

## **CLIMATE CHANGE, POLICY OPTIONS AND RESEARCH IMPLICATIONS**

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### **ABSTRACT**

Policy options for climate change and their research implications are discussed in this paper. Instead of science telling policy actors what to do, this project started by asking policy actors how they perceived the climate change issue, how it could best be handled and what science can do to address their questions and concerns. Through a series of interviews and workshops five different options have been constructed and for each a corresponding research agenda has been developed. Important findings of this project are, 1) it is easier to reach consensus about actions than about the nature of the problem; 2) issue linkage is crucial as the problem of climate change is complex and the benefits of emission limitation are too remote to be the single motivator for action; 3) an important condition for progress in climate change policy is a strengthening of the science-policy interface. This project is an illustration of how this can be achieved.

### **1. INTRODUCTION**

There are many questions surrounding the climate issue. The project on 'Policy options addressing the greenhouse effect' took a look at whether and in what way our society can cope with the risks of climate change and the challenge of sustainable development. A dialogue was initiated between scientists and the broadest range of policy actors such as members of parliament, governmental

policy-makers, representatives of trade unions, employers' organisations, business, environmental and consumers' NGOs etc. This dialogue was organised in such a way that the risk of climate change and opportunities to deal with these risks were dealt with simultaneously. The project was set up to bridge the gap between the perceptions of policy makers, the private sector, societal organisations and scientists. Its objectives were to:

- \* enhance the communication between the various parties;
- \* make the various perceptions of the problem visible;
- \* explore options for policy development;
- \* introduce the options into the Dutch policy formation process;
- \* identify the information needs and related research strategies per option and discuss the results in the research community.

**1.2 Steps towards identification and exploration of policy options**

The project has been carried out in a number of steps as indicated in Figure 1. Step one is a series of interviews, which led to three hundred questions relevant to the problem, formulated by policy actors. Through a workshop with the policy actors the questions were articulated and the number was reduced to 35. In step two these questions were assessed by natural and social scientists. Next, in step three the results were fed back to the policymakers, private sector and societal organisations (all relevant policy actors) through round-table discussions. The results generated through this process formed the basis of a workshop of all parties, including the scientists. This meeting developed options for Dutch (long-term) policy aiming at sustainability in terms of solutions to the climate question. A variety of options and related actions were formulated ranging from no-regrets to social-cultural change. As a follow-up, round-table discussions were held in which policy actors identified information needs and research strategies for each of the options to be addressed by the research community. This paper describes the process, the results of the various stages, the various policy options and the related set of research strategies.

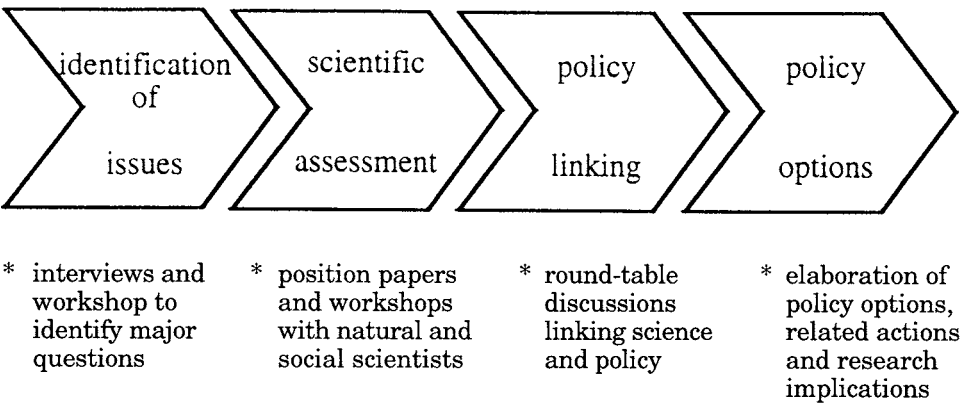


Figure 1. Subsequent steps in the research project

## 2. INTERVIEWS AND ELABORATION OF INTERVIEW RESULTS

Rather than science telling policy actors what to do, this project started by asking policy actors what they thought about the climate issue, how it could best be handled and what science could do to address their questions and concerns.

