Position paper

The Challenge

The prospect of major changes in the earth's climate as a consequence of greenhouse gas emissions and other human actions presents one of the most demanding challenges facing humankind in the decades to come. The challenge has to be jointly tackled by science, policy, industry, NGOs, and the general public.

Numerous academic studies on climate change and on possible adaptation and mitigation policies have been completed in recent years. However, most of these studies have been performed with little direct interaction between the scientists and the stakeholders immediately affected by the proposed mitigation or adaptation measures. In parallel, many industries have made efforts to reduce emissions through improved energy efficiency and carbon saving energy technologies. Much of this work has been similarly divorced from academia. No clear picture has emerged from these diverse efforts on the relative advantages and disadvantages of the various mitigation and adaptation options proposed, let alone a consensus on the desirable research strategies and policy objectives to pursue.

The European Climate Forum (ECF) is a mechanism to bring together representatives of different parties concerned with the climate problem: the coal, oil and gas industries, companies engaged in renewable energy technologies or the manufacture of energy-efficient products, major energy users (including transportation) , insurance and finance sectors, environmental NGOs, and scientific experts investigating climate change and options for sustainable development. The core activity of the Forum is to jointly define and undertake studies and disseminate results that will contribute to providing a more robust foundation for the development of long-term climate mitigation and adaptation policies leading ultimately into a sustainable development path.

Research objectives

The 1992 United Nations Framework Convention on Climate Change (UNFCCC) in Rio de Janeiro and the follow-up series of Conferences of the Parties (COP) of the Convention have highlighted the need for a stronger interaction between climate policy makers, stakeholders and climate research. In particular, the complex negotiations over the 1997 Kyoto Protocol, continued in The Hague, Bonn and Marrakech, have raised many fundamental questions. These require extensive joint studies by scientists from different disciplines, stakeholders representing various sectors of industry, environmental NGOs and political decision-makers.

The Kyoto Protocol established for the first time firm commitments by the industrial nations to reduce greenhouse gas emissions by approximately 5% relative to the reference year 1990 by the time period 2008-2012. This negotiated transition from an uninterrupted increase to a decrease in greenhouse gas emissions marks an historical turning point in climate policy. Nevertheless, the Kyoto Protocol has not been accepted by all nations, and reservations have been expressed regarding its effectiveness. The Protocol also leaves open many questions regarding climate policy after the first commitment period.

The 10-year horizon of the first commitment period of the Protocol is short compared with the relevant time scales of the climate system, which range from decades to many centuries. A 5% greenhouse gas emission decrease in 2012 by the industrial nations is a significant first step towards a precautionary policy regime but has, by itself, negligible impact on long-term global warming. According to the reports of the UN Intergovernmental Panel of Climate Change (IPCC), climate models indicate that global greenhouse gas emissions, in particular CO_2, will need to be reduced to a small fraction of present levels within about a century if societies wish to avoid a change in climate comparable to that which occurred at the end of the last ice age. In the case of unregulated emissions, the predicted global warming lies well beyond the historical experience of humanity both in magnitude and in rate of change.

Climate change predictions, however, are fraught with uncertainty. Climate change computations by different climate models typically differ by a factor of two. The models also cannot reliably predict climate instabilities, such as a collapse of the conveyer-belt ocean circulation, a melting of the Greenland or West Antarctic ice sheets, or the release of methane presently trapped in permafrost layers or in the deep ocean. Even more unpredictable is the evolution of the global socio-economic system on century time scales from which the emission estimates for the climate change computations are derived. The impacts of a major climate change on human living conditions and on sensitive ecosystems are also uncertain.

The response of stakeholders and decision makers to these innumerable uncertainties varies widely, from support of the precautionary principle to a more cautionary approach.

Advocates of the precautionary principle view the risks of climate change as sufficiently large that they warrant immediate action to curb greenhouse gas emissions. The developing nations, which represent three quarters of the world population, but contribute only a third of the present greenhouse gas emissions from fossil fuels, are not included in the emission reductions under the Kyoto Protocol. Yet they aspire to the same living standards as the industrial nations. This implies that, applied on a global scale, the present per capita greenhouse gas emissions of the industrial nations will need to be reduced by at least one order of magnitude if the goal is to limit future climate change to the range of natural climate variability. The transition to a low-carbon or a carbonfree energy system over a time scale of a hundred years requires major technological change. Such change becomes more expensive and difficult to achieve the longer the transition process is delayed. By initially focussing on the 10-year horizon, the Kyoto process tends to emphasize measures that are cost-effective in the short-term. However, many of these short-term options have limited long-term global mitigation potential. The technology for large-scale emission reductions, such as solar energy in combination with hydrogen technology, exists, but is not yet competitive on the free market place. A long-term climate policy needs to anticipate the estimated rapid increase in emission reduction costs once the present negative to low cost options are exhausted (cf. IPCC, 2nd and 3rd reports). Unless timely R&D, commercialisation and market diffusion policies are introduced, this could well present a barrier to deep emission reductions in two or more decades. An early start may be essential to overcome this barrier.

