenecks for climate research in the near future. Climate research is not only widespread but

also fragmented. Money is spread over many different institutions, and there are no science councils equivalent to British "Royal Commissions" structuring and mediating the research field. This may become a drawback once budget cuts loom which may spark distributional conflict. The consensus-oriented system is characterized by discernible institutional inertia and is rather slow to respond to new challenges.

Climate research is now bound to face a period of stress, perhaps transition. Now that the existence of anthropogenic climate change is no longer contested, political institutions are beginning to decrease the resources they make available for climate research. The Federal Research Ministry has reduced funding for the first time, by a factor of 5%. In the words of an official, "the seven fat years are over" for climate research (interview Research Ministry). According to the guidelines of the new Federal Environmental Research Program, environmental research is supposed to yield an "environmental dividend", i.e., visible, practical use for policy stakeholders and citizens. The new benchmark has sent program officers at the ministries spinning looking for practical uses of climate research.

An alarming sign of mounting pressure appeared before Kyoto when paleoclimatologists criticized climate models as an overrated and over-funded approach and demanded more resources for themselves. This was the first time that an internal scientific dispute emerged into German public consciousness. The feud was appeased by a meeting convened by the Research Ministry (interview Federal Environmental Agency).

The post-1991 consensus has come under pressure. Climate research will now have to accustom itself to resource shortages, to increased competition from within and from other research fields, and to more specific demands by political actors. Adapting the system to altered circumstances will be a formidable task given the structure of the German science system, its academic foundation and corporatist stabilization.

B. General Circulation Climate Models as Integrative Links

As the climate system is global in scope and evolves over long time scales, laboratory and field research are not sufficient to grasp its dynamics. Computer models of the climate system thus became a strong pillar of research to test properties of the system and to perform limited prognoses of its behavior in the future (Edwards this volume). The most important (although by no means only) approach to modeling climatic change are so-called Coupled General Circulation Models (CGCM) which attempt to simulate realistically the spatial and temporal behavior of the climate system by including its most important sub-systems, primarily the atmosphere and the oceans. CGCMs require the use of powerful super-computers which makes them so expensive that (until recently) only a handful of research centers were able to pursue them. German climate research and research policy thought it tantamount to command this capacity and established in 1987 (alongside the MPI) the German Climate Computing Centre (DKRZ) in Hamburg. Both institutions have a broader scientific mission than climate modeling, but the CGCMs clearly constitute their major field of activity.

The foundation of the DKRZ was the cornerstone in a wider scientific and political strategy. Both the Climate Advisory Council (representing research) and the first Enquête

Commission (representing scientific and political stakeholders) designated climate models and the computing center as the spearhead of the evolving German climate research effort. From its first consultations, which became the basis for the Federal Climate Research program (see Graßl 1992), to its last report (Klimabeirat 1996), the Climate Advisory Council has always put the improvement of climate models at the top of its list of research priorities. "The national climate programme has put the main emphasis on climate system modelling; the advisory committee has proposed to concentrate on a single global atmospheric circulation model [...] (Graßl 1992, 24)." The DKRZ was also intended to be "an important coordination instrument for climate research (BMFT 1989, 31)" by "bringing together results from the various areas of climate research (Klimabeirat 1996, 82)" and by requiring "groups working in this funding programme [on the greenhouse effect] to use substantially the DKRZ for their computations and to align their project goals with the models established at the DKRZ (BMFT 1989, 31)." The first Enquête Commission, especially in its report on energy, based much of its line of arguments on models (German Bundestag 1991, 233-271, 352-423, 540-571) and reiterated (although to a lesser degree) the recommendation to fund models as a priority task (Ibid., 428).

The indispensable contribution of CGCMs does not fully explain why CGCMs have taken center stage in climate research programs. Models can only be calibrated and perform reliably once they are based upon and tested against climate data as detailed and going as far back in time as possible (Graßl 1992, 23). In principle, therefore, science and politics might as well have laid the stress on unearthing the necessary data instead of expanding computing power at a time when the database to work with was actually quite sparse. The reasons why they chose

the opposite—i.e., to give priority to model development and then to face the problem that available data is insufficient (UBA 1996, 5)—rests, in our view, not only with scientific criteria of quality but also with *institutional imperatives and dynamics:* the need of science and politics alike to secure legitimacy and credibility. Both of these have been *fostered* by the Hamburg CGCMs.