The project primarily focused on the longer term policy options, with 2025 as time horizon. The people interviewed took the opportunity to blow off steam about politics and the way the issue is handled by various governmental departments and about the scientific community, which should produce "consistent signals instead of generating ambiguity and controversy". Some examples of statements that several times cropped up in the interviews are listed in Box 1.

### 2.1 The message: two-way communication

With the statements available, two clear messages were conveyed to the scientific community. The first was that (perceived) controversy among scientists on the nature of the problem is the main hindrance in convincing decision makers and the public at large of the urgency of emission control. Scientists tend to focus on remaining uncertainties, rather than communicating what is known and agreed upon. It was accepted that progress in science thrives on controversy.

It was stressed, however, that the dissemination of results should not reinforce already existing confusion about the greenhouse effect, since this would weaken the initial commitment to action.

The second message was that scientists should not restrict themselves to working in their institutes and communicating their results only through scientific publications. It was stressed that a precautionary approach can only be based on a broadly shared understanding of the nature of the problem and that this can only be gained through active communication by the scientific community with the public at large. Likewise, the societal and technological science community should not just perform disciplinary desk studies: they should carry out a number of demonstration projects in which their claims about the feasibility of certain solutions can be demonstrated to the decision makers and the general public.

Finally, the interviews made it clear that knowledge of climate change is not the monopoly of the scientific community. Among the people interviewed there was a very broad and often detailed knowledge of the greenhouse effect and of the various response strategies.

### 2.2 One government, different voices

On the basis of the interviews, it was observed that the various governmental departments had positioned themselves in different phases of the development of climate change policies. One department (Economic Affairs) was still in the phase of conceptualising the policy issue (Is there a problem?); two were in the second phase: having accepted the risks of the problem, exploring response actions and building coalitions (the department of Agriculture, Fisheries and Nature Management and the department of Transport and Public Works. A fourth department (Environment) was in the next phase: efforts are made to implement policies; societal groups are persuaded and resources are allocated to solve the problem. As a consequence, the government did not speak with one voice. The resulting inconsistency in environmental policy development caused confusion amongst actors. Some considered the policy measures too weak, while others thought they lacked any basis and went too far. The following associated response

patterns were identified: reactive (defensive response to government policy), receptive (receptive response to government policy), constructive (acceptance of one's own responsibility) and pro-active (internalising in one's strategic planning).

### **2.3 Identification of issues, interviews and workshop**

Questions put to the policy actors were:

1. "What are your perceptions of the greenhouse effect?"
2. "What potential impact may the issue have on your organisation, on both a short and long term basis?"
3. "How is your organisation responding to it?"
4. "Can the research community help to address your questions?"

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#### ***Examples of statements from the first round of interviews***

- \* The greenhouse problem is probably the biggest environmental problem that we shall face in the twenty-first century.
  - \* Early action on emission reduction is imperative.
  - \* The main challenge is how to get everybody on board for the far-reaching measures that will be necessary.
  - \* Climate change is a non-issue, pushed by science and embraced by politics
  - \* If it would eventually prove to be a problem, then adaptation would be the best strategy.
  - \* Even if the Netherlands were to be in favour of reducing emissions, a unilateral Dutch policy would never succeed because of the global scale of the issue.
  - \* Strong emission reduction measures in the Netherlands would weaken the industrial sector in international competition.
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Box 1. Examples of statements from the first round of interviews.

The research team grouped the questions and statements that were gathered through the interviews. Next, the results were articulated through a workshop with the policy actors.

## **3. SCIENCE ASSESSMENT**

### **3.1 Scientific controversy discussed**

The next step in the project was a logical consequence of the previous one. Position papers were drawn up around the questions from the previous phase, and these were then discussed in two working conferences in order to provide a scientific assessment of the enhanced greenhouse effect.

The first conference gathered experts from the natural sciences and focused on biogeochemical cycles, responses of the climate system to changes in greenhouse gas concentrations and the effects of climate change. The basic question put to the natural scientists was: does the greenhouse effect exist and, if so, what are the risks? Some controversial positions were discussed and evaluated, including a

recent report written by professor Böttcher, an outspoken dissenter from the 'climate consensus' in the Netherlands.