Protagonists of a more cautionary approach argue, on the other hand, that the long time scales of the climate system should be used to reduce uncertainties and develop alternative technological options before embarking on specific climate programmes. Premature decisions for a particular technological path could well lead to a lock-in of sub-optimal solutions which cannot be readily adjusted later to reflect new scientific insights and unforeseen technological advances. The use of fossil fuels will remain unavoidable and can be expected to increase during the next decades. Thus, the efficiency of fossil fuel use should be increased by technical measures and R&D efforts. The potential of carbon capture and sequestration should be further explored. The call for subsidies for renewable energy technologies is based on learning-by-doing curves derived from past experience. However, past experience may not be appropriate in this instance and the ability of technology to respond to market forces in a rapidly-evolving global information economy may be greater than previously thought. In the long run, the use of renewable energies can only be increased substantially if they become competitive on the world energy markets.

Research Programme

These differing assessments of the role of uncertainties need to be addressed, and where possible quantified, in order to develop flexible, efficient, effective and equitable strategies for dealing with long-term climate risks. The ECF research programme will accordingly focus on the long-term implications of climate change in relation to climate policy. Research themes will include investigations of the time-integrated global mitigation potentials of alternative greenhouse gas abatement technologies; studies of the linkages between technological change and climate policy instruments; investigations of the interrelation between policy, public preferences, public awareness and information dissemination; and the impact of major regional differences on these interrelated issues.

These general research themes will be supported by specific investigations of climate change impacts and adaptation measures, for example with respect to extreme weather events and climate instabilities; socio-economic data analyses, particularly on the regional scale; and the development of modelling tools, including a hierarchy of coupled climate-socio-economic models.

In a first step, ECF proposes to carry out four projects:
1) Instruments for climate policy;
2) Coping with extreme weather events and rapid climate change;
3) Technology assessment; and
4) Data pool: building a Sustainability Geoscope

The principal goals of the projects, which are presently still in a definition phase, are outlined in the following appendices.

Appendix 1. Instruments for climate policy

There exists an extensive literature on instruments for environmental policy, and most of the results carry over to climate policy. Systematic evaluations of past and present environmental regulation are rare, however, particularly with regard to comparisons of the performance of different instruments. Studies of a portfolio of instruments are equally rare, as are analyses of the interactions between target-setting and instrument choice. Recent management theory stresses the importance of experimenting and learning, but there are only a few studies of the advantages of, and barriers to, adaptive management for climate policy. As a result literature on instruments for international climate policy is largely restricted to international “flexibility mechanisms” leaving four outstanding knowledge gaps: the interplay of policy initiatives with pre-existing conditions at the national level; the articulation of voluntary agreements amongst international corporations; the capacity of various policy packages for fostering technological change; and the specific problem posed by greenhouse gases other than CO_2.

Flexibility mechanisms will be implemented in the context of pre-existing tax systems and regulations, which will affect both their attractiveness for industry and the social costs of carbon constraints. Moreover the following questions remain unanswered: how to allocate the first emissions permits to various sectors; the possible use of emissions permits as an implicit subsidy; the complementarity with other instruments in sectors not covered by carbon trading (transportation for example); and the appropriate level of subsidiarity in the management of the system.

Voluntary agreements are usually made between governments and industries, with mixed success. It is unclear whether such voluntary agreements can be negotiated between national governments and internationally competitive industries. Increasingly, corporations adopt self-imposed environmental targets and engage in discussions with environmental NGOs, occasionally without governments becoming involved. One issue here is to what extent voluntary agreements between multinational companies and multinational NGOs, or between companies and governments, may help to overcome two key difficulties: the primary allocation of emissions quotas, and the concerns of companies affected by distortions in international competition.

These issues emphasize that, even though a global climate treaty is likely to be established, it will remain incomplete. Renewed attention needs to be paid to the coordination of unilateral emission abatement policies.

Significant reduction of carbon dioxide emissions does not require new technologies, but rather the commercialisation of proven technologies. One way forward is to build enough experience through the creation of niche markets, for instance through preferential procurement by governments and NGOs combined with pricing reforms, in order to reduce regulatory uncertainty. Guaranteed procurement for the first company to deliver a specific technology could be awarded as a “prize”. Alternatively, the prize may be a money award or market share (e.g., through regulatory standards). The details, pros and cons of such strategies still need to be worked out, together with their relation to the general incentive system (taxes, emissions trading). Another serious challenge is how to make climate-friendly technologies available to developing countries at commercially attractive conditions, preferably without disturbing OECD incentives.