- CGCMs appear to promise the ability to *predict* the future state of climate (given a certain set of assumptions about future GHG concentrations). For politics this is a very desirable quality of models for illustrating and legitimating the threat of climate change. German research policy has stressed that models were funded to "permit predictions of future global climate change, predict the temporal evolution and spatial distribution of major climatic parameters on a regional scale [and] identify the man-made climate signal [...] (German Bundestag 1991, 425)." From a scientific point of view, this claim is ambivalent. In research policy documents modelers use this claim themselves (Klimabeirat 1996, 13); in purely scientific accounts, however, they prefer to stress that models are an *instrument for understanding* climate processes. At best, clarifies one leading German modeler, "one should perceive simulations of climate change as an intelligent assessment of future climates, however not as a deterministic prediction (Cubasch et al. 1995, 276)."
- CGCMs also provide a *visualization* of climate change. This is invaluable to science and politics because climate change, given its global and long-term nature, cannot be seen, heard, or felt. CGCMs help close this gap because change can now be *seen* very *vividly* (remember that zones of warming in climate simulations are always painted in brightest red, signaling

danger) and it can be *projected onto the global scale*, i.e., be shown to effect and encompass the entire globe.

- CGCMs likewise invoke images of *progress* and *completeness*. The appealing aspect to politics (German Bundestag 1989, 41) is that in the course of time, CGCMs will come to incorporate more and more important details of the climate system until, some day, they will have assembled a near-complete picture (Schönwiese 1997, 14). From a scientific point of view, this is not quite accurate. Tests show that CGCMs with more detail do not necessarily simulate climate more reliably than more simplified models; sometimes they actually perform *worse* (interview MPI).
- The idea that CGCMs *embody in miniature* the huge climate system because they provide a *realistic representation* of the climate system (Cubasch 1997, 52) is easy to grasp for political leaders and for the media. This claim, however, is not as self-evident as it may seem. This comes into view once we contrast CGCMs with a different modeling approach, the so-called statistical climate models. These do not attempt to model the climate system's properties but rather take series of measured data and then condense them with mathematical methods to arrive at a *statistical representation* of climate. Statistical models have weaknesses but have worked well in tests and, since they are cheaper to perform, in principle offer an important complement to CGCMs (Schönwiese 1997a). However, despite their scientific merit, they have never achieved nearly the same attention and funding as CGCMs.
- CGCMs satisfy a certain herd instinct in politics. In a situation of profound uncertainty

over priorities, one straightforward strategy is to imitate the leader in an effort to gain global recognition (or at least avoid the potential embarrassment of appearing to be doing something different). Drawing on the fact that U.S. climate research has long relied on CGCMs, German research policy stressed repeatedly that it wanted to foster world-class research and therefore concentrated resources on CGCMs (Klimabeirat 1996, 13).

To sum up, CGCMs appear to perform a special role in Germany for both the *integration of science* and the *linkage of science-policy interaction*. Both dimensions are important for the credibility cycles of science and politics. CGCMs supply science with the image of a deterministic system and politics with a *body of evidence* on *display* in the CGCM centers. Both have stabilized climate change discourse tremendously.

V. German Climate Policy: Entrenchment in Horizontal and Vertical Bargaining Systems

It is a matter of consensus in the German political and administrative realm that the global warming problem *exists*, that it should be addressed by politics and that it would probably best be addressed by markedly reducing GHGs in the nearest possible future. The questions remaining are, simply, how far-reaching measures should be, when to implement them (time horizon), and who will have to bear the brunt of the costs. With these features, Germany displays a strange mixture of foresighted problem-understanding and inertia. As mentioned, it appears that both the speed with which Germany made headway in the years 1986-1991 *and* the slowness of progress since 1992 are symptoms of the same structural and cognitive features pervading German politics.

The German political system is *federalist* and *decentralized*. On the "vertical" dimension, it consists of three different state levels: the Federal state, 15 *Länder*, and the regions and municipalities. Although the Federal government is clearly the strongest, each level has its own political competencies, powers, and resources. These levels coordinate their measures, but each follows and furthers its own specific interests, which makes the legislative process slow and fragile (Kösters 1997). This problem affects both environmental and science policy because, in principle (according to the German constitution), both fall into the domain of the *Länder*.