The second conference included experts from the social sciences and focused on technological solutions, economic aspects of Dutch greenhouse policy options and psychological, sociological as well as philosophical/ethical aspects. The main question which had to be answered was: how do you perceive the climate problem and how can we cope with it from the socio-economic, technological and behavioural points of view?

### **3.2 Scientific assessment of the greenhouse effect**

Plenary sessions during both gatherings resulted in confrontations between representatives of different disciplines. These confrontations resulted from 'language problems' and differences in underlying assumptions among the related disciplines. After these 'language problems' were solved and assumptions were thoroughly discussed, a consensus was reached on a total of 90 statements. A few of these are listed in Box 2.

The natural scientists (the first three statements in Box 2) discussed and evaluated the (un)certainties related to the dynamics of the climate system. The experts from the social sciences were inclined to accept the problem and tried to find ways and means to deal with it. This is reflected in some of their statements.

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#### ***Selected statements from natural and social scientists about the greenhouse effect***

- \* The concentration of greenhouse gases, CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O, CFCs and tropospheric ozone have increased since 1960 as a result of human activities.
  - \* Experimenting with the global climate is not a feasible option. Risk assessment should include the possibility of irreversible changes to the climate.
  - \* The greenhouse effect is only one of man's disturbances of the terrestrial system. If possible, instruments to reduce the greenhouse effect should therefore also reduce other disturbances.
  - \* Estimations of the effects of a substantial reduction of greenhouse gases show that it is possible that macroeconomic effects will be relatively small and sectoral relatively large (employment, profitability and production).
  - \* Sustainable lifestyles should be promoted as positive changes. As a general rule, it can be concluded that lifestyle changes need to be based on the three A's: they must be Achievable, Acceptable and Attractive.
  - \* Sustainable technology requires a shift in ideological, cultural and societal values within society. Ultimately, individuals will have to find new modes of behaviour within the limits of the ecospace.
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Box 2. Selected statements from the natural and social scientists about the greenhouse effect

## 4. FIVE POLICY OPTIONS

### 4.1 Linking science and policy

In the third stage of the project, the results of the scientific assessment were fed back to the policy actors. In six round table discussions the results of the scientific assessment were linked with policy and institutional actors. Participants included representatives of several ministries, the chemical industry, the electricity sector, transport and agricultural organisations, political parties, trade unions, environmental NGOs and consumer organisations. The round table discussions once again revealed the wide variety of perceptions about climate change.

This part of the project showed that policy and institutional decision makers in general accept the scientific statements. The debate primarily focused on the societal aspects of a range of climate change policies. This implied a change in the perceptions of the different actors; at this stage there was more convergence than there had been at the beginning of the project (workshop 1). Differences of opinions were primarily related to the proposed policies for dealing with the problem.

Six round table discussions produced five rough drafts of policy options for dealing with climate change. These were further developed in five working groups. The policy options are:

- \* *No regrets*: it is uncertain whether climate change will occur and, if so whether substantial reductions in greenhouse gas emissions will be necessary; this implies no action regarding climate.
- \* *Least regrets*: climate change is a most serious problem with potentially irreversible effects. Since the effects as yet are unclear, a risk approach should be taken. A trade-off is made between risks linked with intervention and non-intervention; this implies action now; the uncertainties are an important motivator for pre-cautionary measures.
- \* *Acceleration*: climate change is a serious problem, but too complex to address head on; the climate problem can best be addressed through generally recognized short term problems in related fields; the focus is on issue linkage and on synergies and positive feedbacks presently existing in society; this implies action now but only in the context of other issues.
- \* *Technological innovation*: climate change is a serious problem; but technological development is the only way to match the demands of an ever increasing world population with the carrying capacity of the environment; this implies action focusing on technology, research, development, demonstration and diffusion.
- \* *Institutional / cultural change*: within this option it is assumed that technological solutions will not be sufficient to reach a sustainable society. Major societal, cultural and institutional changes are required to create a sustainable society; this implies action in all areas, not necessarily related to climate.

In this project the policy options are defined not as a single type of action or instrument, but as the whole of opinions and suppositions about the climate issue, the effects and the possible solutions. The five policy options represent five different mainstream perceptions present in society. The options are typical views

which represent a mixture of problem perception and solution perception. An important observation in this project is that the perception of the 'problem' per actor is strongly linked with the perception of the 'solution'.