Measures for reducing carbon dioxide emissions from land-use change, or methane emissions from waste and agriculture, require more investigation. The main problem is not so much how to reach the many, diverse emitters (a tax would do this), but rather that climate policy is not at present an important objective in land-use, waste, or agricultural policy (unlike energy policy, where climate is gaining importance).

Appendix 2. Coping with extreme weather events and rapid climate change

A change in climate can lead to altered frequencies and intensities of extreme weather in a number of ways. At the simplest level, a shift in the mean value of climate – for example, seasonal mean temperature or precipitation – will alter the probability of occurrence of the tails of the distribution. If the variance of the distribution is also affected by climate change then more substantial and complex changes in the probability of extreme weather events can occur. Substantial work has been completed in this area in recent years, although detecting changes in observed extreme weather events and attributing them unequivocally to anthropogenic climate change remains problematic.

Less work has been undertaken examining changes in more complex extreme weather phenomena – such as changes in conditional probabilities or bivariate distributions. For example, it may be that the occurrence of multi-seasonal droughts – winter-summer-winter or summer-winter-summer – has more critical impacts for water resources, hydroelectric power or subsidence than a single season drought. Similarly, it may be changes in the frequencies of events with intense rain and strong winds or high temperature and high humidity that have the greatest impact for the built environment and for human health. Overall, it is changes in these dimensions of climate that will likely have the greatest impact on the economy and welfare of nations. Business sectors such as insurance, transport, finance, water, construction and health-care are exposed to these changing risks.

However relevant extreme weather events are defined, one thing that has been generally lacking across a domain as extensive as Europe is a pan-continental perspective of observed and predicted changes in extreme weather phenomena. This is partly because of difficulties of data availability and data homogenisation across national boundaries and partly because the definition of what constitutes 'extreme weather' varies from country to country. There is an opportunity for the European Climate Forum to champion studies that overcome this limitation.

The above examples of analyses are fundamentally historical or statistical in nature. Another area of work would be more process and/or model based and would seek to provide new insights about the probabilities of climate warming triggering rapid and non-linear responses in aspects of the coupled biogeophysico-chemical system. There are some examples of emerging work in this area to draw upon, but new work should also be commissioned. Thresholds, feedbacks and bifurcation points need quantifying.

Results from any of the above areas of work will have implications for the way environmental and social activities and assets are managed – and ultimately will condition the way in which systems and organisations adapt to real or to perceived changes in climate. The European Climate Forum should support work looking at the interaction between irregular or discontinuous changes in the statistical and state properties of climate on the one hand and the institutional response to such changes on the other, a response which itself maybe irregular and discontinuous. Such is likely to be the essential behaviour of a quasi-rational adaptive system making decisions under conditions of uncertainty. Stochastic decision models need coupling with stochastic climate generators.

Appendix 3. Technology assessment

The Technology Assessment Group aims at answering two questions: First, which technical, institutional and political innovations can lead to a substantial and sustainable reduction or disposal of CO_2 emissions? Second, what are the barriers to implementation for each of the above options?

Advocates of precautionary climate policy point out that within the next hundred years we will need to reduce CO_2 emissions substantially to avoid significant climate change. It is by no means clear what kind of technological options are appropriate to achieve this goal. Five options are discussed: Reduction of end energy demand by a more efficient provision of energy services; increase of energy efficiency of the fossil fuel energy system through R&D investments; substitution of fossil fuels by renewable energy; substitution of fossil fuels by nuclear power; carbon capturing and sequestration.

In general, these options require investment decisions, yet it is not obvious, how the investment into the future energy system should be made. Neither the allocation between the five options nor their appropriate timing can be inferred from present knowledge. Indeed, it is an open question how rational these options really are. The research projects within the Technology Assessment Group should highlight the crucial role of the investments into these four options. Based on this information, we will assess whether these options could provide a viable contribution to achieving a transition to a sustainable society and economy. The options have to be assessed within a dynamic economic framework. In particular, past technological progress in saving energy and reducing carbon emissions has been "devoured" by economic growth and the growth of population. Therefore, the crucial question remains: What kind of investment strategy should be launched in order to reduce the emissions from 2020 on. Changing the energy system is an important issue. Buying time may become an important option if our objective is to stabilize climate within the next hundred years.