Federal policymaking in the arenas of economic, environmental, and research policy is usually *administrative policy*. Parliament, on the one hand (including the *Bundestag*'s Environmental and Research Committees), and societal interest groups, on the other, have a role in agenda-setting, fact-finding, issue-framing and consensus-formation processes leading to the establishment of an issue. In these processes, *corporatist bargaining* takes place, i.e., organized, collective social interests (industry sectors, social movements, research associations, trade unions, churches etc.) lobby the system and often are invited by the state to participate in probing and staking out new policy arenas. However, once the government has decided that a problem requires activity, the decision-making is moved into the administrative realm. The concerned Federal and *Länder* ministries and other state agencies form internal bargaining systems which become the arena for formal decisions. These bodies proceed behind closed doors. They can be lobbied from the outside but no interest group has direct access to the process.

In this administrative arena, environmental policy is a *"cross-sectional" policy-domain*, i.e., it is seen as cutting across various portfolios so that decisions have to be negotiated among

federal ministries. Participating in the Interministerial Working Group (IMA) on CO_2 Reduction are nine federal ministries (although only six of them are active). In such processes of administrative bargaining, the Federal Ministry of the Environment is known to be one of the weaker actors (although it formally chairs the negotiations). In the climate sector, the ministries for Economics and Transport, and also Finance, are most important. No decision is passed against their veto.

Apart from these general characteristics of the political system, climate policy is under the influence of three more specific factors. As in many countries, environmental issues are intimately linked to the *energy* issue. In Germany, however, most actors in the policy field have tried to keep both fields *separated.* This is because Germany, for almost 20 years now, has experienced a *stalemate* on all fronts of energy policy-making. *Nuclear energy* is so unpopular among citizens that expansion is not an option; neither is phasing-out an option because the utilities and the energy-producing industry (including Siemens, the second-largest national company) depend on it to a high degree. *Coal* and *lignite* mining (and heating) is still an important economic factor for the *Länder* Northrhine-Westfalia, Saarland, Saxony and Brandenburg. Reducing coal use would represent one sacrifice too many for these *Länder,* hard-hit by economic crisis. *Oil* imports have traditionally been very important for Germany which (apart from coal) possesses no natural raw materials. Reducing oil consumption is bound to meet with resistance from industry which stresses that Germany's export economy is still much too geared to the production of goods, not services. *Renewable energies* have been supported intensively by the state, but given the unfavorable natural preconditions for solar and hydroelectric energy, their

share in electricity (5.5% in 1995) and primary energy (2.3%) production has been low (von Baratta 1996, 1079). A potential for marked increase exists but is overshadowed by "numerous uncertainties" as to when and how broadly this increase will set in (BMU 1997, 49).

In sum, the energy arena is quite immobile and so filled with explosive material for political controversy that most political actors have chosen to *deemphasize* the link between energy and climate. The nuclear energy lobby uses climate changes merely as a side argument. Since the mid-1990s, the environmental movement has taken up the energy link and used climate change to reinforce its case for renewables. Beyond the confines of the environmental ministries and the liberal and left-wing press, however, this move appears to have fallen on barren ground.

Similar stalemates are encountered in the arenas of transport and agriculture. *Transport* offers the opportunity for significant GHG reduction because much individual transport, road haulage and air transport could be shifted to public transport (Beuermann/ Jäger 1996, 207). Unfortunately, the automobile industry is the biggest employer in Germany; cars and *Autobahnen* are Germans' favorite pastime; and Germans are *Weltmeister im Fernreisen*, i.e., enjoy long-distance holiday travel. The Environment Ministry has therefore practically given up hope. "We know of the transportation area that we cannot prevent growth rates; according to all scenarios, reduction rates will therefore turn out lower than 25 percent (Environment Minister Merkel, 1996, 132)." The area of *agriculture* is equally immobile. It is known to be a major pollutant but farmers muster the single most effective lobby in Germany and receive massive subsidies (28 billion Marks in 1995, von Baratta 1996, 979). No changes can be expected.

The general political circumstances have turned more unfavorable in recent years. As in

most other countries, the argument of economy vs. ecology was sharpened by the issue of *global competitiveness*. German industry has not only lost market shares to foreign companies, but an increasing number of companies have also moved their manufacturing and even R&D sites abroad, claiming that the burden of taxes and bureaucratic red tape—partly caused by environmental legislation—has become too heavy. If political measures are to be taken, it is argued by industry, this should be done by all (industrial) nations, because unilateral measures would mean a loss of economic competitiveness. The weight of this argument has grown since Reunification. Following a short phase of optimism in 1990/91, the economy has declined rapidly and constantly. In 1997, the unemployment rate in Germany hit a post-war high of 11.4% (17% in the East German *Länder*, Frankfurter Alggemeine Zeitung, January 10, 1998), and improvement cannot be expected soon. Small wonder that (according to opinion polls) environmental affairs have fallen in the citizens' esteem (although they are still high on the list of priorities). Even under the new coalition of Social Democrats and Greens, the new leadership will have to ease economic worries first.