For each of the five policy options a number of actions were formulated. The interesting result of the project is that there is much more agreement on the type of actions than on the policy options. It was possible to identify eight different fields of action that were mentioned under all policy options. The main difference between the options is the intensity and geographic scale of the implementation of the listed actions. The 'common' fields of action are indicated in Box 3.

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### ***Common actions***

- \* Towards an eco-tax system.
  - \* Low carbon transport systems/infrastructure.
  - \* Energy efficient housing/offices.
  - \* Redesign of industrial processes and products.
  - \* Towards renewable energy sources and renewable materials.
  - \* Joint implementation.
  - \* Towards closing the substance cycles at smallest geographical scale.
  - \* Stimulate technological and cultural innovation.
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Box 3. List of common actions.

## **5. RESEARCH IMPLICATIONS**

### **5.1 Introduction**

The next step in the project was to investigate the research implications of the various options. For each option a round-table conference was held. In these meetings the information needs and related research areas (including their focus) were identified. The research implications are discussed in the following paragraphs per policy option. This part of the project has not yet been finished. Nevertheless, a number of observations with respect to information needs and research implications can tentatively be made.

### **5.2 No-regrets**

Within the no-regrets option it is considered uncertain whether climate change will occur and, if so, whether substantial reductions in emissions of greenhouse gases will be necessary. Priority is given to instruments that serve other (socio-economic and environmental) objectives, simultaneously resulting in a reduction of greenhouse gas emissions. No-regrets instruments will, irrespective of climate change, pay off anyway. Key words for this policy option are *scarcity and real politics*.

- Climate change is considered not to be a real problem. However, scarcity of fossil fuel resources is a problem. Moreover, policies that address scarcity are likely to get much more support. Simultaneously, such policies lead to a reduction of greenhouse gas emissions.

- In addition, greenhouse gas emission reductions in the Netherlands, including high cost for the Dutch economy, would not have a significant effect on global greenhouse gas concentrations, since the biggest countries in the world continue to grow both with respect to their populations and emissions.
- Finally, there is no strong indication that the Dutch economy would significantly suffer from a changing climate.

The following information needs and research areas are identified by the policy actors supporting the no-regrets view.

1. Scarcity of fossil fuel and mechanisms that can help to increase the efficiency of resource use are important research fields. Mechanisms and institutional arrangements that help to remove intersectoral barriers should be investigated (such as full cycle management).
2. Possibilities and impossibilities of demand side management should be investigated. What are the demands of the people and what are their priorities. Research should be carried out in the fields of price-elasticity and into the question of whether people at all are willing to adjust their consumption patterns on the basis of uncertain long-term changes in the climate system that may have both positive and negative effects.
3. Global, particularly Third World, growth of fossil fuel use and CO<sub>2</sub> emissions should be investigated. Special attention should be given to ways and means to increase energy efficiency in developing countries. A special point of interest is research into the leakage of greenhouse gases during exploitation and transportation of oil and gas (the total global quantity of flared natural gas is equal to the total European consumption of fuels by cars).
4. Population growth and ways to control this growth is an important area for research.
5. Regarding climate system research, priority should be given to monitoring and process analysis.

### 5.3 Least regrets

Within the least regrets option climate change is perceived as a serious problem with potentially irreversible effects. As the effects are unclear a risk approach should be taken. A trade-off should be made between risks linked with the occurrence and non-occurrence of climate change in relation to the policies selected. The policies include all no-regrets instruments supplemented with anticipatory policies aimed at limitation of risks resulting from climate change. Policies anticipate a substantial reduction of greenhouse gas emissions. If reduction proves to be unnecessary, part of the effort is lost. If reduction proves necessary, further reductions will be more efficient than they would have been if only a no-regrets policy was implemented. The least regret option thus includes hedging strategies. From its inception, this option offers a long-term perspective.

Keywords in this option are *probability and insurance*.

- In this option climate change is recognized as a real problem. However it is not known how large the problem is. Therefore it is necessary to take immediate



action to reduce the risks. Such actions can be seen as an insurance premium. The least regrets option is seen as a rational policy based on a quantitative risk analysis.