The second question to be addressed is: What are the barriers to implementation for each of the above options? An appropriate investment strategy that has the potential to foster a sustainability transition has to overcome the barriers of implementation. These become relevant if individual preferences of actors diverge from social rationality – commonly referred to as a "social dilemma". Identifying social dilemmas is a powerful tool for analysing barriers of implementation. Social science also offers tools to overcome social dilemmatic situations, which will be explored by the Technology Assessment Group. The group will assess important barriers of implementation for different investment strategies. These include: market imperfections like monopoly power, subsidies and taxes, high ecological risks which are not perceived by relevant actors, lack of technological feasibility, too little social acceptance which may prevent the implementation of technologies, even if they are economically reasonable, too short time horizon of investors and savers, network externalities which create public good problems for energy systems and lack of dissemination for energy technologies.

The ECF encourages stakeholders and scientists to formulate a long-term investment strategy for the transition to a sustainable energy system. Barriers of implementation will be identified and strategies developed to overcome them. The research results will be communicated to the broader public.

Appendix 4. Data pool: building a Sustainability Geoscope

The 21st century will be characterized by global change on an unprecedented scale. The data needs of governments, businesses, other organizations and the general public will be profoundly different from what they have been in the past. The present project proposes to develop a global observation system based on regional samples and remote sensing data combined with ground-level observations. Such a system is called a Sustainability Geoscope.

In order to develop strategies for a transition to sustainability, for monitoring success and failure of attempts to alter the current socioeconomic paradigms, and to give us a feeling of where we stand, we will need robust sets of data. These data sets will address issues of education, infrastructure, nutrition, state of the environment, resources, biological and cultural diversity, to name just a few. In a first phase, analysis of existing data and regional case studies will be used to address exemplary issues for sustainable development, such as the interaction between increasing welfare, changing diets, limited water resources, and food production.

We do not yet have a system for the consistent and continuous worldwide collection of socio-economic data. Global observation has reached a far more advanced state in the natural sciences. For example, data from weather stations and geostationary weather satellites are routinely compiled to drive models for weather forecasting. With regard to the global socio-economy, there is no comparable effort for deriving consistent global time series of key observational data based on co-developing theories of the system as a whole. What is required is an extension of the global observation networks of the natural sciences into the socioeconomic domain. In order to build an integrated information system for the earth, we can no longer ignore that the natural and the human sphere are increasingly difficult to separate. Human influence today affects almost all components of the global environment, while remaining fundamentally dependent on that environment.

The number of parameters to be observed comprehensively should be small. The aim is not a complete digitisation of the world in all its aspects, but the observation of a well-selected, limited number of key parameters. The behaviour of complex systems can usually be described with few parameters, as long as these parameters are measured at many points in time and space. The real challenge is to identify a robust set of parameters for this task.

The Sustainability Geoscope will need to combine satellite remote sensing with on-the-ground observations. Satellites provide spatial and temporal mappings of earth surface features at a resolution not available with other means, but their reliable interpretation is difficult without the numerous associated parameters that can only be observed on the ground, for example through statistical services and empirical social research. Thus, satellites may well observe the global patterns of agricultural activity, but its relationship to nutritional habits, agricultural policy and historical-cultural developments are the indispensable basis for understanding these patterns and their significance. Systematic observation with standardized procedures shall be complemented by in-depth case studies of specific regions, phenomena, and problems. The instrument is to be built step-by-step. Naturally, a large global information system requires gradual implementation. To begin with, a series of comparative studies will be undertaken in different regions of the North and South.

Appendix 5. ECF Board of Directors and Council

Members of the Board of Directors are:

Carlo C. Jaeger (*Chairperson*, Potsdam Institute for Climate Impact Research PIK)

Klaus Hasselmann (*Vice-Chairperson*, Max Planck Institute for Meteorology)

Carlo Carraro (Fondazione ENI Enrico Mattei)

Baldur Eliasson (ABB)

Stephan Singer (WWF International)

Members of the Council are:

Mike Hulme (*Chairperson*, Tyndall Centre for Climate Change Research)

Jürgen Engelhard (Rheinbraun AG)

Bill Hare (Greenpeace International)

Jean-Charles Hourcade (Centre International des Recherches Scietific d`Enviromentet de Development)

Ola M. Johannessen (Nansen Environmental and Remote Sensing Centre, Bergen)

Nick Otter (Alstom Power)

Alexander Wokaun (Paul Scherrer Institut, ETH Zürich)

Contact:

Dr. Martin Welp
European Climate Forum
c/o Potsdam Institute for Climate Impact Research (PIK)
P.O. Box 601203, 14412 Potsdam, Germany
Tel. +49 (0)331 288 2619
Fax +49 (0)331 288 2620
E-mail: info@European-Climate-Forum.net
Internet: http://www.European-Climate-Forum.net