Owing to this entrenched, rigid set-up, it will be a formidable task for German politics to move beyond no-regret measures.

VI. The Science-Policy Interface: Narrowing Down and Sealing Up the Climate Issue

The Enquête Commissions (EK) were the only hybrid institutions deployed in Germany (i.e., combining political and scientific experts) and the first panels charged with pondering actual political measures. EK I, in particular, had a formative influence on the way the climate issue is

perceived and politically responded to in Germany. To explain this influence, we have to look (a) at the procedures of coupling applied by the EKs, (b) at their proceedings, especially at their choice of topics and the management of conflict within the commissions and (c) at the consequences the EK's carried for the framing of the climate change issue.

Like the IPCC, EKs are a *hybrid forum* in which scientists and politicians meet and inform each other, *trading knowledge claims* and *coupling* science and politics in the form of a *platform.* EK I worked to establish *a tight coupling* of science and politics by the following mechanisms of *integration*:

- Scientists and parliamentarians were *combined in one body.*
- The members of the commission—also the scientists—were chosen by the *political parties* in the *Bundestag, along party-political lines,* i.e., experts were considered for membership on the basis of their identification with certain portions of the political spectrum and expectations that they would vote accordingly should disagreement occur. The chairman of the commission (who is quite influential) is always a member of the ruling party.
- The *agenda* and *conclusions* of the commission had to be *approved by consensus* (although, in case of disagreement over the conclusion, minority votes could be added to the consensus statement). This requirement subdued scientific reasoning to a *political criterion* which helped to reduce statements to a politically tolerable level.
- EK I *extended* the requirement of consensus to the *research process* itself. For its most important and controversial report on the energy system, it commissioned a study program on "Energy and Climate" in which 51 research institutes worked out 150 studies on selected

aspects of energy use. The EK commissioned "at least two institutes with differing approaches for each topic. They were required to present the commission with jointly endorsed results [...] This made sure that they had to move towards each other and reach agreement. This limited expert controversy on the data base (EK member Ganseforth 1996, 217)."

Armed with these instruments, the EKs set about assessing the climate threat. We can only briefly describe their results (which included 7 official reports amounting to more than 6,000 pages). In the following description, note which aspects of climate change the experts addressed (and in which sequence), how they phrased and framed the problems, and on which of them they reached consensus.

EK I worked in three phases. It first prepared a preliminary overview of scientific knowledge about the climate system and global warming. As the first practical problem, it addressed the depletion of the ozone layer and recommended political measures. The second phase addressed the protection of tropical rain forests. Describing the physical and economic causes of deforestation was easy, but, when it came to recommendations, controversies broke out. "The more it showed that the destruction of tropical forests was tightly linked to the world economic system, the indebtedness of tropical countries, the distribution of land ownership and the social and capitalistic structures, [...] the more the views diverged (EK member Ganseforth 1996, 217)." Social Democrat and Green members wanted to stress these factors; liberal and conservative members emphasized the responsibility of the developing countries. The final text was phrased according to the liberal view, i.e., toned down and equipped with the

recommendation that it was "necessary for ongoing development cooperation projects to be more strongly oriented [...] towards conserving the tropical forests (German Bundestag 1990, 68)" and for the World Bank to become more concerned (ibid., 801). EK member and climate research figurehead Hartmut Graßl became more plain when he decreed that "development aid projects which destroy the tropical forests must be stopped (Graßl 1989, 63)." Dissenting views within EK I were published in five minority votes.

The third report faced the most feared issue: energy policy. To prevent deadlock, the EK took two steps. It decided to ignore the nuclear energy problem; and it decided to concentrate its energies on preparing a comprehensive scientific and technical data base on energy production and consumption in Germany. This base was prepared by the previously mentioned study program and held under control by strict application of consensus procedures. The program yielded more than 10,000 pages of material which were then welded by the EK I into a two-volume report of more than 1,600 pages. The first volume again presented the scientific evidence on climate change and ozone depletion. The second dealt with strategies for reducing energy-related emissions. As had to be expected, at this stage fundamental political differences came to the fore. The report therefore included 12 (!) dissenting votes, and apart from an inventory of reduction potentials there was hardly any consensus.