- The Netherlands as an energy and emissions intensive country has the responsibility to take actions according to its historic and present contribution and according to its economic and technical capabilities.

The information needs and research areas as identified by the policy actors supporting the least regrets option are the following.

1. Action research in communicating the risks of climate change and the range of anticipatory actions is important. Especially the question of how all societal actors can be encouraged to implement a least regrets approach, should be addressed.
2. Regarding the climate system, the most important task is to describe the uncertainties in terms of probabilities. In particular, the possibility of non-linear behaviour of the oceans and of the sources and sinks of greenhouse gases should be studied.
3. Research into the effects of climate change should not just look at the Netherlands. The primary focus should be on the global ecological and socio-economic systems such as ecosystems, food production and extreme events. Adaptation research should investigate the possibilities of decreasing the vulnerability and thus increasing the robustness of society, infrastructure and other socio-economic systems.
4. Research is also required to increase the understanding of the response capacity of society in relation to climate change scenarios including surprises. Investment cycles and rates of market penetration of new technologies need to be studied for a range of climate change scenarios. A special field of research concerns the possibilities and the potential of lifestyle changes.
5. Research to investigate and develop a range of options for drastic emission control: both in the field of rapid implementation of existing technologies as in the field of development of new technologies (renewable energy sources, sink enhancement). Simultaneously, research should be carried out for drastic emission control through institutional changes such as new fiscal regimes and new international regimes such as joint implementation and transfer of technology.

#### **5.4 Acceleration**

The acceleration option focuses on synergies and positive feedbacks presently existing in society. Forces and currents that are consistent with climate change policy are accelerated and barriers are removed. All policies should take into account the different time cycles of society.

Key words in this option are *opportunities and issue linkage*.

- Also in this option climate change is considered to be a real problem, but the government and intellectual elite is not capable to convince the major economic actors and society at large to substantially invest in emission control measures.

The only way to achieve something is "hitch hiking": riding with other issues. The direction to go is clear, but the (climate) vehicle does not have enough power on its own to get things moving so any opportunity that comes along should be grasped.

- This option takes other environmental and societal problems as its point of departure. The climate issue is thus linked to other problems such as: employment, congestion, technology co-operation, urbanisation, individualisation..

The following information needs and research areas are identified by the policy actors that adhere to the acceleration option.

1. Climate system research should focus on the relations between the greenhouse effect, the effects of aerosols, acidification, ozone formation, the effects of land-use changes and the various problems related to the human interference with the bio-geo-chemical cycles. Hence, climate research should be fully embedded in the global change research. Research should identify the common sources of a range of environmental problems.
2. Impacts and adaptation research should start by identifying which natural and socio-economic systems have the attention of the government and the public at large. Particularly those systems should be systematically studied for the potential of issue linkage. Research should focus on measures that help to reduce the vulnerability vis-à-vis climate change but that are originally envisaged for other reasons.
3. Similarly, the emission control type of research should start with an analyses of the various relations between climate change limitation measures and the range of technological, infrastructural, economic and other presently perceived problems that society wants/needs to address: urbanisation (housing, work, recreation and infrastructure), employment, transport/congestion, energy supply, communication, fiscal regimes, liberalisation of energy markets in Europe, agricultural problems and land surplus, world trade arrangements, development co-operation, population growth, international debt etc..
4. Systematic research into issue linkages and development of strategies based on issue linkage, not just in the technical sense but also, perhaps even more so, in the communication domain.
5. Research into the question of how the various actions primarily driven by other issues, can be orchestrated in such a way that the total result with regard to climate is satisfactory. Research on how the climate change momentum can be maintained in a policy strategy that primarily focuses on other problems.
6. Systematic research into what people value, with the aim to identify those issues and actions that have sufficient support for implementation.

## **5.5 Technological innovation**

According to this strategy, technological development is the only way to match the demands of an ever increasing world population with the environment's carrying

capacity limited. This requires a long-term co-operation between government and private enterprise. In this option it is required that government plays a very active role in directing technological development by providing opportunities and constraints (e.g. subsidies, fiscal incentives, regulations, etc.) to stimulate the required development.