Strange as it may seem, despite these difficulties, EK I was widely seen as a success. It had reached agreement on the existence of the problem of global warming, it had identified technical potentials for GHG reduction, and it had presented a reduction formula which became the basis for actual political decisions. Also, people were relieved that the commission had not

stalled from the start. One of its predecessors, a study commission on nuclear energy had worsened instead of appeased the nuclear energy conflict. Compared to this quite traumatic experience (interview Research Ministry), EK I had actually been quite productive.

EK I was used as the matrix for a second commission, EK II, which, however, fared less well, partly because the political circumstances (rising unemployment after Reunification) became more hostile, partly because IMA and (on the international level) IPCC had already taken over the initiative and left the commission in a vacuum. EK II started by reiterating the work of EK I, i.e., reviewing the state of climate science, a decision controversial within the commission itself (interview with EK member) which led observers to criticize "that one was constantly taking refuge in diagnosis because one feared therapy so much [...] (Vierecke 1995, 105)." During the start-up discussions, two members had proposed the creation of a working group on implementation strategies (like IPCC's WG III) instead, but did not receive support (interview with EK member).

EK II then turned to the issue of transportation and climate—and suffered a foreseeable debacle. Controversies were so intense that the commission mainly agreed to disagree (Bals 1994). After this crisis, the next issue, agriculture and forestry, was almost easy to handle (partly because many EK members took little interest) (Kords 1996, 210). The study of energy options was again postponed to the last phase. This time, nuclear energy could no longer be ignored. As a result, the opposition camp published 11 dissenting votes alongside the thin-lipped consensus position, delineating fundamental political differences. Needless to say, EK II was much less successful than its predecessor, but at least it reinforced the basic political consensus that climate

change was a real problem deserving political attention.

The EKs had a formative influence because they provided the *arena* in which scientific and political credibility cycles could directly intersect and reinforce each other, thereby also shaping the *agendas of political and scientific institutions*. The EKs strengthened political institutions because they stated that the phenomenon of climate change existed and thereby provided political actors such as the government and the Research and Environment ministries with the necessary legitimacy to expand their agendas. The EKs provided a formula for political action which the government took up and institutionalized in the form of the Interministerial Working Group (IMA) which became the center of climate politics but also led to an admininstrative closure of decisionmaking. In this sense, the EKs provided the discursive and institutional basis for the present German climate policy; they led to the formation and also finalization of German climate policy.

The credibility of scientific actors was improved because science was given a central role in shaping and preparing political decisionmaking. Most notable was the increase of resources which became available to science. As mentioned, federal funding for climate research multiplied between the mid-1980s and the mid-1990s. These increases had already been in preparation in the Research Ministry and in the Climate Advisory Council; EK I, which held close contact to both of them, and also to Chancellor Kohl himself, bestowed a seal of approval on these plans. This rise in available resources had a direct effect on the output of German science. Our bibliometric analysis indicated that between 1989 and 1995 the number of natural science journal articles by German researcherson climate and atmosphere more than quintupled (Schwechheimer

1997, 4) (which is of course only a very rough gauge of productivity but still indicates the stimulus given to science's credibility cycle).

The EKs also *shaped and reinforced the emerging scientific agenda of climate research*. Scientists involved in or consulted by the EKs could expect reinforcement of their agendas. The parallel bargaining processes within EK I and the Climate Advisory Council (which were partly filled by the same experts) prepared a distribution of work and horizontal integration among disciplines and research approaches which bestowed stability to the research field. Themes designated in the EK reports as important were, to a large part, supported by the new Environmental Research Program. One consequence was the emphasis on climate models and computing facilities. These were repeatedly mentioned in the EK reports as the top priority for research. In contrast, research efforts which fell by the wayside were climate impact research and the social sciences. Impact research only came up for consideration for funding in 1992, after all of the important funding decisions had already been made; and the social sciences were not funded by federal programs at all.

The mutual reinforcement of credibility cycles was based on a *consensual framing of the problem* of climate change, a problem definition which scientific and political actors had negotiated in the course of the EKs (Mormont and Dasnoy 1993, 104-105). By and large, it consisted of the following elements.

- Climate change was defined as a *research problem*. This frame stressed the scientific *uncertainty* in the issue, i.e., the *knowledge gaps* which would have to be closed before more profound political action could be taken. This would require *more research*, therefore, an

expansion of research funding was recommended.

- Climate change was defined as a *technical problem* of reducing GHG emissions. This definition emphasized refining existing technology instead of devising new approaches to consumption and energy use. Solving these technical problems also required *more research*, i.e., benefited science and could only be done in the future.
- Part of the problem definition made by the EKs was the *globalization and internationalization* of the issue (Engels and Weingart 1997). From the beginning, climate change was defined as a "High-Priority International Task" (German Bundestag 1990) and as "A Threat to Global Development" (German Bundestag 1992) (the sub-title of two EK reports). Once the problem is defined as global, abatement becomes dependent on international cooperation. This spares national policymaking from having to make too many unilateral sacrifices, and it slows down the design of measures because international consensus is hard to achieve. Globalization also had the effect of perceiving Third World countries as, as it were, future culprits of climate change and of obliging them to engage in climate friendly policies. Poor countries will damage the climate system, the argument goes, once they start to enjoy the same standard of living as industrialized nations. Therefore, one should start today to change their behavior. It is notable that the EKs first addressed deforestation (a problem undoubtedly important but not the main cause for global warming) and methane emissions, a gas mainly produced by the Third World's agricultural societies. Both decisions made it possible to construct a global community of malefactors before turning to the more embarrassing problem of minding one's own backyard.

The interests of both science and politics *coincided* in the identificationof *research gaps* and in the postulate that *more research* was needed before more profound measures (than no-regret) could be pondered.

Climate change can be seen in different contexts which define what makes "the climate change problem". The frame of the problem may be one of *changing the structure of societal sectors* like energy and transport. It may be framed as a debate on *sustainable lifestyles* of societies and the question of whether modern industrial societies are, as it were, based on poor concepts of wealth. The *time frame* of the issue may be widened, making climate change a matter of "intergenerational justice", a frame which, if accepted, would change the axioms of many economic concepts applied to the problem. The frame may be widened by including a *moral dimension,* especially regarding the *Third World*. Climate change will mainly affect the Third World which lacks adaptation options compared to industrial countries. Instead, scientific accounts have often chosen to conceptualize the Third World as a future contributor to climate change.

Seen in a wider frame, the climate change problem may, however, also lose importance. It may be argued that among the many problems approaching humankind climate change is one of the less important, second-tier evils. Some critics claim, not without good reason, that one should give priority to these bigger, more immediate problems because their mitigation would, in one breath, counter climate change. Poverty, for example, lessens the ability of a society to deal with environmental hardship; if the poverty problem were solved, a good deal of the climate problem might also disappear. In this view, many of the political energies and research resources

devoted to the climate issue would have been better invested into other areas.

From a scientific point of view, all of these frames to global warming are equally legitimate and important. There is no scientific law stating that climate change has to be framed as a problem of scientific proof and technical cure; it may as well be framed as one of lifestyles and profound societal choices, as one of equity and development on a global scale—or as a less important problem.

These alternative frames, however, were not discussed in the EKs or, when addressed, led to political conflict that could not be packed into a consensus position. The closure mechanism of consensus could be seen at work several times. The EKs, therefore, worked out and settled for problem definitions which were more narrow but were also more compatible to existing orientations in science and politics and kept the problem manageable.

One may draw the following conclusion: The Enquête Commissions of the Bundestag incorporated, organized, and reinforced existing institutional patterns in Germany: a corporatist political bargaining system and a mature, academically-oriented science system. These features were coupled through a strong consensus requirement. The output of this process was a definition which stressed scientific fact-finding, technical emission reductions, and economic no-regrets measures. Favored by coincidental circumstances, these political measures were fed into environmental and research policy and led to a process of closure. The *expansion, institutionalization, and finalization* of the climate issue were sealed by the same process of science-policy coupling which gave rise to a specific *path of climate research and research policy* in Germany that has remained largely unchanged to this date. This path is based on what may

be called (in a non-polemical sense) a *narrow framing of scientific and political thinking* on the subject.

We believe that this explains the two mysteries mentioned at the beginning of our chapter: namely, Germany was quick to move from political monitoring to activity because there was a detailed consensus to work from; yet, by the same token, Germany is today locked into a position of little political leeway because the existing consensus is deeply embedded in the institutional foundations both of the scientific and the political system.