The key word in this option is *innovation*.

- The technological innovation option builds on (i) the assumption that there is sufficient technological creativity available in our society to address the climate change problem without loss of economic welfare and (ii) on the notion that technology development and implementation can be accelerated by removing existing barriers and creating positive incentives.

The information needs and research areas identified by the policy actors supporting this option are the following.

1. The various relations between the climate problem and other effects of resource use should be investigated, as it is of crucial importance that new technologies address all problems and not just one single (climate) problem while increasing or creating other problems. Similarly, research into climate effects and adaptation should be relatively broad and linked with research in other environmental fields for the development of a robust technology strategy.
2. Research into the time dimension of emissions, concentrations and climate change impacts is very important for the implementation of the right technology at the right time and for minimization of the overall cost for society (e.g. a hundred year strategy for emission control and technology development). Investigate the possibilities of bifurcation problems (one type of technology/infrastructure precluding the implementation of a better technology at a later stage).
3. Investigate and identify the conditions that are optimal for technology development and implementation (adoption and diffusion): e.g. market, infrastructural, institutional and cultural conditions.
4. Research and development programmes in the field of energy efficiency (supply and demand side, renewable energy, materials and redesign of industrial processes (the potential of a shift from non-renewable fossil resources to agro/biological renewable resources), and energy systems research (centralized versus decentralized systems and storage systems). The research programmes to be developed should be based on careful analyses of (potential) competitive advantages for the Netherlands.
5. Research with the aim to identify the sectors/technologies for which small incremental changes can produce large results, for example avoidance of leakages, process integrated energy efficiency schemes, more efficient cars, land use management systems etc.

## 5.6 Institutional/Cultural Change

Within this option it is assumed that technological solutions will not be sufficient to create a sustainable society. Social, cultural and institutional changes are required

to reach such a goal. Furthermore, it is assumed that sustainable development can only be achieved through processes of change within society. The role of government is limited to setting conditions and providing support. Changes are promoted through support of concerted actions within society, mobilization of social organizations and the removal of institutional barriers. The focus within this option is on the achievement of the desired situation (positive motivation) rather than on the avoidance of a non-desired situation (negative motivation). Keyword in this option is *quality*. Quality of life is the central theme in this option, as opposed to quantity and speed.

The following information needs and research areas were identified by the policy actors supporting this option.

1. With regard to climate change research, it was noted that some research will be necessary in order to illustrate the impact of wasteful human activities on the life support systems. However, it should be realized that the mechanisms that are advocated in climate research, such as ever larger computers trying to predict the inherently unpredictable and conventions to manage this are part and parcel of the same societal systems that are causing climate change such as ever increasing global trade and transport. Since closing the material cycles at the smallest possible geographical scale is the aim under this option, not much research would be needed to illustrate that large scale fossil fuel use and large scale land use changes are detrimental for the environment and thus should be avoided.
2. Effects and adaptation research should focus on the relation between social, cultural, economic systems and the local climate. This relation is probably more important than presently realized, research should investigate this.
3. Research into the question of what a sustainable lifestyle looks like.
4. Research into technological innovation in support of sustainable lifestyles: technology supporting a local closure of material cycles (including carbon and nutrients). This includes research into the institutional, infrastructural and cultural systems that support a sustainable lifestyle. Research into the driving mechanisms for unsustainable production and consumption.
5. Research into the phenomenon of defensive/compensating consumption (skiing as required to compensate for stress work and intensive travelling; far away eco-tourism to compensate for lack of nearby natural ecosystems that are destroyed to make way for international airports; driving your children to school because the traffic is too dangerous for them to walk or to go on bicycle).
6. Research into the higher order effects of institutional and technological changes both to explain what has happened in the past, what is happening at present and what may happen in the future.
7. Action research and local experiments to investigate the feasibility of different lifestyles. The aim is to demonstrate that a large diversity of social/technical configurations are possible within the domain of sustainable life styles. The idea

of social learning and the idea of demonstration is important in the design of these experiments. Part of this type of research should also be how such experiments can be encouraged through generic instruments or removal of (generic) barriers (including research into what we may learn from earlier idealistic/utopian movements and their ideals, including research into the role of elite behaviour as a change agent, and research in the role of examples as media/agents communicating the necessity of change).