To be sure: This is not a moral or polemical but a sociological judgement. It points out *social choices* which are based on *social discourses, processes of closure and path dependencies.* If the present path to climate protection were deemed insufficient, we would have to choose a new path, based on a new frame, obtained from a new round of social discourse.

We would like to finish our account with a short list of scientific and political innovations which all have in common that they might open up new roads to climate protection. To date, these approaches have had only a limited effect on climate policy, partly, we believe, because they do not fit into the pathway of climate science and politics inaugurated by the EKs.

VII. Global Warming Today: Isolated Innovations

In both the scientific and the political realms, various innovations have been introduced in Germany. In science, several institutions have been founded which entertain research topics that extend beyond the purely natural-science perspective. Climate impact research is the mission of the Potsdam Institute for Climate Impact Research (PIK). Potsdam's claim to fame is fivefold. Within nine core projects, it attempts to model: (a) the impacts of climate changes on (b) a small,

regional scale (e.g., on the North Sea coastal area) for (c) specific socio-economic sectors (e.g., agriculture), integrating (d) natural and socio-economic climate impacts—all of which (e) should lead to concrete political recommendations (see PIK 1996). Each aspect is quite a novelty in Germany, their combination a promise hard to fulfill.

The Wuppertal Institute for Climate, Environment and Energy (WI) (founded in 1991) has repeatedly attempted to substantially widen the reference frame in which global warming is conceptualized by forging discourse coalitions with NGOs and Third World development organizations and by promoting the view that the issue should be perceived in terms of sustainable development (BUND and Misereor 1996).

The most notable innovation has been the foundation of the German Advisory Council on Global Change (WBGU) in 1992 by the Federal Researchand the EnvironmentMinistry. The council, which reports directly to the ministerial level, marks the first time that social scientists have been integrated into an advisory institution. Climate change is just one of several of its activities, but it has devoted important statements to the subject. The WBGU has become active on the conceptual level by introducing the so-called "syndrome concept" which aims at showing the interconnection among different aspects of global change such as climate change, water use, desertification and soil degradation (WBGU 1996). It hopes to promote a more integrated approach to environmental protection and to create synergy effects among policy measures. Although still quite tied to natural-science views, this is certainly a path-breaking initiative.

In the political and public arena, there have also been various attempts to widen social discourse about climate change. The environmental movement has (quite belatedly) adopted the

cause of climate, and organizations like the World Wildlife Fund, the German Ring for the Protection of Nature (DNR) and GermanWatch argue with force that climate protection should be carried beyond no regret and placed in a wider ecological and social context. Terms such as sustainability, sustainable development, and global change have been used to provide these approaches with a comprehensive theme. Also remarkable are initiatives at local and regional political levels. Numerous German cities have joined "climate alliances", created their own climate protection and Local Agenda 21 schemes, and committed themselves to energy efficiency (DIU 1995).

Aspect that all of these advances have in common include that media interest in their initiatives has rapidly declined, that they achieved little federal political acknowledgement or response, and that our interviewees in German administrations were quite unimpressed. This should not be simply attributed to a lack of interest by citizens and politics. These approaches have been left high and dry so far because they do not connect to the scientific and political "mainstream" established by the EKs in the early 1990s. They are incompatible or even undermine the present consensus arrangement. They could only grow roots if they were integrated in the formation of a new science-based consensus. This leads us to our conclusion.

VIII. Conclusion: Waiting for 2008?!

In the course of a few years, the issue of global warming in Germany has experienced a dramatic expansion of attention, high degrees of institutionalization, and encapsulation within Germany's corporatist form of government. The result may be viewed from two perspectives. It may be perceived as a successful example of pragmatic political risk management. After all,

global warming is characterized by pervasive scientific uncertainty and intractable political reverberations. Hence, a slow, measured political response may be the best option. It may, on the other hand, be viewed as a case of short-sightedness, incrementalism, even muddling-through that is bound to founder in the near future.

Be that as it may, the successful and the disheartening features of the German climate arena are due to the same structural reasons. To put this in another way, German political culture, as with that of any country, exhibits a strong tendency to respond to public policy issues in predictable ways. When new issues arise, they tend to be re-inscribed by social actors along familiar lines, reinforcing widespread beliefs among scientists, policymakers, and citizens in Germany that they have found the right way. Things do change, but rarely rapidly.