## 6. CONCLUSIONS AND RECOMMENDATIONS

*The evaluation of the results of this research project has not yet been finalized. Still a number of conclusions can be drawn.*

One conclusion came forward rather clear: the interviews and the analysis indicate that it will be very difficult, if not impossible, to reach consensus on the nature and the seriousness of climate change. It is not likely that one of the five options discussed above will emerge as a consensus option as the way the risk of climate change is perceived appears to depend strongly on the societal and economic interests of the policy actors and on the individual values. For example, all participants from the energy intensive industries were convinced that IPCC is trying to fool them and that some politicians join this game out of publicity interests. They typically favour the no-regrets option. The majority of the actors from the private sector, with interests that are relatively neutral vis-à-vis climate change policy, are in favour of either a least regrets, an acceleration or a technological innovation policy. A small part of the policy actors are in favour of the socio-cultural change option.

The conclusions and recommendations that can be formulated at this phase of the project are listed below.

1. Based on the results of the project the researchers believe that it is more fruitful to seek consensus about actions than to seek consensus about the nature of the climate issue.
2. For all participants technology is an important and valued parameter in addressing the climate issue. However, preferences about the type of technology and the role of technology in society may differ. Still, all participants, also the ones favouring social-cultural change, favour technological research. All the promoters of technology agree that the societal needs and concerns should play the major role in technology development.
3. With regard to the climate problem, it appears as if most of the actors are fairly well informed about the nature of the problem, although the interpretation of the information differs. It seems as if society as a whole is waiting for the scientists to come with the ultimate answer about the risks. However, for many of the scientists the expected response of the climate system and the uncertainties involved are a major reason for action.
4. A large part of the policy actors implicitly favour some kind of acceleration

policy. Issue linkage as a basis for common action looks like a promising approach to climate change policy. However, this reveals a paradox. The general thrust of the acceleration option is that society is not willing or not ready to address the climate issue in its own right. This is expressed by the statement often made that climate change measures should piggy back on other issues. The paradox is that other issues, for example fossil fuel scarcity, usually are not perceived as sufficiently urgent to generate effective and long-term policies. If the climate issue had not been raised, all energy efficiency programmes would have been stopped in the late 1980's. It is only because of the climate issue that combined heat and power could become a success in the Netherlands.

Consequently, in order to develop and implement an effective strategy, existing problems and concerns in the society other than climate change, may need to be the starting point for greenhouse gas control policies. Nevertheless, the climate issue needs to be raised continuously to keep the action going. So climate change may serve as a long-term argument for change, while short-term problems and concerns are the practical, day to day motivator for business. It should be realized that both problems are real and both arguments are needed for coherent and long-term action. This implies that the framework convention for climate change should be regarded as a meta-level policy driver, whereas more sectoral agreements should serve as implementation agents of the broader goal of limiting greenhouse gas emissions.

5. Perhaps this also holds for the research agenda: climate change research and the related research for climate change policy, play an important role as an overarching and integrating element in many fields of research. Still, their role in guiding the overall research may not be sufficiently addressed yet. The overall agenda should probably focus on global environmental change including biodiversity, land use, resource use (energy, water, etc.) and demographic issues, while climate change research should be embedded in such a global change research agenda.
6. The project has revealed that crucial societal actors may have different perceptions about climate change and the desirability of certain responses. As a consequence, they also have different information needs. In order to adequately address these needs, it is important to involve various policy actors in the development and evaluation of climate change research programmes. In this respect it is recommended to give more attention to the science-society dialogue.
7. Finally, the project was evaluated as particularly fruitful for the scientists who participated in the workshops. Many of them had never before exchanged ideas beyond existing disciplinary boundaries. This project revealed that scientists from different disciplines may come to opposite conclusions with regard to the feasibility of controlling greenhouse gas emissions. In most cases it was apparent that it is not the scientific elaborations that cause the differences, but the differences in paradigms and related assumptions that are taken for granted a priori. It is therefore recommended to stimulate multidisciplinary dialogues as a formal part of climate and global change research programmes. The effectiveness of climate change research can particularly be enhanced when also the policy actors are involved in the multidisciplinary dialogue.