This can best be appreciated when looking at the *institutional dynamics* and the *institutional interplay* of science and politics. The development of an issue such as climate change is not simply driven by the intentions of actors. It is driven and shaped by the *functional requirements* (resources, legitimation, credibility) and the *self-interests* (the prospecting for new agendas) which the institutions of science and politics have to secure to be able to address the issue in the first place. The interlocking of these two credibility cycles markedly influences the societal discourse on climate change and shapes they way in which the issue is framed, i.e., perceived and reacted to. These frames can become *reified* in symbolic and institutional arrangements and create routines, path dependencies and unexpected side effects.

This article has attempted to shed light on these dynamics. In our view, the German stance toward global warming can be traced back to a science system which is

- very strong, autonomous and detached from politics,
- highly academic and disciplinary-minded in orientation,
- highly integrated through horizontal accomodation (while at the same time ignoring the social sciences almost completely) and through the promotion of one research approach, Coupled General CirculationModels (CGCMs) which supplies visualizationand coherence to the issue.

The result is a strong research system which has supplied much credibility to politics but which is also unprepared to move beyond the confines of climate monitoring into the more controversial seas of impact assessment, policy consulting, and wider societal discourse.

The most important features of German politics are

- a federalist system geared to consensus-formation in corporatist circles,
- opting for the containment of issues through administrative politics,
- tied by immobile, intimidating issue linkages.

The interaction of these constellations was mainly forged through a hybrid institution (the first Enquête-Kommission) which achieved an unusually tight coupling through a pronounced consensus principle and which quickly became reified by favorable political conditions.

Thereafter, the climate issue became deeply embedded in the structures of German scientific and the political institutions and has been promoted to a strong, uncontroversial position. At the same time, it has been administratively tied into a phalanx of other, more powerful issues which limit the reach of climate protection schemes.

More profoundly, the consensus-oriented coupling of science and politics that has taken place in the EK and the IMA has led to a channeling and narrowing down of the social discourse on global warming. German science and politics have adopted a reference frame which is based on the lowest common denominator: climate as a research problem and as a matter of technical and market-based reduction of GHGs. The result was a pragmatic, sturdy policy response which may also be viewed as stifling any attempts to grapple with some of the larger social dimensions of the problem.

Politics and society may take the view that radical change is not necessary, that the problem is basically a chimera or (given the underestimated resilience of ecosystems) can be managed by instruments presently available. Be that as it may, any effort to change gear in climate policy would require changing the path Germany is on and *re-opening and widening social discourses on climate change.*

This is difficult to imagine, in part because the present arrangement appears to be on track to many people while the pressures of changing climatic conditions have not yet arisen, let alone reached critical thresholds. Moreover, changing the arrangement would create *new risks* for science and politics. Politics could no longer neatly compartmentalize and contain the problem. German science would also face unrest. The ingenious horizontal consensus among researchers would fall apart. New research directions would have to be accommodated, disturbing the distribution of resources. Scientific uncertainty would become visible again and would lower credibility. What is more, new arrangements would be faced with the same institutional circle: the need to secure legitimation, resources and credibility for science and politics. The solutions would

create new path dependencies - and new unanticipated side effects. Shifting climate change discourse and policy in Germany would require a great deal of work and fundamental reevaluations of many deeply held commitments on the part of Germans regarding the nature of science, politics, and society.

At the moment, it is unlikely that either science or politics would prove able (even if they wanted to) to re-open Pandora's box in a significant, acute way. Could impulses from outside this arrangement force them? There are various candidates for changes, but at the moment they do not appear to be strong enough.

There is however light at the end of the tunnel, although we cannot derive much confidence from its glare. To dare a prognosis: Major changes in the German climate change arena will occur around January 31, 2008. Why? On that day, the nuclear power plant in Grohnde is scheduled to go off duty. Then, slowly but surely, eight to twelve (of 21) nuclear plants will have to be taken from the grid and mothballed in a very expensive technical process. This will disrupt the German energy consensus (or stalemate, if the reader prefers). It will require a fundamental debate in society about which path in energy policy the country wishes to pursue. The debate will probably be constricted by the equally unsatisfying options of the Swedish way (discontinue nuclear energy and place all our bets on renewable energy) or the French way (shoulder the risks of nuclear energy). Given the enormous economic and emotional energy invested in the issue, this is bound to be an earth-shaking debate. All stake-holders—including science studies—had better prepare: the countdown is on for January 31, 2008.