## 7. DISCUSSION ON "DEVELOPMENT OF (POTENTIAL) POLICY OPTIONS IN THE NETHERLANDS"

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This research project did have four goals: 1) to enhance the communication between policy makers, third parties and scientists; 2) to identify and explore a range of options; 3) to input these options to the Dutch policy making process and 4) to generate a series of questions and concerns for the second phase of NRP.

The activities of the project took place in a dialogue between policy and research, between policy makers themselves and researchers of different disciplines. It was organised as follows. In interviews, policy makers were asked to identify the problem. This resulted in some 300 questions for scientists. In workshop-I these were reformulated into 50 questions. Together with several position papers from scientists these questions were input into two workshops: workshop II A for the natural scientists and workshop II B for the social scientists and technological experts. The natural scientists felt obliged to re-arrange some of the questions to bring them more in agreement with their views. They reached consensus on 41 statements about observations on and possible effects of changes in the climate system. In the workshop of the social scientists (II B), it proved to be more difficult to create understanding among sociologists, economists and philosophers, because of different presuppositions and disciplinary frames of reference. Once they reached consensus on the assumptions underlying the statements, they were able to formulate 49 statements conveying their joint views on causes, impacts and solutions. However, a straightforward scientific assessment could not be given and was even considered to be impossible. The statements underlined the necessity to strive for a common reference framework. The results of the workshops II A and B were fed back to policy makers and third parties during Round Table meetings. During this stage rough drafts of five policy options were formulated, which served as input for the final workshop III. This workshop did not aim at recommendations, but at the formulation of internally consistent policy options.

Different perspectives on climate change response strategies were grouped into five options:

1. *No regrets*. In this option priority is given to instruments that serve other objectives and which simultaneously result in reduction of greenhouse gas emissions. 'Climate' is no issue, and even if it eventually would prove to be a problem, then adaptation would be the best strategy. Because of the eventual scarcity of fossil fuel reserves, energy efficiency is worthwhile to strive for, however.

Keywords: Realism, Scarcity.

2. *Least regrets*. A climate problem exists, but what it looks like is uncertain. We have to manage risks. Policy has to anticipate substantial but no absolute reduction and has to provide a long-term perspective. Science must support action.

Keywords: Probability, Insurance.

3. *Acceleration*. Climate problems are tackled by linking it with other issues. Policy has to focus on synergies. Measures developed to contribute to other environmental and societal problems should be strengthened in order to address climate change. Climate problems are used to solve other problems. Acceleration might be called an active form of hitch hiking or active version of no-regrets, as the climate problem is accepted as a problem.  
Keyword: Opportunities, Issue linkage.
4. *Technological innovations*. This option is based on the assumption that technology is the only way to match the demands of an ever increasing world population with the carrying capacity of the environment. A long-term cooperation between governments and private enterprises is required. Governments have to provide opportunities and remove constraints in order to enhance R, D & D and implementation. However, innovation itself comes from the private sector.  
Keyword: Innovation.
5. *Institutional and cultural change*. Technological solutions will not be sufficient to create a sustainable society. Fundamental changes are required. Societal organizations have a potential that has to be fully mobilized.  
Keyword: Society, Quality of life.

Each of these options is most cost-effective in its own way of thinking. It might be impossible to strive for a narrowing of the range of these basic beliefs, but a promising similarity in actions may be observed that are proposed by the representatives of different options. These possible actions range from low carbon transport systems and energy efficient buildings to ecotaxes and joint implementation. Of course there is a difference in timing and scope of the proposed actions, but the fundamentals differ less with regard to actions that are considered useful than with regard to basic beliefs.

A continuing improvement in inter- and intradisciplinary communication among scientists and policy makers is necessary to look for a more solid foundation for action. The way forward leads to utilization of shared opportunities, more than to a possibly fruitless search for consensus in basic beliefs. However, scientists and policy makers should more actively communicate those viewpoints they agree upon.

The general idea in the workshop was that this important project should be known better internationally. Ideas on an international 'repetition' with representatives from different groups of countries exist. Learning-by-doing might be a fruitful way of constructing knowledge for both scientists and policy makers.